Chesapeake Bay Restoration and the Tributary Strategy: An Analysis of Maryland's Efforts to Meet the Nutrient and Sediment Reduction Goals of the *Chesapeake 2000* Agreement

Department of Legislative Services
Office of Policy Analysis
Annapolis, Maryland

January 2007

Contributing Staff

Edward M. Cheston
Lesley G. Cook
Cristen E. Flynn
Andrew D. Gray
Kelly Keyser
Ryane M. Necessary
Carol L. Swan
Marcia A. Tannian
Patrick T. Tracy

For further information concerning this document contact:

Library and Information Services
Office of Policy Analysis
Department of Legislative Services
90 State Circle
Annapolis, Maryland 21401

Baltimore Area: 410-946-5400 ● Washington Area: 301-970-5400
Other Areas: 1-800-492-7122, Extension 5400
TDD: 410-946-5401 ● 301-970-5401
Maryland Relay Service: 1-800-735-2258
Email: libr@mlis.state.md.us
Home Page: http://mlis.state.md.us

The Department of Legislative Services does not discriminate on the basis of race, color, national origin, sex, religion, or disability in the admission or access to its programs or activities. The Information Officer has been designated to coordinate compliance with the nondiscrimination requirements contained in Section 35.107 of the Department of Justice regulations. Requests for assistance should be directed to the Information Officer at the telephone numbers shown above.

January 24, 2007

The Honorable Thomas V. Mike Miller, Jr., President of the Senate
The Honorable Michael E. Busch, Speaker of the House of Delegates
Members, Maryland General Assembly

Ladies and Gentlemen:

While the Chesapeake Bay is America's largest and most productive estuary, its health has declined significantly over the past several decades due to nutrient and sediment pollution. In 1999, the U.S. Environmental Protection Agency (EPA) identified the bay as an impaired water body. In 2000, the Chesapeake Bay partners (the bay states, the District of Columbia, the Chesapeake Bay Commission, and EPA) negotiated the *Chesapeake 2000* Agreement (C2K), which specified restoration goals to improve the bay and remove it from EPA's List of Impaired Waters. As part of C2K, specific pollution reduction goals have been allocated to the various bay states.

In April 2004, the Department of Natural Resources (DNR) released *Maryland's Tributary Strategy*, which outlines basin-specific nutrient and sediment control actions necessary to reduce pollution from every source. *Maryland's Tributary Strategy* is intended to be the road map that the State will use to achieve and maintain the water quality and habitat improvement goals of C2K. In February 2006, the Governor's Chesapeake Bay Cabinet released a draft of *Maryland's Chesapeake Bay Tributary Strategy Statewide Implementation Plan*.

While progress is being made, meeting the nutrient and sediment reduction commitments of C2K will take continued collaboration from a variety of stakeholders and will be costly. Given the significance of this issue, during the 2006 interim, the Natural Resources, Environment, and Transportation workgroup of the Office of Policy Analysis prepared this report to provide background information, an overview of the draft implementation plan, the total funding needed to implement the plan, and policy issues that need to be considered.

I trust this report will prove useful to you as the legislature reviews the Governor's proposed fiscal 2008 budget and considers modifications to existing programs and/or the establishment of new ones.

For further information on this report, please contact Lesley Cook of the Office of Policy Analysis at 410-946-5510.

Sincerely,

Karl S. Aro
Executive Director

KSA/LGK/kk

Table of Contents

Chapter 1. Introduction

Background

The Chesapeake Bay is America's largest and most productive estuary with 6,000 miles of shoreline and the ability to produce over half a billion pounds of seafood each year. The bay's water quality problems derive from two salient characteristics. First, it is a very shallow body of water, averaging 21 feet in depth; it is this shallowness and the ability of light to penetrate to the bottom that gives the bay its productivity. Second, the watershed that drains into the shallow tidal systems is immense, including 64,000 square miles flowing through 110,000 miles of streams and rivers. Together these factors give the bay a ratio of land area to water volume that is nearly an order of magnitude greater than the next largest body of water on Earth that is surrounded by land – the Gulf of Finland.

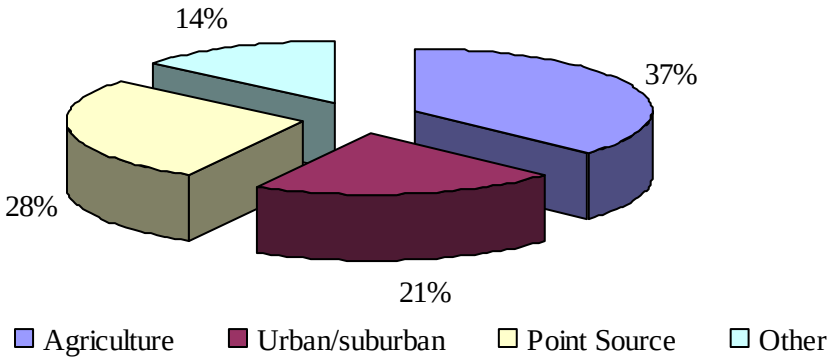
Because of these factors, what happens on the land is critically important to the health of the bay and its tributaries. While almost 60 percent of the watershed is forested, extensive and intensive farming is carried out in many other areas. A majority of the people in the watershed live in three large metropolitan areas which lie on tidal portions of the Chesapeake Bay and its rivers. The population in the Chesapeake Bay watershed increased 22.0 percent between 1985 and 2005 (from approximately 13.6 million people in 1985 to 16.6 million in 2005). The population is expected to increase to 17.1 million by 2010, 18.3 million by 2020, and nearly 19.4 million by 2030.

Nutrient Pollution a Major Problem

By the early 1980s, it became generally accepted that many of the problems the bay was facing were due to the increase in nutrient loadings from sewage treatment plants, agricultural use of manures and fertilizers, and urban runoff.

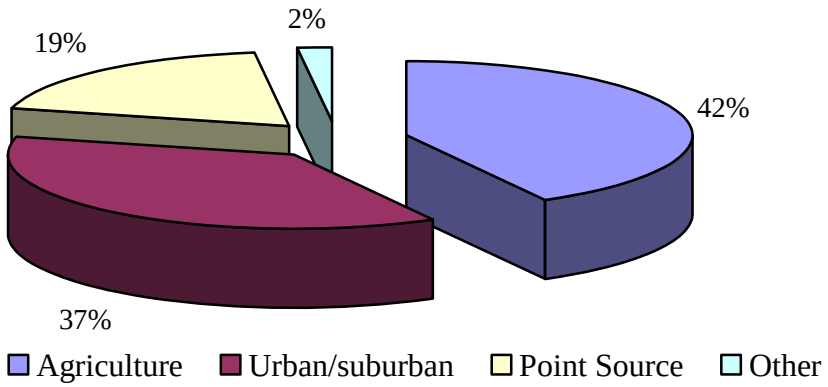
In 2004, Maryland was responsible for 21 percent of the nitrogen and 20 percent of the phosphorus and sediment loads to the Chesapeake Bay. In Maryland, 46 percent of the land is forested, 29 percent is urban/suburban, and 25 percent of the land is in agricultural use. As shown in **Exhibits 1, 2,** and **3**, agriculture is the largest source of nutrients (37 percent nitrogen, 42 percent phosphorus) and sediment (70 percent) from Maryland. Urban/suburban runoff contributes 21 percent of the nitrogen, 37 percent of the phosphorus, and 21 percent of the sediment coming from Maryland. Point sources in Maryland contribute 28 percent of the nitrogen and 19 percent of the phosphorus. These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the bay. Watershed-wide, air pollutants comprise anywhere from a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year. Source data for the entire watershed and for the other bay states are shown in **Appendix 1**.

Exhibit 1
Nitrogen Loading by Source (Maryland)



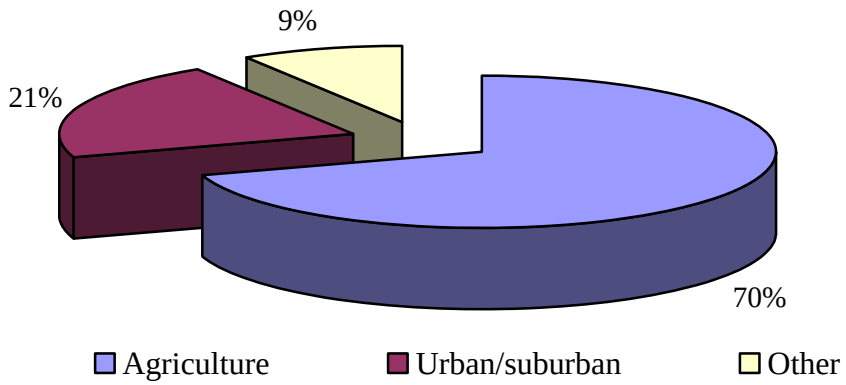
Source: Chesapeake Bay Program

Exhibit 2
Phosphorus Loading by Source (Maryland)



Source: Chesapeake Bay Program

Exhibit 3
Sediment Loading by Source (Maryland)



Source: Chesapeake Bay Program

The Chesapeake Bay Program and the Bay Agreements

In 1983, the Chesapeake Bay states, the District of Columbia, the Chesapeake Bay Commission, and the U.S. Environmental Protection Agency (EPA) signed the first Bay Agreement, a short document setting out a set of broad objectives for the restoration of the waters and living resources of the bay. This was followed by another agreement in 1987, which established more far-reaching objectives, including the goal to reduce nutrient loadings by 40 percent by 2000. As a result of these agreements, states and the federal government enacted laws and established programs to move toward the cooperatively established goals, including a wide range of actions to support agricultural best management practices and to fund improvements to sewage treatment plants. As a result, some fish populations were restored, bay grasses began to return, and progress was made toward the 40 percent reduction goal in both nitrogen and phosphorus. Additional amendments were added to the agreement in 1992 to establish specified nutrient reduction targets for the watersheds of each of the Chesapeake Bay's 10 major tributaries.

By the end of the 1990s, however, concern was raised that more specific efforts were needed. The result was the *Chesapeake 2000* Agreement (C2K), with many new or revised goals for restoration and with a different approach to achieving the necessary water quality improvements. In order to retain the cooperative federal/state approach, the program devised a unique goal – to resolve nutrient impairments in the Chesapeake Bay by 2010, thus removing it

from the list of waters subject to new provisions under the federal Clean Water Act (CWA). This bold step has required resetting to realistic levels the entire system of water quality designated uses, criteria, and standards in the bay and the tidal tributaries. It also required the nutrient reduction goals to be substantially more aggressive than they were previously.

The new water quality standards were stated for the first time in terms of actual living resource response and recovery. These will be measured in terms of oxygen, chlorophyll, and water clarity. What prevents these standards from being met are the excess of nutrients and sediment being loaded to the bay from the rivers and shorelines. Therefore, the reductions assigned to each tributary relate to these three pollutants (nitrogen, phosphorus, and sediment).

On a watershed basis, C2K committed to the following reduction goals:

- reduce nitrogen loads by 95.0 million pounds per year from 2004 levels (to 175.0 million pounds per year);
- reduce phosphorus loads by 5.97 million pounds per year from 2004 levels (to 12.8 million pounds per year); and
- reduce sediment loads by 0.775 million tons per year from 2004 levels (to 4.15 million tons per year).

Maryland's pollutant reduction goals are shown in **Exhibit 4**. Maryland's goals reflect a reduction in nitrogen loads by nearly 20.0 million pounds per year from 2004 levels; a reduction in phosphorus loads by 0.9 million pounds per year from 2004 levels; and a reduction in sediment loads by 0.283 million tons per year from 2004 levels. The reduction goals for the entire watershed and the other bay states are shown in Appendix 1. Virginia and Pennsylvania, which, along with Maryland, account for nearly 90 percent of the nutrient and sediment loads to the bay, have not made quite as much progress as Maryland has in reaching the reduction goals. Accordingly, regional efforts will be critical to achieving the C2K commitments.

Exhibit 4
Maryland's Pollutant Reduction Goals

Pollutant	1985 Loads	2004 Loads	2010 Goal
Nitrogen (million lbs/yr)	82.4	56.9	37.3
Phosphorus (million lbs/yr)	6.77	3.82	2.92
Sediment (million tons/yr)	1.252	0.995	0.712

Source: Chesapeake Bay Program

In February 2006, Maryland released its draft *Chesapeake Bay Tributary Strategy Statewide Implementation Plan*. The plan is Maryland's blueprint for achieving the nutrient and sediment reduction goals of C2K. As of December 2006, the Department of Natural Resources (DNR) expects that a final implementation plan, which will be revised pursuant to the State fiscal 2008 budget as enacted, will be released sometime in the spring of 2007. DNR advises, however, that even the final implementation plan will be a dynamic document that will be updated every year or two.

Status of Nutrient Reduction Efforts

Estimating Progress

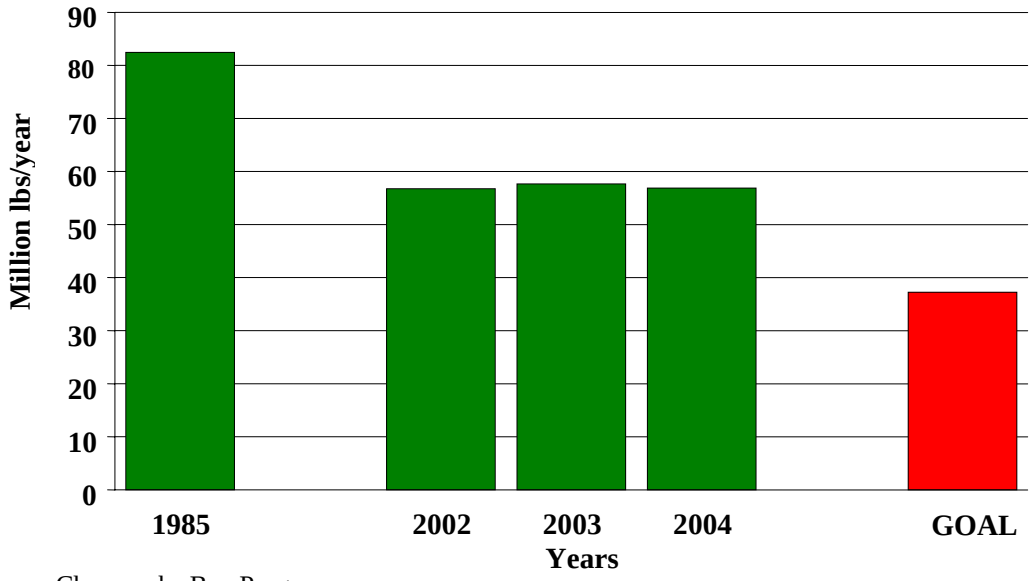
Progress toward nutrient reduction goals is estimated by EPA's Chesapeake Bay Program's watershed computer model. The scientific community remains somewhat skeptical of the quantitative use of model-based results such as baywide nutrient reductions based on reported best management implementation and efficiency assumptions when they are used to shape policy. Progress is likely to be overestimated; the Chesapeake Bay Program has tried to improve accuracy by compensating for the overestimation of nutrient reduction efficiencies.

In response to concerns about the accuracy of the reported estimates, in August 2004, Senators Mikulski and Sarbanes from Maryland, along with Senator Warner from Virginia, requested that the U.S. Government Accountability Office (GAO) study the project. In an October 2005 report, GAO made three recommendations to ensure that EPA's Chesapeake Bay Program Office completes its efforts to develop and implement an integrated assessment approach, revises its reporting approach to improve the effectiveness and credibility of its reports, and develops a comprehensive, coordinated implementation strategy that takes into account available resources. EPA is currently working to address those recommendations.

Current Estimates

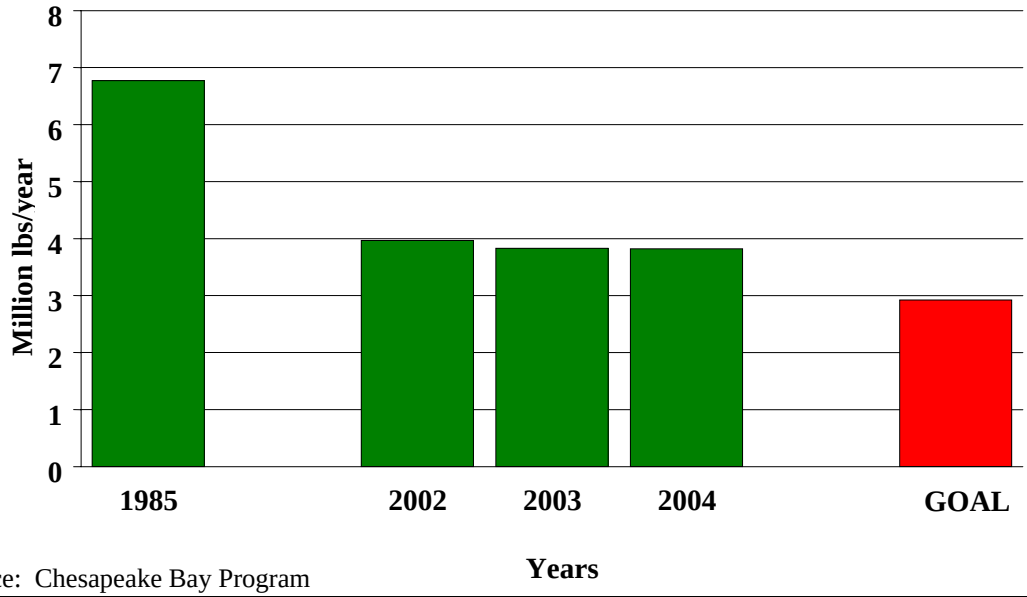
Based on estimates from the predictive model, since 1985, nitrogen loads from the watershed have been reduced by 20 percent; phosphorus loads have been reduced by 31 percent; and sediment loads have been reduced by 16 percent. Based on progress made from 1985 to 2004, the Chesapeake Bay Program estimates that the watershed is 41 percent of the way to reaching the watershed-wide nitrogen goal, 58 percent of the way there to meeting the phosphorus goal, and 54 percent of the way to reaching the sediment goal. Since 1985, Maryland is 57 percent of the way to reaching its nitrogen goal, 77 percent of the way to meeting its phosphorus goal, and 48 percent of the way to reaching its sediment goal. Maryland's progress in reaching these goals is shown in **Exhibits 5** through **7**. Data on the entire watershed's progress as well as the progress of the individual bay states are shown in Appendix 1.

Exhibit 5
Nitrogen Load to the Bay



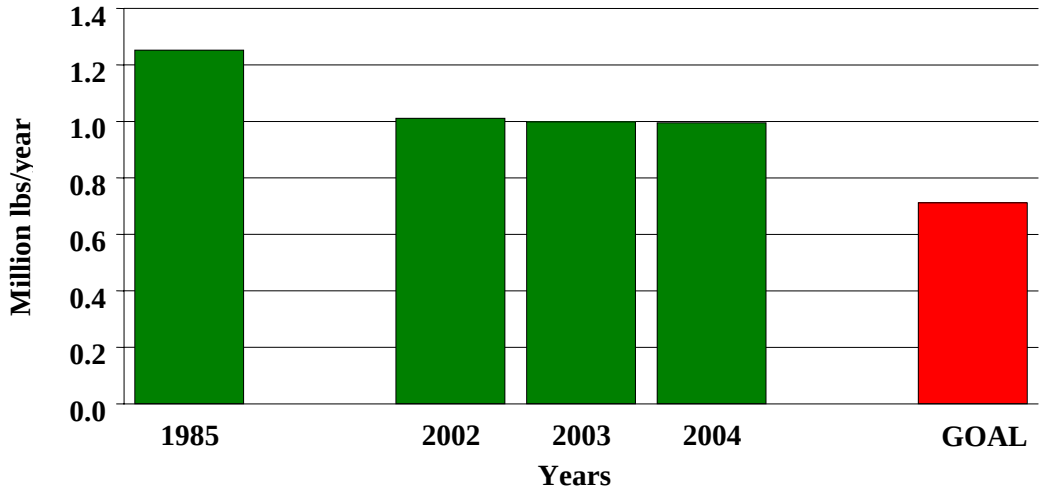
Source: Chesapeake Bay Program

Exhibit 6
Phosphorus Load to the Bay



Source: Chesapeake Bay Program

Exhibit 7
Sediment Load to the Bay



Source: Chesapeake Bay Program

What Happens If the C2K Goals Are Not Met?

Under the CWA, states are required to designate intended uses for their water bodies and to set water quality standards to serve these uses. Further, water bodies that are designated as "impaired" are cleaned up and restored under a framework, called a Total Maximum Daily Load (TMDL). A TMDL sets a maximum amount of pollution that a water body can receive and still attain water quality standards. It identifies all sources that contribute to the "impaired" water body and allocates reductions from those sources so that water quality standards can be attained.

If Maryland fails to achieve its water quality goals under C2K, it will be bound to a court agreement signed in 1999 to develop an enforceable TMDL for the Chesapeake Bay in 2011. While many environmental groups believe that TMDLs are an effective way to achieve water quality standards, State and federal officials worry about the potential for court challenges that have interfered with the establishment of TMDLs across the country. If the State fails to implement a TMDL and attain its water quality standards, EPA may step in and enforce the clean up plan on its own, in addition to withholding millions of dollars in grants to the State.

Framework for This Report

While progress is being made, meeting the nutrient and sediment reduction commitments of C2K will take continued collaboration from a variety of stakeholders – including State and

federal agencies, local governments, elected officials, advocacy organizations, businesses, and private individuals – across the watershed. And while Maryland's nutrient reduction goals are well-established, its implementation plan to achieve these reductions is still being developed and will be costly.

The Department of Legislative Services has prepared this report to examine the status of Maryland's progress toward meeting the C2K goals. In addition to the background information provided in this introduction, this paper will address:

- Maryland's Draft Chesapeake Bay Tributary Strategy Statewide Implementation Plan, including an explanation of each sector's strategy, a description of existing programs used to implement the strategy, and the limitations and challenges of the strategy;

- the total funding needed to implement the implementation plan, including projected available funds and funding gaps; and

- next steps to bay restoration, including policy issues that need to be considered and an overview of recommendations made by various stakeholders.

Chapter 2. Maryland's Tributary Strategy and the Implementation Plan

Maryland's Tributary Strategies Program was officially created when the State signed the 1992 amendments to the Chesapeake Bay Agreement. These amendments established specified nutrient reduction targets for the watersheds of each of the Chesapeake Bay's 10 major tributaries. A Tributary Team was established in each watershed; these teams are composed of citizens, business leaders, farmers, watershed organizations, and local, State, and federal government representatives. Since 1995, these teams have been working to meet the goals established in 1983 and 1992 through policy, restoration, education, and outreach activities.

Upon the signing of the *Chesapeake 2000* Agreement, the State and the tributary teams began working to revise the tributary strategies in order to meet the latest set of goals and commitments. Between 2000 and 2004, more than 25 public meetings were convened to obtain input from stakeholders. This information was used to compile *Maryland's Tributary Strategy*, which was published in April 2004. *Maryland's Tributary Strategy* is intended to be the road map that the State will use to achieve and maintain the water quality and habitat improvement goals of the *Chesapeake 2000* (C2K) Agreement. It identifies a number of actions that the State, through its various agencies and programs, will undertake in the next two to five years in order to reduce nutrient and sediment pollution from all sources.

Following the development of the tributary strategy, the State and the tributary teams began to develop *Maryland's Tributary Strategy Statewide Implementation Plan*. This plan, a draft of which was released in February 2006, describes ways to achieve the tributary strategy goals with regard to point sources, stormwater, septic systems, growth management, agriculture, and air deposition. Specifically, the plan is divided into two parts, a "Statewide Implementation Plan," and "Strategies to Achieve, Maintain, and Monitor Water Quality Goals." The Statewide Implementation Plan is broken down into individual strategies for the following:

- Point sources
- Urban sources
    - Stormwater
    - Septic
    - Growth management
- Agriculture
- Air Deposition
- Other State initiatives to address the implementation gaps

The objectives of the plan are to provide an implementation schedule, define program coordination, and to report implementation progress. In achieving these objectives, the plan lists the current programs that will be used to implement the individual strategies. It also highlights relevant implementation barriers, possible solutions to these barriers, and any State initiatives that may be used to address the implementation gaps. Finally, the plan outlines the roles that various stakeholders will need to play in implementing the strategies.

The second part of the plan, "Strategies to Achieve, Maintain, and Monitor Water Quality Goals," illustrates the initiatives and challenges that the State must address to facilitate plan implementation and to maintain water quality in the future. More specifically, this section discusses the need for coordination between regulators and planners, nutrient cap management, additional research, and restoration progress monitoring.

Part I of the Draft Implementation Plan – An Overview by Sector

Point Source Strategy

Background

Point sources contribute a significant portion (28 percent nitrogen, 19 percent phosphorus) of Maryland's total pollutant load to the Chesapeake Bay watershed. Discharges from wastewater treatment plants (WWTPs) account for the majority of point source nutrient pollution reaching the bay.

Summary

The Point Source Strategy targets sources attributed to a specific identifiable end of pipe or "point." The draft implementation plan sets forth the following two-part plan for Maryland's Point Source Strategy for the Chesapeake Bay watershed: (1) upgrade the State's 66 major publicly owned WWTPs with enhanced nutrient removal (ENR) technology so they are capable of achieving wastewater effluent quality of 3 milligrams per liter (mg/l) total nitrogen and 0.3 mg/l total phosphorus; and (2) maintain specified nutrient loading caps within the bay watershed. Upgrading the State's 66 major WWTPs with ENR technology will reduce nutrient loads to the bay by more than 7.5 million pounds of nitrogen per year from 2000 levels; these reductions will account for more than one-third of Maryland's commitments under C2K.

Existing Programs

The Maryland Department of the Environment (MDE) administers several grant programs that address the reduction of nitrogen and phosphorus loading into the bay from point sources. These programs are discussed below.

- ***Biological Nutrient Removal (BNR) Program:*** The BNR Program provides grants of 50 percent of the eligible cost of a project to reduce the output of nitrogen and phosphorus from wastewater treatment facilities. BNR biologically removes the total nitrogen to an average level of 8 mg/l and the total phosphates to an average level of 3 mg/l prior to discharging the water into the receiving waters.

- ***Enhanced Nutrient Removal (ENR) Program:*** In an effort to further reduce nitrogen and phosphorus loading into the Chesapeake Bay from point sources, Chapter 428 of 2004 established the Bay Restoration Fund within the Water Quality Financing Administration of MDE. The fund is financed by a bay restoration fee assessed users of WWTPs and septic systems. The main goal of the fund is to provide the grants necessary to upgrade the State's 66 major publicly owned WWTPs with ENR technology so they are capable of achieving wastewater effluent quality of 3 mg/l total nitrogen and 0.3 mg/l total phosphorus. Priority is given to wastewater facilities discharging into the Chesapeake Bay. The fund provides grants to facility owners for up to 100 percent of eligible costs to install ENR technology. In order to be eligible for funding, a WWTP must already be operating at the BNR level.

- ***Water Quality State Revolving Loan Fund (WQRLF):*** WQRLF was created to provide low-interest loans to counties and municipalities to finance water quality improvement projects. Projects eligible for funding include wastewater treatment plants, failing septic systems, and non-point source projects such as urban stormwater control projects.

- ***Supplemental Assistance Program:*** This program provides grant assistance to local governments for planning, designing, and constructing WWTP improvements throughout the State. Funds are targeted principally to two types of projects (1) maintaining compliance at existing WWTPs; and (2) eliminating failing septic systems in older communities. Funds are directed principally to projects where local governments need a subsidy to undertake the needed water quality or public health project. This program is often used in conjunction with other sources of federal and State financial assistance to achieve project affordability. This program funds up to 100 percent of eligible costs for sewer projects and up to 25 percent for BNR projects.

Limitations/Challenges

While numerous efforts are underway to reduce nitrogen and phosphorus loading into the Chesapeake Bay from point sources, the draft implementation plan highlights certain barriers to implementing the point source strategy. These are discussed below.

- ***Impacts of Growth:*** *Barrier:* Continued growth will lead to increased nutrient loads on WWTPs. *Possible Solution:* Local governments and WWTP owners could explore water reuse and zero discharge to maintain nutrient loading caps. Loading caps can also

be maintained through trading or offsets. MDE is currently exploring approaches for managing nutrient load caps for point sources.

- ***Blue Plains WWTP:*** *Barrier:* The District of Columbia tributary strategy does not include upgrading the Blue Plains WWTP. Because the Blue Plains WWTP is one of the three biggest WWTPs in the State, upgrading this plant with ENR technology would have a significant impact on overall nutrient loading into the Chesapeake Bay. MDE estimates that upgrading Blue Plains will require $68.0 million in additional BNR funds and $264.0 million in ENR funds. However, the plant serves the District of Columbia and parts of Northern Virginia, as well as Maryland, and upgrade plans have been complicated by interstate negotiations on funding responsibility and timing. *Possible Solution:* Federal, State, and local governments should continue discussions with the District of Columbia Water and Sewer Authority to secure federal support and funding for the Blue Plains WWTP upgrade.

In addition to the implementation barriers highlighted in the draft implementation plan, the Department of Legislative Services (DLS) notes that funding shortfalls also compromise the implementation of the point source strategy. MDE estimates that for the 66 major publicly owned WWTPs, $91 million will be required over the next six years for BNR, and $931 million will be required over the next eight years to install ENR technology. However, the current BNR six-year funding plan provides for only $87 million, leaving a $4 million funding gap. In addition, the current ENR eight-year funding plan provides for only $767 million, leaving a $164 million funding gap. While MDE's goal is to implement BNR and ENR upgrades by 2012, funding gaps and major delays with Blue Plains present a substantial obstacle.

Urban Sources: Stormwater Strategy

Background

The State began reducing the adverse effects of stormwater runoff in 1982, with the passage of the Stormwater Management Act. State regulations followed in 1983, which required local ordinances to be adopted and implemented by 1984. At this time, each local jurisdiction has a State approved and locally enforced stormwater management ordinance. Unfortunately, the increasing amount of impervious surfaces within the Chesapeake Bay watershed is outpacing current stormwater controls.

Summary

The Stormwater Strategy relies heavily on the implementation of existing Maryland stormwater management regulatory requirements. Specifically, the strategy includes:

- using existing regulatory requirements for all newly developed and redeveloped lands;

- inspecting all stormwater management practices for recently developed lands and maintaining all current practices in accordance with existing regulatory requirements;

- retrofitting up to 40 percent of untreated developed lands, as funding is available;

- educating Maryland residents about home fertilizer use; and

- using existing sediment and erosion control regulations for 100 percent of disturbed lands.

Existing Programs

There are a number of existing programs that will be used to implement the Stormwater Strategy. These include:

- ***MDE's Stormwater Management Program:*** This program will be primarily responsible for the implementation of any new stormwater management practices, the upgrade of older stormwater management facilities, and any retrofitting of older urban development with new stormwater management practices. The program relies on the *2000 Maryland Stormwater Design Manual*, Volumes I and II, which were developed in conjunction with the Center for Watershed Protection, and are considered to be "state-of-the-art" in stormwater design.

- ***The Municipal Separate Storm Sewers (MS4) Permit Program for Local Jurisdictions and the State Highway Administration:*** MDE will use this program to help reach the goal of retrofitting 40 percent of existing developed lands. Under this program, a detailed watershed assessment is conducted in all permitted localities, which identifies water quality improvement opportunities and the development and implementation of plans to control stormwater discharges to the maximum extent practicable. In addition, each MS4 permit that MDE issues for stormwater discharge must contain watershed restoration requirements. These requirements are incremental; initially, the goal is to retrofit 10 percent of the existing impervious area in the locality within a five-year permit term. Whether this requirement is met, however, depends largely upon the available funding in the locality. At this time, only Montgomery County has reported successful implementation of its restoration plan for 10 percent of its impervious acreage.

- ***MDE's Small Creeks and Estuaries Restoration Program:*** This program will be used to offer financial assistance to local governments for voluntary stream and creek restoration projects that improve water quality and restore habitat. Over the past five years, $2.8 million has been authorized for the program, which has helped to restore and enhance a total of 49,660 linear feet of streams and creeks across the State.

- ***Erosion and Sediment Control Program*:** Maryland's Erosion and Sediment Control Program, which was developed in 1970, requires an approved erosion and sediment control plan for any earth disturbance of 5,000 square feet or more and 100 cubic yards or more. It also provides for exemptions for agricultural uses, plan review and approval by local soil conservation districts, grading ordinances, project or construction inspections by local jurisdictions, and criminal penalties.

Limitations/Challenges

The draft implementation plan highlights some barriers to the implementation of the Stormwater Strategy and possible solutions to overcome some of the barriers. These include:

- ***Privately Owned Facilities:*** *Barrier:* Upgrading and retrofitting privately owned stormwater facilities could be problematic due to a lack of financial assistance and property access issues. *Possible Solution:* Local, State, and federal governments could provide additional financial assistance or other incentives to encourage stormwater facility upgrades and/or retrofits.

- ***Lack of Local Resources:*** *Barrier:* Inspecting and maintaining stormwater facilities can strain the limited local resources.

- ***Limitations of Local Codes:*** *Barrier:* Local public works codes limit the ability of using certain Environmentally Sensitive Design (ESD) measures and/or Low Impact Development (LID) techniques. *Possible Solutions:* Local governments need to have greater flexibility within their local codes to allow for greater use of ESD measures and/or LID techniques. Maryland's Stormwater Design Manual provides flexible design practices to local governments and promotes ESD techniques. Local governments and developers should be educated about the flexibility and innovation allowed under Maryland's stormwater techniques.

- ***Need for Research:*** *Barrier:* Additional research is needed to quantitatively assess other useful stormwater best management practices (BMPs) and pollution prevention measures in order to provide other options to address urban pollutant loads.

Urban Sources: Septic Strategy

Background

There are approximately 420,000 septic systems in Maryland. While septic systems account for only 4 percent of the region's nitrogen load into the bay, they have become a growing source of nitrogen pollution in localized areas. Septic systems also allow development

to spread beyond the reach of WWTPs, exacerbating the problems caused by stormwater runoff, erosion, and sediment control. Moreover, as nutrient caps and ENR are applied to WWTPs, developers are increasingly looking to septic systems as a low cost – though more polluting – alternative.

Summary

To address nitrogen pollution from septic systems, the septic strategy calls for two ambitious goals. The first goal is to have enhanced denitrification technology in all newly installed septic systems as funding is available or required by regulatory action. Enhanced denitrification technology is technology that qualifies as best available technology (BAT) for removing nitrogen from waste before it reaches the bay and its tributaries. The second goal is to install enhanced denitrification technology in all existing septic systems, or have those systems hooked up to an existing sanitary sewer system as funding is available. To implement these goals, the septic strategy identifies several initiatives to be implemented in two-year, five-year, or long-term action plans.

In the two-year action plan, the strategy calls for the University of Maryland to seek EPA approval of a performance monitoring grant for advanced nitrogen removal technology for on-site disposal systems, and to perform in-place nitrogen removal monitoring in at least two counties. In addition, the University of Maryland is charged with developing education programs through the Maryland Cooperative Extension for county administrators, real estate developers, and homeowner associations regarding advanced nitrogen removal and eligibility for Bay Restoration Fund grants.

Following on the progress to be made under the two-year action plan, the five-year action plan directs the Bay Restoration Fund Advisory Committee to promote the use of denitrifying septic systems within the critical area. Finally, the strategy's long-term action plan identifies the need for additional funding and the enactment or adoption of laws or regulations to require the use of denitrifying septic systems.

Existing Programs

- ***Bay Restoration Fund:*** The Bay Restoration Fund was established by Chapter 428 of 2004 to create a dedicated fund to provide grants for upgrading major WWTPs and septic systems in Maryland. As a revenue source for the fund, a fee (generally $30 annually) is collected from users of WWTPs and septic systems. Of the revenues collected from septic system users, 60 percent is earmarked for grants to septic system owners for the purpose of upgrading septic systems, while the remaining 40 percent is directed to the Cover Crop Program within the Maryland Department of Agriculture (MDA). With respect to the grants provided to septic system owners, which are administered by MDE, statutory priority is first given to those septic systems within the Critical Area, and second, to failing systems that MDE determines are a threat to public health or water

quality. For those systems, grant funding may pay for the cost of upgrading a septic system to BAT for nutrient removal or for the marginal cost of using BAT instead of conventional technology. In addition, Chapter 462 of 2006 established a third level of priority for grant funding under the Bay Restoration Fund based on income levels and types of eligible costs. At a minimum, to qualify as BAT, technologies must have undergone an evaluation at least as stringent as required by EPA's Environmental Technology Verification Program. Typically, technologies that remove 50 percent or more nitrogen qualify as BAT.

- ***WQRLF:*** Although not identified in the draft implementation plan, the WQRLF was established in 1988 to provide low-interest loans to counties and municipalities to finance water quality improvement projects. Through WQRLF, MDE provides low-interest loans to counties and municipalities to finance water quality improvement projects, including WWTPs, failing septic systems, and non-point source projects such as urban stormwater control projects. However, because the WQRLF provides low-interest loans, and not grants, without performance standards requiring septic systems to be equipped with denitrifying technology, there is little incentive to apply for a loan for a septic system upgrade. Moreover, under WQRLF, funding for septic system upgrades must compete with funding for wastewater treatment plant upgrades and stormwater management projects.

Limitations/Challenges

The septic strategy identifies several barriers to implementation and possible solutions to overcome the barriers. Examples include:

- ***Lack of Performance or Maintenance Standards:*** *Barrier:* The lack of uniform standards for performance or maintenance of new septic systems could result in neglected systems that fail to properly denitrify. *Possible Solution:* The State or local governments could require long-term maintenance contracts prior to approving a septic system. Additionally, the State could adopt regulations or enact standards for septic system performance and maintenance.

- ***Lack of Incentives to Install Denitrifying Septic Systems:*** *Barrier:* Without incentives, the public may be unwilling to accept the increased costs of installing and maintaining denitrifying systems. According to MDE, the average cost of upgrading a failing septic system with denitrifying technology ranges from $10,000 to $15,000. *Possible Solution:* The State could develop incentives to encourage installation of denitrifying systems. Additionally, outreach and education programs may encourage the public to install denitrifying systems.

- ***Lack of Regulatory Authority:*** *Barrier:* In addition to failing to justify the need for this program in many locations, the State lacks the regulatory authority to enforce septic

upgrades. *Possible Solution:* Counties should take a proactive role in identifying situations where sewer connections to convenient or failing septic systems are possible. Additionally, the State should increase the nutrient cap of the local WWTP to accommodate such connections.

In addition to the above barriers and solutions identified in the draft implementation plan, DLS has identified several other limitations of the septic strategy, as described below.

- ***Funding*:** By DNR's calculations, there is an approximate $3.0 billion funding shortfall to accomplish the goals set by the septic strategy; however, the draft implementation plan does not identify any new revenue-generating opportunities to dedicate to the strategy. According to MDE estimates, the bay restoration fee will generate only an estimated $7.2 million annually for septic system upgrades.

- ***Unreasonable Goal*:** The goal of upgrading all existing and new septic systems is likely unreasonable, unless additional funding is provided or legislation is enacted to require all existing and new septic systems to install BAT for nitrogen removal. MDE estimates that the BRF can provide enough funding to upgrade approximately 500 septic systems per year. At this rate, however, it will take approximately 102 years to upgrade the estimated 51,000 septic systems located within the critical area and another 740 years to upgrade the remaining 370,000 septic systems in the State.

Urban Sources: Growth Management Strategy

Background

The C2K commitments made by Maryland, Virginia, and Pennsylvania are to reduce the rate of urban sprawl by 30 percent by 2012 and to permanently preserve from development 20 percent of the land area in the Chesapeake Bay watershed by 2010. Baseline estimates for this sprawl rate were developed using a report by the Maryland Department of Planning (MDP) entitled *Maryland's Changing Land: Past, Present, and Future (2001),* and reduction rates will be measured as an average over five years from the baseline years of 1992-1997. An estimated 3 million people are predicted to settle in the Chesapeake Bay watershed by 2020, and of that, approximately 1 million will be in Maryland. According to the report, if development continues as it did in the 1990s, over 300,000 acres of resource land will be lost.

Summary

The growth management strategy focuses on how growth management within the State will aid in achieving and maintaining nutrient caps. The strategy relies on local government planning and zoning agencies to adopt various Smart Growth initiatives. The strategy reaffirms the State's commitment to achieve a 30 percent annual reduction in the rate of sprawl by 2010.

Existing Programs

The draft implementation plan identifies several existing programs that will support the growth management strategy. Examples include:

- ***The Economic Growth, Resource Protection and Planning Act of 1992 (Chapter 437 of 1992):*** This Act is the primary building block for the growth management strategy. Among many things, the Act provided the framework needed to implement a reduction in the rate of sprawl and required all local comprehensive plans to be revised to be consistent with seven visions designed to guide policymakers in deciding where and how future development should occur. An eighth vision regarding adequate public facilities and infrastructure was added by Chapter 676 of 2000. The eight visions are:

  - development is concentrated in suitable areas;
  - sensitive areas are protected;
  - in rural areas, growth is directed to existing population centers, and resource areas are protected;
  - stewardship of the Chesapeake Bay and the land is a universal ethic;
  - conservation of resources, including a reduction in resource consumption is practiced;
  - to assure the achievement of items 1 through 5, economic growth is encouraged and regulatory mechanisms are streamlined;
  - adequate public facilities and infrastructure are available or planned in areas where growth occurs; and
  - funding mechanisms are addressed to achieve these visions.

- ***Smart Growth:*** In 1997, the General Assembly passed several laws that became part of a comprehensive State approach called Smart Growth. The Smart Growth initiatives were passed to provide funding mechanisms and use financial resources as incentives for implementation. Five core initiatives were a result of the 1997 legislation:

  - ***Priority Funding Areas:*** The Smart Growth and Neighborhood Conservation Act of 1997, Chapter 759 of 1997, also called the Priority Funding Areas Act of 1997, was designed to protect the State's green spaces and to preserve the State's rural areas and aimed to manage growth by restricting State funding to designated priority funding areas (PFAs). The State may not provide funding for any

growth-related project that is not located within a PFA. Thus, with some exceptions, State spending for transportation, housing, economic development, water and wastewater treatment facilities, and government operations is restricted to PFAs.

- ***Rural Legacy Program:*** The Rural Legacy Program directs State funds to local governments and conservation organizations (such as land trusts) to purchase property and conservation easements within designated "rural legacy" areas. The program was designed to create "greenbelts" of forested land and open spaces surrounding populated areas and to improve the State's water quality by reducing pollution run-off into streams, rivers and the Chesapeake Bay.

- ***Voluntary Cleanup Program and Brownfields Revitalization Incentive Program:*** The Brownfields programs are intended to promote economic development, especially in distressed urban areas, by identifying and redeploying underutilized properties. Reusing real property makes efficient use of existing infrastructure while providing an alternative to developing open space and contributing to sprawl. The law limits liability for certain unused or abandoned properties and provides economic incentives for redevelopment.

- ***Job Creation Tax Credit:*** Originally passed in 1996, and amended in 1997, the Job Creation Tax Credit Act encourages mid-sized and small businesses to invest in PFAs by providing income tax credits to targeted growth sector businesses. Eligible industries include manufacturing, biotechnology, research and development, and computer related services. One goal of the Act is to reinvigorate and revitalize neighborhoods and encourage economic activity and redevelopment in designated PFAs.

- ***Live Near Your Work Program:*** This program encourages employees in the State to buy homes near their workplaces. The program is designed to use State, local, and private resources to help people purchase homes in distressed communities near their employment, with the goal of revitalizing and stabilizing these neighborhoods. In addition, the program encourages employees to use alternative modes of transportation for daily commutes.

- ***Priority Places:*** In October 2003, Governor Robert L. Ehrlich, Jr. issued an executive order that created a Priority Places Strategy, which is intended to foster well-planned new development, redevelopment, and revitalization efforts that will serve as models for land use patterns that benefit the economy, quality of life, and the environment, and ensure the best possible return on State investments. The Priority Places Strategy is based on the eight visions from the 1992 Act, the 1997 Priority Funding Areas Act, and existing State and local planning processes. MDP takes the lead on implementing this strategy.

- ***Several Other State Initiatives, Led by MDP, Are Also Listed in the Strategy:*** These efforts include reviewing applications for priority places, completion of a development capacity methodology that can be used to assist local governments in watershed and natural resource planning, and commencement of a pilot project to incorporate land use assessment in a watershed restoration action in Frederick and Worcester counties. In addition, MDP continues to develop a Growth Simulation Model to generate growth forecasts on a watershed basis. Furthermore, the agency continues to work in partnership with federal, State, and local agencies to increase transit oriented development by identifying land use characteristics that change development trends and policies and encourage development of communities near public transit.

Limitations/Challenges

The draft implementation plan identifies two barriers to implementation.

- ***Conflicts:*** *Barrier*: Local regulations and caps on WWTPs may cause conflicts with the desire to develop inside PFAs. *Possible Solutions*: County comprehensive plans should be updated to reflect the tributary strategies. Also, the State could develop a system that combines WWTP capacity and local needs with development capacity. Finally, better local planning for water quality would help.

- ***Lack of Tools for Tracking:*** *Barrier:* Lack of sufficient legal tools available to the counties and the State to track the rate of sprawl and enforce growth management techniques.

In addition, DLS has identified several other challenges regarding the implementation of the growth management Strategy, as described below.

- ***Indicators for 30 Percent Reduction in Sprawl:*** The growth management strategy states that implementing the 30 percent reduction in urban sprawl requires the State and counties to agree on which indicators will be used. For example, the governing bodies need to determine whether to use acres that are consumed outside of the PFAs, newly generated impervious cover inside and outside of PFAs, or some other indicator as a measurement. According to the Chesapeake Bay Program, reducing the rate of urban sprawl by 30 percent equates to a reduction of 17,429 acres of impervious surface acres per year. However, between 1990 and 2000, the total acres of impervious surfaces in the watershed increased from 611,000 acres to 860,000 acres. Reversing the trend remains a challenge for the growth management strategy.

- ***Effectiveness of Smart Growth Initiatives:*** Part of the challenge for the strategy is the effectiveness of the current programs. Do the Smart Growth initiatives work? The State and counties need to evaluate the effectiveness of the existing programs and make improvements if necessary. Several concerns have been raised that PFAs do not prevent

sprawl that is privately or locally funded and do not prevent growth outside of PFA boundaries, but just prevent the use of State funds to assist projects that are outside of PFAs. In addition, some analysts have raised concerns that neither benchmarks nor indicators were established with the 1997 legislation, making evaluation of the effectiveness of the initiatives and measuring the success of the program difficult.

- ***Growth Projections:*** The draft implementation plan does not appear to incorporate projected growth for the watershed, rather, it reflects reductions needed from current levels. While the goal of 30 percent reduction in sprawl is vital to the watershed, the strategy must be comprehensive enough to address projected growth and sprawl past the 2010 deadline.

- ***Educating the Public:*** Part of the strategy includes having private landowners choosing to live in PFAs, altering their use of fertilizers, and changing landscaping on their properties to minimize runoff. A public awareness campaign of the five core initiatives would be helpful to bolster the incentives within the initiatives.

Agriculture Strategy

Background

Since 1950, total farmland acreage in the Chesapeake Bay watershed has declined by 45 percent, and an estimated 90,000 acres of farmland are lost each year to development. Nevertheless, agriculture remains the largest single land use in Maryland, with 2.1 million acres, or roughly 33 percent of total land area assessed as agricultural land and about 1.6 million, or 25 percent of total land area in active agricultural use. While many farmers have already taken steps to reduce pollution, a renewed look at agriculture is seen as one of the next greatest opportunities to improve bay water quality. Imposing more requirements on farmers without adequate financial support, however, is not feasible, as farmers are struggling to maintain economic viability.

Summary

The agriculture strategy includes a plan to work with Maryland's farm community to implement a range of BMPs on farmland across the watershed to reduce nutrient and sediment loads. The strategy includes more than 20 different BMPs that work to accomplish water quality goals while balancing the needs of crop and livestock production. **Exhibit 8** identifies the various BMPs listed in the strategy, the progress that had been achieved through 2005, and the five-year implementation schedule.

Exhibit 8
Agriculture Strategy Implementation Schedule

Best Management Practice	Units	Strategy Goal	Progress through 2005	5-year Implementation Schedule: 1-2 Year Goal	5-year Implementation Schedule: 3-5 Year Goal
Soil Conservation and Water Quality Plans	acre	1,364,718	723,912	-100,000	-150,000
Conservation Tillage	acre/year	718,037	739,244	665,037	665,037
Cover Crops, Small Grains, and Alternative Crops					
Cover Crops	acre/year	600,000	52,329	230,000	230,000
Commodity Cover Crops	acre/year	150,000	0	50,000	50,000
Alternative Crops	acre/year	50,000	0	0	3,500
Animal Waste Management Systems					
Livestock	systems	2,023	1,086	50	75
Poultry	systems	1,247	1,100	50	75
Runoff Control	systems	1,092	753	40	60
Pasture BMPs					
Off-stream Watering w/Fencing	acre	11,505	5,777	300	450
Off-stream Watering w/o Fencing	acre	29,748	28,231	600	900
Nutrient Management, % Treated	%	100%	80%	100%	100%
Precision Agriculture	acre	300,000	90,628	0	100,000
Retirement Programs					
Forest Buffers	acre	32,506	18,995	500	780
Grass Buffers	acre	60,764	37,840	8,000	12,000
Wetland Restoration	acre	16,678	6,707	300	450
Retirement of Highly Erodible Land	acre	28,922	13,506	4,000	6,000
Tree Planting – Agriculture	acre	10,712	8,567	200	300
Ammonia Emissions Reduction	houses	740	0	12	300
Phytase Feed Additive (% reduction)	%	32%	16%	30%	32%
Manure Transport (tons)	tons/year	70,000	38,333	75,000	75,000
Horse Pasture Management	operations	7,040	0	50	150

Source: *Maryland's Chesapeake Bay Tributary Strategy Statewide Implementation Plan* (February 22, 2006 Draft), Maryland Department of Agriculture

According to the draft implementation plan, implementation schedules were developed using current and projected budget allocations and tracked implementation rates as a result of State regulations and voluntary participation. The plan notes that projected statewide implementation schedules emphasize cost-effective practices and the need to continue to pursue

additional State and federal funding to increase implementation rates. The draft plan states a goal of 100 percent implementation rates for all BMPs listed in the strategy.

Existing Programs

The draft implementation plan identifies several existing programs that work to implement the strategy. These include:

- ***Maryland Agricultural Water Quality Cost Share Program (MACS):*** MACS provides farmers with grants to cover up to 87.5 percent of the cost to install eligible BMPs on their farms to control soil erosion, manage nutrients, and safeguard water quality.

- ***Cover Crop Program:*** This program provides cost-share assistance to farmers to plant cover crops, which absorb unused crop nutrients remaining in the soil following the fall harvest and act as a ground cover to keep the soil from eroding during the winter months.

- ***Soil Conservation and Water Quality Program:*** This program helps farmers and landowners develop plans featuring a menu of BMPs uniquely suited to each site. Soil Conservation District (SCD) staff provide technical assistance to develop the plans and design and implement BMPs.

- ***Nutrient Management Program:*** This program provides technical and financial assistance to farmers to help them meet the requirements of the Water Quality Improvement Act. Farmers who have a gross income of $2,500 or more or who have 8,000 pounds or more of animals must develop and implement a nutrient management plan that addresses the timing, application, and management of all nutrient sources used in the farming operation. MDA certifies and licenses nutrient management consultants who provide technical assistance in the development and implementation of plans. Farmers may also have their plans developed by Maryland Cooperative Extension agents for free or may become certified to develop their own plans. Cost-share assistance is available for private-sector development of plans through MACS or the Environmental Quality Incentives Program (EQIP).

- ***Manure Transport Program:*** This 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 farmers where it is land applied in accordance with a nutrient management plan or for alternative uses. Poultry companies provide a 50 percent match for litter transported from their growers' farms. Cost-share support is administered through MACS.

- ***EQIP:*** EQIP, a federal program administered by the Natural Resource Conservation Service (NRCS), 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. Projects may be co-cost-shared with MACS.

- ***Conservation Reserve Program and Conservation Reserve Enhancement Program (CREP):*** These programs, administered by the U.S. Department of Agriculture (USDA), are designed to set aside and implement conservation measures to protect highly erodible land and other sensitive farmland for a period of 10 to 15 years. CREP also targets the creation of riparian buffers and wetland restoration. The State also offers cost-share assistance through MACS for installation of BMPs and may purchase easements under CREP.

- ***Conservation Security Program:*** This program, administered by NRCS, provides assistance to producers to maintain and enhance natural resources. The program 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.

- ***Wetland Reserve Program:*** This program, also administered by NRCS, provides financial incentives to landowners seeking to restore nontidal wetlands. Payment includes compensation for a wetland easement and cost-share assistance to restore wetlands.

- ***Low Interest Loans for Agricultural Conservation (LILAC) Program:*** This program is available to help farmers install BMPs or purchase equipment to protect natural resources and safeguard water quality. Loans offered through LILAC are guaranteed by the State's WQRLF within MDE.

- ***Operation and Maintenance Plans for Public Drainage and Public Watershed Associations:*** These plans outline upkeep activities that a Public Drainage Association intends to perform for a two to three year period. Cost-share assistance for the installation of several eligible BMPs for drainage ditches may be available from MDA.

- ***Rural Abandoned Mine Program:*** This program, administered by NRCS, is a land reclamation program. Soil Conservation Districts are involved in the design, approval, and inspection of implemented BMPs to assure their performance.

Limitations/Challenges

Despite the numerous programs underway to address nutrient and sediment runoff from agricultural lands, there are several barriers that will make implementing the strategy difficult. The agriculture strategy identifies several of these barriers and offers possible solutions to overcome the barriers. Examples include:

- ***Cover and Alternative Crops:*** *Barrier:* Alternative crops are not attractive to landowners because there is no market for them. *Possible Solution:* The State could assist in creating the necessary infrastructure and funding source for a successful alternative crops program.

- ***Animal Waste Management:*** *Barrier:* Often landowners with horses do not perceive themselves as part of the agricultural community, complicating the implementation of Horse Pasture Management Programs. *Possible Solution:* Federal, State, and local governments and SCDs should reach out to those landowners to help educate them about the impact of their operations. Additionally, a funding mechanism for assuring adequate staff and program implementation would aid this process.

- ***Land Retirement:*** *Barrier:* Most of the available land has already been used for a retirement BMP, and landowners are concerned about taking additional land out of production. *Possible Solution:* Consider allowing the harvest of grassed buffers to encourage landowners to plant more.

- ***Agriculture Conservation Plans:*** *Barrier:* There are insufficient funds and personnel to implement the nutrient management and soil conservation and water quality plan programs. *Possible Solution:* In addition to SCD staff requirements, increased staffing and resources for the State and SCD agricultural programs are necessary to meet ambitious implementation goals. DLS notes that Chapter 289 of 2006, among other things, mandates additional funding for the SCDs.

- ***Innovative Practices:*** *Barrier:* Precision agriculture is not fully evolved or adapted for Maryland conditions. *Possible Solution:* The federal and State governments should fund more research in this field.

In addition to the implementation barriers highlighted in the draft implementation plan, DLS has identified several other limitations of the agriculture strategy which were not identified in the plan. These are described below.

- Despite the fact that most experts agree that the most cost-effective measures to reduce nutrient and sediment loading to the bay is through the implementation of agricultural BMPs, the strategy does not recommend any new programs or initiatives in this sector or call for the prioritization of existing State funds for these BMPs. Five of the six BMPs that were identified as most cost-effective by the Chesapeake Bay Commission in its December 2004 report, *Cost-Effective Strategies for the Bay* are agricultural BMPs.

- The plan acknowledges that increased funding will likely be needed to implement the agriculture strategy but does not identify any revenue-generating opportunities to dedicate to the implementation of agricultural BMPs.

- Some of the underlying assumptions of the strategy may be unreasonable:

  - One-hundred percent implementation of all BMPs is likely unreasonable unless legislation/regulations mandating the implementation of various BMPs is enacted; however, there seems to be a reluctance to recommend mandatory measures.

  - The nutrient reduction goals set for agriculture are extremely ambitious and will require implementation of the entire suite of BMPs at levels projected. Additional cost-share and technical assistance will be needed to meet the goals.

  - Implementation of some of the BMPs outlined in the agriculture strategy would likely require significant increases in funding for existing programs. For example, the strategy assumes that 600,000 acres of cover crops will be planted each year, that 150,000 acres of commodity cover crops will be planted each year, and that 50,000 acres of alternative crops will be planted each year. This is a significant expansion of the existing program. In fiscal 2006, 124,500 acres of cover crops were planted. In fiscal 2007, MDA expanded the program to include commodity cover crops. In addition, the program received additional funding. An estimated 168,750 acres of traditional cover crops and 58,500 acres of commodity cover crops will be planted in fiscal 2007. DLS notes that Chapter 289 of 2006 recommended additional funding of $3.0 million annually until a total of at least $14 million is provided for the Cover Crop Program each year. Even with that level of funding, however, the program would still fall significantly short of the tributary strategy goals. In order to plant 600,000 acres of traditional cover crops and 150,000 acres of commodity cover crops, an estimated $25.0 million to $28.0 million would be needed each year.

Air Deposition Strategy

Background

The deposit of nitrogen into the bay from the atmosphere significantly contributes to nutrient overload in the bay. Airborne nitrogen can enter the bay either directly from the atmosphere or by deposition on land and then the bay through waterways or stormwater runoff. Airborne nitrogen that reaches the bay after being deposited on land can be mitigated with the same stormwater, agriculture, and forestry policies previously discussed. Mobile sources (*i.e.* cars and trucks) are the largest contributor of airborne nitrogen, followed by electric generating units.

Summary

The air deposition strategy encourages MDE to continue to implement the federally mandated standards to reduce airborne nitrogen emissions in the State. Specifically, the strategy

encourages MDE to develop and implement the recent U.S. Environmental Protection Agency (EPA) air quality standards for ozone and fine particulates. The strategy also urges MDE to continue to work aggressively with the EPA and regional organizations to reduce emissions transported from outside of the State.

Existing Programs

A number of existing programs work to reduce air pollution in Maryland:

- ***The Federal Clean Air Act (CAA):*** The intent of the CAA is to reduce smog and atmospheric pollution nationwide for the purpose of improving environmental, health, and aesthetic conditions. The CAA also has the corollary effect of reducing air deposition pollution into waterways, including the bay. The states are mainly responsible for implementing the CAA, because pollution control problems often require an understanding of issues that are local in nature, including issues related to local industry, geography, housing patterns, etc. EPA assists the states by providing scientific research, expert studies, engineering designs, and money to support clean air programs. Under the CAA, EPA establishes limits on the amount of a particular pollutant that may be present in the air anywhere in the United States. A state may not have weaker pollution controls than those established nationwide. Each state must develop an EPA-approved state implementation plan (SIP) that governs the implementation and enforcement of the CAA. If a state does not have an EPA-approved SIP, EPA may take over the implementation and enforcement of the CAA in that state.

- In its efforts to meet CAA requirements, MDE administers several air pollution control programs, including:

  - ***Air Quality Monitoring Program:*** This program monitors the level of six criteria pollutants, including nitrogen dioxide;

  - ***Air Quality Compliance Program:*** This program works to achieve compliance with EPA emissions standards for stationary sources. Program staff conduct inspections, respond to complaints, provide compliance assistance, and pursue enforcement actions;

  - ***Title V Program (Air Quality Permitting):*** This program governs construction and operation permits for new stationary "major sources" of pollutants;

  - ***Air Quality Planning Program:*** This program develops, seeks EPA approval for, and adopts the Maryland SIP; and

  - ***Mobile Sources Control Program:*** This program governs the emissions of pollutants from mobile sources. This program includes:

- ***Vehicle Emissions Inspection Program:*** This program requires vehicle emissions inspections every two years and the repair of vehicles with substandard emissions;

- ***Diesel Emissions Program:*** This program authorizes State and Maryland Transportation Authority police to conduct an emissions inspection on large diesel powered vehicles and requires repair of vehicles with substandard emissions;

- ***Alternative Fuel and Advanced Technology Vehicle Program:*** This program facilitates the ability of vehicle fleets to use alternative fuels; and

- ***Commuter Choice Maryland Program:*** This program provides tax incentives for commuter programs.

Limitations/Challenges

While Maryland has been a national leader in implementing programs to reduce air emissions, the draft implementation plan lists one primary barrier to implementing the air deposition strategy:

- ***Transport from Other States:*** *Barrier:* A considerable amount of emissions that are present in the air in Maryland and deposited in the bay are produced outside of Maryland. *Possible Solution:* To achieve EPA mandated air quality standards and thus reduce air deposition into the bay, MDE must continue to reduce in-state emissions to the extent possible and work aggressively with the EPA and regional organizations to reduce out-of-state emissions that are transported into Maryland.

Other State Initiatives to Address the Implementation Gaps

The draft implementation plan also identifies a number of miscellaneous policy actions that will help implement the tributary strategy goals. Many of these actions will require coordination between State agencies, local governments, and various stakeholders. These actions include:

- fostering the restoration of both public and private wetlands;

- using the Corsica River Pilot Project as a model for tributary restoration;

- completion by the University of Maryland of the *Chesapeake Bay Program Innovation Strategy* to enhance the tributary strategy;

- providing implementation guidance with respect to Total Daily Maximum Loads (TMDLs) to assist local governments in maintaining nutrient caps;

- creating documents and maps to identify areas for wetland restoration, creation, enhancement, and preservation;

- developing new guidelines for marsh creation as a tool for shore erosion control and expanding wildlife habitat;

- developing new methods for evaluating the effectiveness of mitigated wetlands;

- doubling, using new planting technologies, the acreage of submerged aquatic vegetation restoration;

- coordinating with federal agencies and stakeholders to restore wetlands functions and to improve the vitality of restored wetlands;

- coordinating with stakeholders, the University of Maryland College of Agriculture and Natural Resources, and utilities in the State to create a fund to finance the reduction of nutrient deposition into State waterways and terrestrial carbon sequestration;

- continuing to conduct education and outreach programs related to the bay;

- incorporating water quality and wetland restoration policies when developing, updating, and implementing fishery management plans;

- prioritizing areas for water quality improvement and habitat enhancement, and increasing implementation in those areas;

- conducting studies of all aspects of nutrient dynamics in the air, land, and water by the University of Maryland Center for Environmental Science;

- developing multi-species fishery management plans;

- conducting ecosystem-based restoration research on the native oyster;

- continuing to conduct targeted research on the nonnative Asian oyster;

- researching the ecology and ecosystem dynamics of harmful algae blooms;

- identifying the effect of landscape changes on water quality and quantity, flooding, and aquatic ecosystems; and

- studying the effect of sea level rise and fall on bay restoration.

Part II of the Draft Implementation Plan: Strategies to Achieve, Maintain, and Monitor Water Quality Goals

Coordination Between Regulatory and Incentive Based Programs: In Part II of the draft implementation plan, the plan discusses the importance of coordination between regulatory and incentive based programs. The tributary strategies and TMDLs are parallel and complementary programs, in that they both set quantitative nutrient loading goals on a watershed basis. According to the Department of Natural Resources (DNR), TMDLs are developed for smaller basins to correct local water quality impairments, and tributary strategies are for larger basins and are usually more stringent than TMDLs. On the other hand, TMDLs are based on regulatory measures, while the tributary strategies are a cooperative incentive based plan. The use of BMPs to reduce nutrient loadings is a critical tool for both. According to the draft implementation plan, there is often a perception that TMDLs prohibit development, yet TMDLs provide an assessment of allowable loads of a pollutant into a water body. The plan recognizes that growth can be accommodated and water quality restored with projects that offset or reduce runoff. According to the draft implementation plan, more than 100 TMDLs are finalized. The next crucial step is for local governments to incorporate TMDLs and tributary strategies into their comprehensive plans.

Cap Management Strategy: The challenge for the State, once water quality standards are met and nutrient loads are capped, is how to manage continued growth without exceeding the cap. The cap is vital to maintaining improved water quality in the bay. Included in Part II of the draft implementation plan is a cap management strategy to address this issue. There are several components to the cap management strategy, including technical, policy and political considerations. Inherent in a cap management strategy is a viable growth management strategy. According to DNR, elements of the strategy are under development as part of the TMDL implementation guidance. The draft implementation plan notes that as a comprehensive approach to growth management develops, several key components must be included, such as a watershed planning approach, flexibility in existing regulations that encourage innovative techniques for landscaping, stormwater design, and funding programs that address maintenance of existing facilities. Permits required by regulations, in accordance with the federal Clean Water Act, make water quality restoration mandatory and will aid in developing a comprehensive cap management framework.

Nutrient Trading: Nutrient trading is a market-based approach for protecting and improving water quality by allocating the total amount of pollutants that enter a watershed. Nutrient trading works by transferring credits for nitrogen and phosphorus between buyers and

sellers from among the pollution sources for that watershed. The EPA recognizes that trading can help provide greater efficiency in achieving water quality goals and more incentives for sources to reduce pollution output. Once pollution allowances are allocated, sources with low-cost pollution reduction options have an incentive to reduce nutrient loadings beyond what is required of them and to sell the excess credits to sources with higher control costs. Trading provides flexibility that a traditional regulatory regime cannot, but maintains the obligations under the federal and state water quality laws. This flexibility may help reduce the total cost of improving water quality. MDE has been holding listening sessions with respect to developing a nutrient trading program in Maryland.

In October 2006, an innovative trading program was signed between the EPA and the USDA that allows farmers to earn credits that they can trade with industrial or municipal facilities by implementing conservation practices that reduce runoff. A pilot project is in the Chesapeake Bay watershed. This type of partnership and trading program, if feasible, would help with a successful cap management strategy.

Focus Areas and Tracking and Monitoring Progress: Finally, the draft implementation plan lays out several recommended future actions that the plan needs to assume to reach the approach envisioned in the tributary strategy. Some of these are partnerships with homebuilders and planners to identify and pilot cost-effective retrofits in high impact subwatersheds. An immediate need is to target critical areas where septics play a significant role in water impairment. Other future efforts need to be addressing nonpoint sources with continued improvements in the agricultural strategy such as manure management, precision agriculture, and cover crops. In addition, efforts need to be made to find cost effective prevention strategies for waste streams, especially in new or expanding communities. Finally, the plan recognizes that communication and tracking progress is a key element in its success. Reports will be provided on the status of watershed restoration, measurement of stressors and factors affecting the bay's health, and a report on bay ecosystem health. In addition, there will be four annual reports with State-specific information reported as part of the larger Chesapeake Bay Program reporting.

Chapter 3. Funding, a Significant Concern

The Cost of a Clean Bay

The overall cost to restore the Chesapeake Bay is in the tens of billions of dollars. While exact funding requirements to meet the goals set under the Chesapeake 2000 Agreement (C2K) are constantly evolving, two recent reports shed light on the significant costs of bay restoration.

In 2003, a Chesapeake Bay Commission report entitled, *The Cost of a Clean Bay: Assessing Funding Needs Throughout the Watershed*, estimated that the total cost of meeting C2K through 2010 was $18.7 billion, and that, with $5.9 billion in projected revenue between the three signatory states, there existed a funding gap of $12.8 billion.

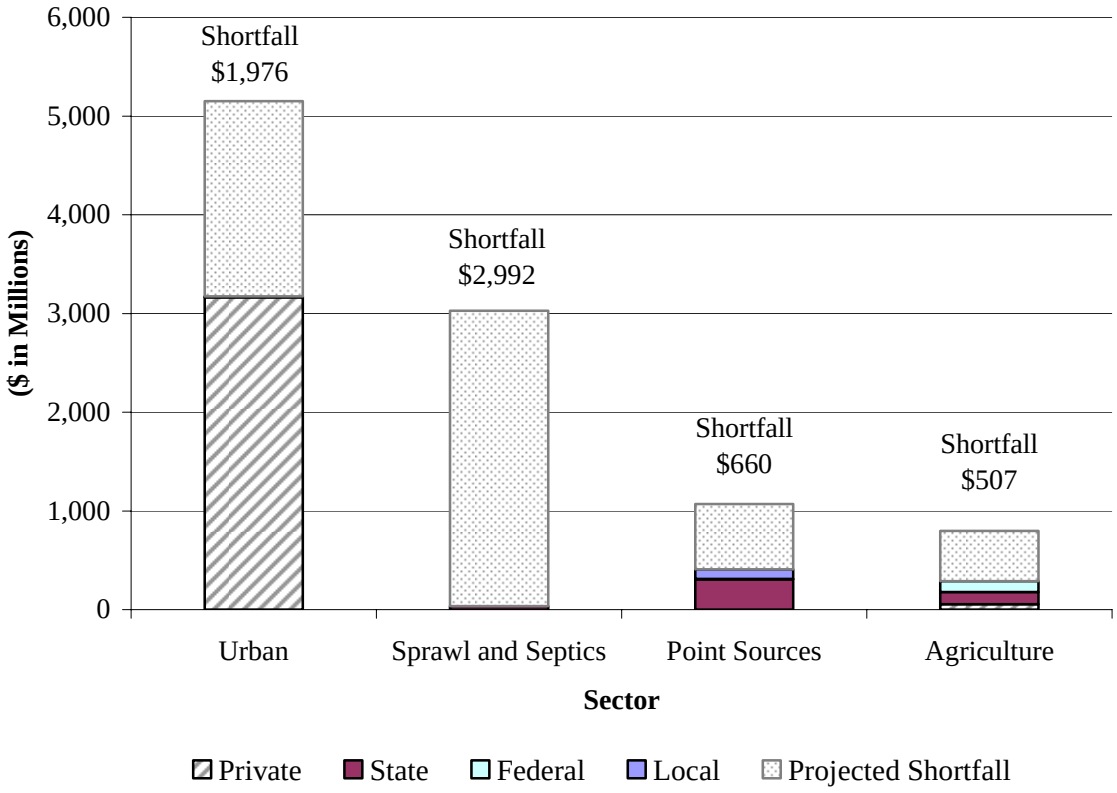
In 2004, the Chesapeake Bay Watershed Blue Ribbon Finance Panel report, *Saving a National Treasure: Financing the Cleanup of the Chesapeake Bay*, examined the restoration strategies of the three C2K states and estimated that watershed-wide restoration costs totaled $28.0 billion in initial capital costs and $2.7 billion in annual costs. The report noted, however, that these costs were for meeting local water quality standards in addition to bay standards; that the cost methodology was not uniform across jurisdictions; and that cost effectiveness was not the primary consideration in developing the various restoration strategies. The report concluded that a target of $15.0 billion for watershed-wide restoration efforts would enable funding for the most cost-effective areas of wastewater management and agriculture.

The Department of Natural Resources' (DNR) Draft Funding Analysis

DNR prepared a draft funding analysis in November 2004, which estimated an overall cost of implementing Maryland's draft implementation plan at approximately $10.1 billion from 2003 through 2010. Of this amount, approximately $6.0 billion is attributable to capital costs, with operating expenses accounting for the remainder. Overall, the analysis predicted a funding shortfall of $6.1 billion. While much of the funding information contained in this analysis is already outdated, the draft analysis provides a general outlook on the sector-by-sector funding shortfall. In certain sectors, such as agriculture and point sources, this outlook is enhanced with funding updates from the Maryland Department of Agriculture (MDA) and the Maryland Department of the Environment (MDE).

The estimated cost to implement the tributary strategy by sector and funding source, as identified in DNR's draft funding analysis, is shown in **Exhibit 9**. Projected funding shortfalls by sector are also shown.

Exhibit 9
Projected Implementation Costs by Sector and Type of Funding
2003-2010



Source: Department of Natural Resources

DNR's draft funding analysis shows that, due to high implementation costs for stormwater retrofits and sediment and erosion control, urban best management practices (BMPs) account for roughly half of the overall $10.0 billion price tag. According to the analysis, there is approximately $3.2 billion to cover these costs, leaving a funding shortfall of about $2.0 billion. However, it should be noted that of the $3.2 billion in estimated funding, only $12.4 million is attributable to federal, State, or local programs. Estimates for the remaining funding for urban BMPs are based on compliance with existing laws and regulations. Thus, the estimated funding shortfall of $2.0 billion is likely conservative.

DNR's draft funding analysis indicates that the septic strategy has the highest funding shortfall at approximately $3.0 billion. The primary reason for this shortfall is due to the fact that, out of approximately 420,000 septic systems throughout the State, current revenue estimates

for the Bay Restoration Fund only provide enough funding to upgrade approximately 500 septic systems per year. Consequently, substantial funding will be required in order to upgrade all new and existing septic systems in accordance with the draft implementation plan. However, MDE advises that there are only 15,000 septic systems within the critical area, which accounts for only 3.5 percent of all septic systems statewide; accordingly, with respect to the highest priority projects, the estimated funding shortfall may be exaggerated.

The Bay Restoration Fund has reduced the funding shortfall for point sources. Current MDE estimates indicate that the fund will cover $767 million of the $931 million cost (through 2015) to upgrade the State's 66 major publicly owned wastewater treatment plants (WWTPs) with enhanced nutrient removal technology. However, because costs to perform the necessary upgrades continue to escalate, this funding shortfall will likely increase.

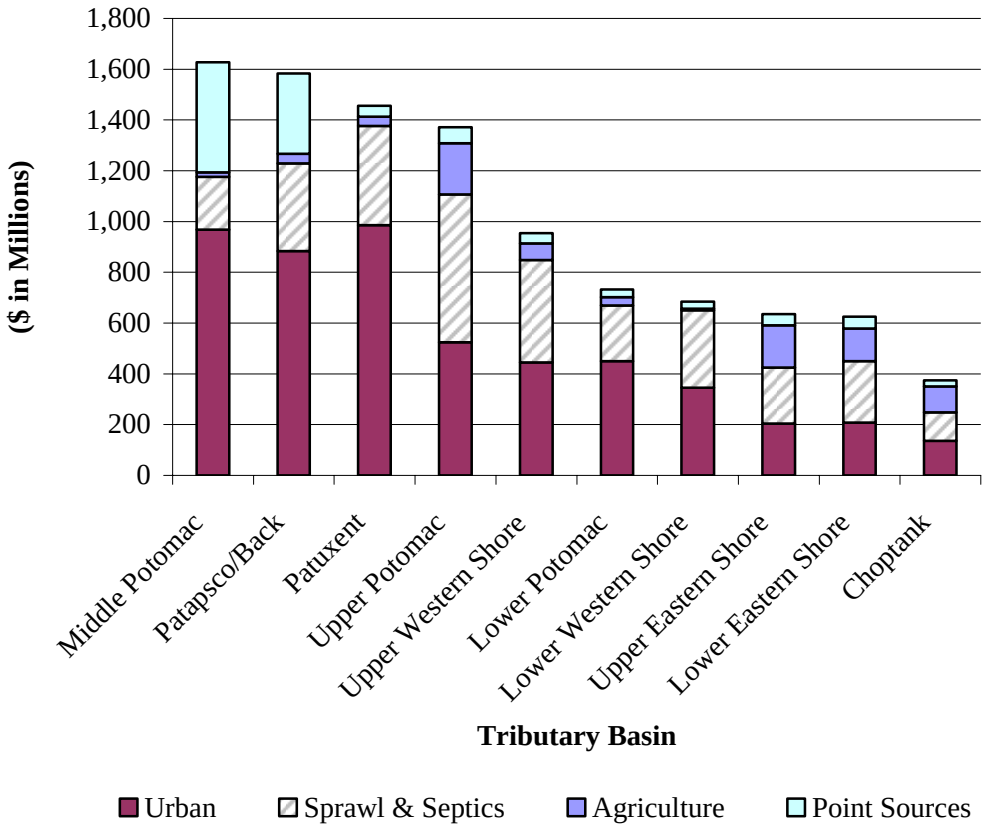
Agriculture is arguably the most cost-effective nutrient reduction sector, but it is also the sector in most need of funding for technical assistance, outreach, and ongoing capital project costs. The working philosophy is that funding should be provided for agricultural BMPs until the BMPs become part of normal farm practice and no longer require funding. For instance, the BMP conservation tillage was originally funded with State money, but has since become funded by farmers; a similar transition is expected for cover crops in the future.

According to recently updated funding information from MDA, the funding shortfall for the agriculture sector from 2006 through 2010 is estimated at $380 million, versus approximately $507 million under DNR's draft funding analysis. However, this is not necessarily a positive sign because the shortened time period of MDA's revised analysis means that the overall cost per year has increased. According to MDA, overall BMP implementation has been static for a number of initiatives, such as horse pasture management, due to a lack of funding and staff. Conversely, MDA reports that other BMPs, such as manure management, have experienced notable successes. Therefore, for the agriculture sector to succeed under the draft implementation plan, a comprehensive approach of funding and monitoring for all agricultural BMPs will be necessary. The Agricultural Stewardship Act of 2006, which mandated and recommended additional funding for several agricultural programs, is a step in the right direction.

The 2007 federal Farm Bill could provide a boost for the implementation of agricultural BMPs due to the federal government's interest in moving toward so-called "green payments" and away from crop subsidies, in order to meet World Trade Organization dictates. However, MDA reports that the Farm Bill may be smaller than in past years because of ongoing federal commitments both domestically and abroad.

Estimated tributary strategy implementation costs vary by tributary basin, as shown in **Exhibit 10**. For example, the Middle Potomac tributary basin, with the highest overall cost, will require significant stormwater management retrofits and WWTP upgrades, increasing the overall cost in that tributary.

Exhibit 10
Projected Implementation Costs by Tributary
2003-2010



Source: Department of Natural Resources

A Unified Budget Is Needed

Overall, funding for the State's draft implementation plan appears to be hampered by the lack of a unified budget. For instance, there is no centralized location for tributary strategy funding in the State operating and capital budgets, which means that funding is spread across the various State agencies involved (DNR, MDA, MDE, the Maryland Department of Planning, the University of Maryland, and the Maryland Department of Transportation). With a constantly evolving funding analysis and no coordinating entity for updating funding estimates and programmatic oversight, tracking the success of the tributary strategy is fragmented and difficult to measure.

In addition, the State government is only now determining what efforts local governments are making in terms of implementation and funding. While the lack of communication is being rectified by current discussions between State agencies and local governments, better communication and coordination is imperative. Watershed organizations have been forming over the last 30 or so years, but do not appear to have found a communication channel with local governments. As a result, public interest in watershed issues has been unable to marshal local resources for creating regulatory and financing mechanism changes in local government watershed plans. Notable exceptions currently can be found in Takoma Park's stormwater utility and the ongoing work of the University of Maryland's Environmental Finance Center to stimulate innovating financing ideas.

Conclusion

The next step in coordinating funding for the State's draft tributary strategy implementation plan will be the regular updating of DNR's draft funding analysis and the delineation of dedicated funding sources. A discussion with DNR staff indicates that local governments are ready to engage in tributary strategy implementation, but that funding is still a major concern. The federal government is not considering a substantial infusion of money for the implementation of the tributary strategy and so, barring a future change in federal policy, citizens of the bay watershed will bear the cost one way or another. For the State's tributary strategy to be fully implemented, financing will have to be pursued from the bay region down and from the local watershed level up.

Chapter 4. Next Steps to Bay Restoration

Policy Issues for Consideration

Over the years, the State has taken numerous steps to reduce nutrient and sediment pollution to the Chesapeake Bay, including recent legislative actions such as the enactment of the Water Quality Improvement Act in 1998, the establishment of the Bay Restoration Fund in 2004, and the enactment of the Agricultural Stewardship Act in 2006. Despite this progress, significant measures will still be needed to restore the Chesapeake Bay.

This report raises a number of issues that merit special consideration by the General Assembly in reviewing the Governor's proposed fiscal 2008 budget and in considering modifications to existing programs and/or the establishment of new ones. These issues are listed here and described in more detail below:

- enforcing existing programs more stringently could help achieve the nutrient and sediment reduction goals of the *Chesapeake 2000* Agreement (C2K);
- a significant increase in funding is likely needed to fully implement the strategies;
- targeting limited funds to most cost-effective measures may be necessary;
- managing growth and maintaining nutrient caps is essential to the bay restoration effort;
- strengthening stormwater management programs is also critical to a successful restoration program;
- controlling animal waste and other nonpoint sources will help achieve the goals;
- innovative approaches are needed; and
- a coordinated approach is necessary.

Enforcing Existing Programs More Stringently Could Help Achieve the Nutrient Reduction Goals of C2K

Even without the establishment of new programs, the strict enforcement of existing laws could result in significant reductions of nutrients and sediment into State waters. Attorney General Gansler has indicated that he will take action to prosecute all violators of environmental laws in an effort to help restore the bay.

Strengthen Enforcement of the Critical Area Law

In May 2006, the Environmental Law Clinic at the University of Maryland School of Law released a report entitled *Enforcement in Maryland's Critical Area: Perception in Practice*. The report identified a number of limitations and weaknesses in enforcing the critical area law. The limitations and weaknesses described in the report are summarized below.

Local Implementation: The clinic found that local implementation of the law has led to critical area programs that are different throughout all 63 participating jurisdictions. These inconsistencies create less predictability for landowners throughout the State.

Limited Role and Authority of the Commission: The commission is almost solely an advisory body, with very few of the powers that a typical State agency holds. The commission may only approve local critical area programs, grant or deny the approval of certain limited types of development, and review and make recommendations on development applications. The commission has no authority to adopt its own regulations.

Enforcement: There is no requirement for the State government to step in and enforce the laws on behalf of local jurisdictions. In addition, unlike many federal environmental laws, there is no citizen suit provision that would allow a citizen to challenge a violation in the absence of local or State enforcement. Further, the commission is under no duty to refer violations to the Attorney General, and there is no duty on the Attorney General to pursue compliance with the critical area law.

Grandfathering Clause: The clinic identified the grandfathering clause, which allows the continuation of a land use that was in existence at the time of program approval even though the use is inconsistent with the critical area program, as the largest loophole in the critical area law. Most existing waterfront properties are subject to grandfather clauses. The critical area law does not provide for the termination of these clauses at a future date. Also, nearly all development requests on grandfathered lots go through a relaxed variance process.

Variance Procedures and the Retroactive Granting of Permits and Variances: Although the standard for the granting of variances requires that the landowner experience "unwarranted hardship," both the courts and the legislature have struggled with the interpretation of this standard. This situation has led to inconsistent implementation throughout the State. Furthermore, retroactive variances provide an unfair advantage to a landowner because it is time consuming and costly for a jurisdiction to force a structure to be torn down. Retroactive variances also allow a landowner to avoid the pre-permitting exchange between local officials and commission members that may result in beneficial pre-construction project modifications.

Annexation and Land Reclassification: The reclassification of land in the critical area from one land use designation to another is authorized under critical area law on proof of a

mistake in the existing zoning. However, there is no termination provision or statute of limitations to limit the time period in which a landowner may allege a mistake and petition for reclassification.

Changes to the critical area law addressing these issues would likely increase compliance with the law, reducing the impact of development in these sensitive areas.

Impose Penalties for Environmental Violations

Numerous environmental, natural resource, and agriculture statutes have penalty provisions. The imposition of penalties acts as a deterrent effect for violations, especially if the penalty is significant. However, some penalties are so minimal that developers choose to violate certain laws, such as the critical area law, intentionally. They treat the penalty as simply a cost of doing business – paying the penalty is cheaper than complying with the law in the first place. In addition, some agencies responsible for enforcement do not fully utilize their existing enforcement authority. For example, although the Maryland Department of Agriculture (MDA) is authorized to impose penalties on farmers who do not comply with the nutrient management plan requirements of the Water Quality Improvement Act, to date, no penalties have been assessed.

Increase the Number of Inspectors at the State and Local Levels

One reason that enforcement of many environmental laws is lacking is due to the limited number of inspectors employed by the various State and local agencies responsible for enforcement. For example, one of the primary concerns regarding the implementation of the draft implementation plan's stormwater strategy is the lack of local resources for inspecting stormwater facilities.

A Significant Increase in Funding Is Likely Needed to Fully Implement the Strategies

The State Should Be Creative in Identifying New Funding Sources

The focus on funding shortfalls shifts the bay restoration problem to the next higher level of government and acts as a barrier to action when the next higher level of government fails to provide funding. Instead, there should be a focus on finding ways to finance bay restoration at all levels of government; under this model, the State and local governments would view bay restoration like a shared car or mortgage payment that requires the identification of large, sustainable revenue streams. Good examples of this concept include the Bay Restoration Fund at the State level and stormwater utility funds at the local level.

Establish a New Fund Dedicated to the State's Tributary Strategy: One way to enhance funding for the implementation of the State's tributary strategy is to create a dedicated fund for

that purpose. In its *Legislative Blueprint for 2007-2010*, the Chesapeake Bay Foundation (CBF) recommends establishing a Green Fund dedicated to funding the tributary strategies. As envisioned by CBF, the Green Fund would be allocated first to the most cost effective strategies. CBF believes that the agricultural strategies, including manure management, planting cover crops, and establishing forest buffers, are the most cost effective strategies. Financing for the Green Fund could come from a variety of sources. CBF has identified four potential funding sources that could be dedicated to the Green Fund, including increasing the Vehicle Emissions Inspection Program fee, establishing a tipping fee at landfills, increasing the toll across the Chesapeake Bay Bridge, and providing tax incentives for private donations.

Establish Local Stormwater Utility Funds and/or a Statewide Stormwater Management Fee: Due to the significant costs of implementing and retrofitting stormwater management systems, stormwater utility fees are gaining popularity in some communities as a funding source. For example, the City of Takoma Park assesses a stormwater management fee based on factors that influence runoff, such as land use and the amount of impervious surface on a property. This type of fee may encourage landowners to reduce the amount of impervious surface on their properties. In addition, the revenue generated from the fees could be used to fund and maintain local stormwater management systems.

In 2005, the Policy Analysis Workshop of the University of Maryland's School of Public Policy issued a report entitled, *A Bigger Bang for the Buck – Offsets and Other Cost-Effective Strategies for Nitrogen Reductions for the Chesapeake Bay.* The concept of stormwater utilities was one of the recommendations made by the workshop in that report.

The State could also establish a mandatory statewide stormwater management fee to be imposed on new development projects. The concept would be that each new development provide sufficient funds to fully offset the additional nutrient runoff created by the project by generating funds to install stormwater management controls or reduce nutrients in other parts of the watershed.

Identify Additional Funding for WWTP Upgrades: In *A Bigger Bang for the Buck*, the workshop recommends that in order to enhance funding for WWTP upgrades, all State and municipal funding sources should be considered. Further, the workshop recommends that the State and municipalities should continue to be creative in seeking out funds for point source pollution reduction. Specifically, they should consider obtaining funds from non-governmental sources through the establishment of user fees or development assessments.

The State Should Direct Funding for Conservation Programs More Efficiently

In *A Bigger Bang for the Buck*, the workshop concludes that one way the State could more efficiently direct funding for conservation programs targeted to nutrient reduction goals would be to establish a regional financing authority that would coordinate and distribute funding on a regional basis to address critical needs throughout the watershed. The concept of a regional

financing authority was also the primary funding consideration in the Chesapeake Bay Watershed Blue Ribbon Finance Panel's *Saving a National Treasure* report.

One proposal is to have a regional financing authority act like a State Revolving Loan Fund with an inter-jurisdictional mandate and the ability to provide capital grants and traditional loans. In addition, the following three regional financing authority funding models were proposed by the Chesapeake Bay Program's Financing Authority Committee in its 2005 *Chesapeake Bay Financing Authority Organizational Template*:

- ***Federal Appropriation*:** For example, the Appalachian Regional Commission, a federal-state partnership established by Congress to create self-sustaining economic development through regional planning, research activities, and special grant programs;

- ***Fee-based System*:** For example, Florida's water management districts, which constitute special taxing districts throughout the state with the authority to collect property taxes, and to manage and protect water resources; and

- ***Jurisdiction/Member Contributions*:** For example, the North American Development Bank (NADB), which was created under the North American Free Trade Agreement to address environmental issues in the U.S.-Mexico border region. Funding for NADB is provided by equal commitments from the United States and Mexico.

A regional financing authority has yet to gain political traction among the bay watershed states, and the Department of Natural Resources (DNR) advises that it is unlikely that the federal government will contribute to the $15 billion in federal and state matching funds, which the Chesapeake Bay Watershed Blue Ribbon Finance Panel suggests is the necessary start-up cost.

The State Should Work Diligently to Maximize Federal Funding from the 2007 Farm Bill

Federal funding has played and will continue to play a role in supporting Chesapeake Bay restoration efforts. Opportunities exist for enhanced funding through a variety of federal programs and appropriations bills. Given that the agriculture sector is relied on so heavily in the implementation plan, the State should work diligently to maximize federal funding from the Farm Bill.

In *A Bigger Bang for the Buck*, the workshop recommends that, in an effort to maximize federal funding, a Chesapeake Bay Farm Bill Block Grant could be established in the 2007 Farm Bill. According to the workshop, no authority currently exists for block grant funds, and there may be political opposition to this authority due to a decreased ability of the federal government to provide oversight and prioritization of funds. If, however, the states within the Chesapeake Bay watershed successfully lobby for this authority, it could provide flexibility in directing program funds.

Targeting Limited Funds to Most Cost-effective Measures Is Necessary

While some believe that the State should target its limited resources to the agriculture sector, the reality is that significant additional funding will be needed for *all* sectors to achieve the nutrient and sediment reduction goals. With limited dollars available, however, the concept of strategically targeting those dollars to cost-effective measures in critical locations is necessary.

In its December 2004 report, *Cost-Effective Strategies for the Bay*, the Chesapeake Bay Commission took an intensive look at the broad suite of pollution control options and ultimately concluded that significant water quality benefits can be had at reasonable cost if funding is targeted toward the most cost-effective measures. According to the Chesapeake Bay Commission, the implementation of the six most cost-effective best management practices (BMPs) in Maryland would get the State about 92 percent of the way toward meeting its nitrogen reduction goal, 76 percent of the way toward meeting its phosphorus reduction goal, and 97 percent of the way toward meeting its sediment reduction goal. Further, the commission advises that the cost to implement these BMPs (estimated at $193 million annually) would total only 12 percent of the total estimated annual tributary strategy cost.

As the commission's report acknowledges, two of the six most cost-effective BMPs (diet and feed adjustments and enhanced nutrient management) are emerging technologies and are, therefore, not yet ready for widespread implementation. The other four BMPs identified in the report, however, are existing technologies and are already being implemented to some extent. Further, these four practices are part of the draft implementation plan. With the passage of the Bay Restoration Fund in 2004, Maryland is now investing a significant amount of funding into WWTP upgrades. The other three BMPs (traditional nutrient management, conservation tillage, and cover crops) are existing practices that are included in the draft implementation plan's agriculture strategy. While additional funding will be needed to fully implement these BMPs at the level called for in the implementation plan, it may be reasonable to target any additional funding to these BMPs.

The concept of targeting is also raised in *A Bigger Bang for the Buck*. Specifically, the workshop recommends targeting available funding to the five most cost-effective BMPs, identified in that report as nutrient management, grassed buffers, conservation tillage, land retirement, and manure transport. The report suggests that nutrient management and manure transport alone could provide 46 percent of the nitrogen reductions at only 8 percent of the cost. While the assumptions used and the results vary from those reported by the Chesapeake Bay Commission, the general conclusion is the same – that by targeting funding toward the more cost-effective measures, significant reductions can be realized at only a fraction of the cost.

While several groups have recommended targeting limited State dollars to the more cost-effective BMPs, this concept may have limitations. For example, MDA advises that limiting cost-share and technical assistance to certain BMPs or watersheds will compromise the State's ability to achieve the agricultural goals set forth in the draft implementation plan.

Implementation of agricultural BMPs is very site-specific and based upon natural resource conditions, the type of agricultural operation, and how the BMP fits into the overall management of the farm. Planners and technicians who work directly with the farmers target specific BMPs to the operation that will provide the most benefit. According to MDA, because the nutrient reduction goals set for agriculture are extremely ambitious, implementation of the entire suite of BMPs is needed to reach the goals.

Managing Growth and Maintaining Nutrient Caps Is Essential to the Bay Restoration Effort

Continued growth presents a significant obstacle to the bay restoration effort. Efforts to cap nutrient loading will have an impact on all sources.

Encourage Regional Planning and Strengthen Existing Land Use Laws

Sound land use and development within the watershed will be a critical part of meeting the C2K goals. As population within the watershed increases, however, so does stormwater runoff, air emissions from vehicle travel, and pollution from wastewater treatment plants and septic tanks. While Maryland has implemented its Smart Growth policy, sprawling development continues to consume the State's farm and forest lands.

In order to address this issue, CBF, it its *Legislative Blueprint*, advises that action to ensure compliance with existing land use laws must be taken. CBF recommends consistency in targeting State spending for development-related activities to priority funding areas (PFAs) and priority places. CBF also suggests that the State penalize jurisdictions that fail to create protective agricultural zoning and that fail to discourage growth outside PFAs by withholding State funds.

CBF also notes that impacts from major developments often extend beyond a single jurisdiction. Accordingly, in its *Legislative Blueprint*, CBF recommends establishing a multi-jurisdictional planning authority in each of Maryland's five regions to ensure that development is consistent with a regional vision for growth. Currently, there are several cooperative efforts that coordinate regional planning goals, such as the Tri-County Council for Southern Maryland and the Maryland – National Capital Park and Planning Commission; these efforts may serve as a model for CBF's recommendation.

Finally, CBF recommends that the State increase technical and financial assistance to local governments to, among other things, update local comprehensive plans, establish agricultural priority preservation areas, and implement zoning efforts that are protective of agricultural land. Increasing technical and financial assistance to local governments may result in significant increases in agency workload, however.

In *A Bigger Bang for the Buck*, the workshop recommends improving the implementation of the Chesapeake and Atlantic Coastal Bays Critical Area Protection Program and using it as a model for broader application within the watershed. The program currently requires specific land use and resource management activities on lands within 1,000 feet of tidal waters or adjacent to tidal wetlands. The workshop suggests recognizing the impact of land use beyond the critical area and into other environmentally sensitive areas. It also suggests that the State provide more stringent criteria, standardized guidance, and technical resources to better implement the program. Further, the workshop suggests expanding the use of the offset provision found within the program to require projects to meet higher standards for controlling runoff. Developers could offset pollution associated with their development across pollutant sources by obtaining offsets in the agriculture sector or in a different watershed. Developers could also be required to offset for other sources of nutrients from developed land, such as wastewater in more urban areas.

Enforce the State's Smart Growth Policy More Stringently, Evaluate Whether It Is Effective, and Make Changes If Necessary

Several articles raise areas of concern regarding the implementation of the State's Smart Growth initiatives. First, the articles raise the concern that local implementation of Smart Growth policies makes it difficult to achieve success as a result of inconsistencies across jurisdictions. In addition, local governments are not required to develop only in PFAs but are merely encouraged to do so through the use funding restrictions. The articles recognize that local governments are critical to the success of the Smart Growth initiatives, however. While these articles raise several valid points regarding the limitations of local implementation, in Maryland, zoning and planning has traditionally rested with local governments. Further, if the State were to have authority over growth management, it would make the process for approving local development projects even more cumbersome than it currently is.

Strengthening the Maryland Department of Planning's (MDP) initiatives for a statewide Growth Simulation Model and uniform framework for local jurisdictions may help alleviate some of these concerns. Likewise, efforts by MDP to build a framework and model that may be used throughout the State may help with another concern raised by the articles, which is the lack of benchmarks or indicators to measure the success of the Smart Growth initiatives. Measurement tools should be developed in order to determine the success of Smart Growth. However, MDP advises that there is a lack of resources (staff, data, etc.) for tracking growth statewide. MDP also advises that if local governments were to do a better job tracking their development activities, it would be easier for the State to compile this information. Accordingly, a uniform framework could be beneficial.

In *Maryland's Smart Growth: Using Incentives to Combat Sprawl*, the author, James Cohen, notes that critics believe there are three main aspects of Smart Growth implementation that may limit its effectiveness. First, concerns have been raised that the 1997 legislation does not prevent sprawl that is privately or locally funded. Other concerns have been raised that the minimum density requirements for PFAs are too low and are possibly the result of

political compromise rather than concrete analysis. He raises the concern that changes in leadership could affect current Smart Growth policies and their implementation, and continued support by State leaders and local governments is critical to the success of Smart Growth. In addition, the author notes that the 1997 legislation did not command local government to focus development in PFAs; instead, it is an incentive based program. In addition, the author comments that no progress measurement mechanisms, such as benchmarks or indicators, were established with the 1997 legislation, making evaluation of the effectiveness of the incentive-based initiatives difficult.

Another article, *Twenty Lessons from Maryland's Smart Growth Initiative*, by John Frece, reiterates the problem that benchmarks for the Smart Growth initiatives were never set, so the State has no way of measuring if the programs are successful. In addition, the author raised a concern that land use decisions remain at the local government level rather than with a State agency, which makes it difficult to review the overall picture of growth management in the watershed. The article criticizes the PFA law as being "too weak and porous to slow sprawl," and says the PFA concept does not prevent growth outside of PFA boundaries, but just prevents the use of State funds to finance projects that are outside of PFAs. In *Land-Use Changes in a Pro-Smart Growth State: Maryland, USA*, the authors Qing Shen and Feng Zhang present a study of the effectiveness of Smart Growth initiatives in Maryland. Using a statistical analysis, the authors conclude that generally the Smart Growth initiatives have been successful in achieving land use objectives and channeling development into designated areas. The authors note, however, that there are significant variations across counties in terms of Smart Growth policies regarding land conversion and development patterns, and suggest that this is a weakness in the State's overall Smart Growth initiative. The authors suggest that their findings show the importance of having collaboration between the State and local governments in designing and implementing Smart Growth initiatives.

In *The Effects of Moratoria on Residential Development: Evidence from Harford, Howard, and Montgomery Counties*, the author, Antonio Bento, reviews the effect of an adequate public facilities ordinance (APFO), which is one type of Smart Growth policy that aims to prevent development in areas where public services are overwhelmed by demand. The author concludes that APFOs that are in the form of moratoria on development are effectively command and control regulations and do not reflect market forces. Therefore, if the regulations are too strict, moratoria could mean a reduction in housing availability and potential increase in housing prices. Furthermore, growth that does not take place in a county that adopts moratoria could happen elsewhere. This displacement of growth could increase the adverse affects of sprawl in other areas of the State.

Strengthening Stormwater Management Programs Is Also Critical to a Successful Restoration Program

The State Should Provide Assistance for "State-of-the-art" Designs and Encourage Local Governments to Remove Barriers

The workshop in *A Bigger Bang for the Buck* recommends removing certain regulatory requirements and notes that in many cases, local jurisdictions and municipalities have zoning requirements that prevent the implementation of Low Impact Development (LID) techniques. LID is a comprehensive land planning and engineering approach that maintains and enhances pre-development hydrology on a site, and has provided significant cost-savings for developers over traditional stormwater management technologies. Some LID techniques include bioretention, permeable pavements, green roofs, and other techniques to reduce the amount of impervious surfaces on a developed site. Further, LID methods are easier and less expensive for new projects; urban retrofits are often more complicated and expensive. However, widespread use of LID techniques has yet to catch on, mainly because of local subdivision controls, zoning, and other regulatory barriers. Montgomery County is one of the first local jurisdictions to have taken steps to revise and strengthen its local stormwater regulations. In August, Montgomery County passed a resolution in support of more stringent stormwater standards, including pollution caps, enforceable plans to meet the pollution caps, a new set of design standards, and LID retrofits such as rain gardens, parking lot filters, and green roofs.

While stormwater management is currently regulated, it is not regulated for water quality results. In *A Bigger Bang for the Buck*, the workshop suggests that more stringent regulations could provide for better on-site stormwater management. Although the *2000 Maryland Stormwater Design Manual* is considered to be "state-of-the-art," the Maryland Department of the Environment (MDE) acknowledges that implementation of the treatment systems described in the manual is not occurring as intended. This is attributed to loss of staff at MDE and the need for additional training for local government staff and the construction industry.

The State Should Use Its Existing Permitting Process to Implement the Most Cost-effective BMPs for Stormwater Management

The U.S. Environmental Protection Agency (EPA) requires municipal separate storm sewer systems (MS4s) serving jurisdictions with populations of 100,000 or more to obtain a National Pollutant Discharge Elimination System permit. In Maryland the MS4 permit program is implemented by MDE. Nine Maryland jurisdictions and the State Highway Administration have these permits. The permits must be renewed every five years. According to CBF's *Legislative Blueprint*, MDE could use the MS4 permit renewal process to implement the most effective stormwater management requirements, including BMPs designed to meet specific pollution limits on a watershed basis, the use of LID standards for development, monitoring requirements, and more effective restoration activities. Although these options are listed by CBF as a legislative priority, MDE may be able to implement the options administratively.

Controlling Animal Waste and Other Nonpoint Sources Will Help Achieve the Goals

The State Should Enhance Measures Relating to Manure and Litter

Two recent reports, the CBF's 2004 *Manure's Impact on Rivers, Streams, and the Chesapeake Bay: Keeping Manure Out of the Water*, and the Chesapeake Bay Program's 2005 *Strategy for Managing Surplus Nutrients from Agricultural Animal Manure and Poultry Litter in the Chesapeake Bay Watershed*, analyzed animal manure and poultry litter as sources of nutrient pollution into the bay and made recommendations to better manage nutrient pollution from manure and litter. Although numerous specific recommendations to reduce nutrient pollution were made in each report, the general recommendations of both reports centered on reducing the amount of nutrients in manure and litter; establishing safeguards for manure spread as fertilizer; addressing regional imbalances of waste surpluses; and building markets for manure and litter products. Some of these recommendations are discussed in more detail below.

According to the CBF report, approximately 185 million livestock animals in the bay watershed excrete about 44 million tons of waste each year, accounting for 600 million pounds of nitrogen. Moreover, the report states that three regions – the lower Susquehanna River basin, the middle Delmarva Peninsula, and the Shenandoah Valley – known as manure "hot spots" – contribute up to 54 percent of the manure nitrogen load into the watershed. Because two of the three regions are located wholly outside of Maryland, the transportation of animal waste from areas of surplus to areas of need must be a regional endeavor with coordination among all bay states.

To stimulate markets for alternative manure or litter use, CBF recommends that the Maryland Animal Waste Technology Fund be reinstated, and that $5 million be committed to initiate competition among private enterprises to develop cost-effective and environmentally friendly alternative uses of manure. This fund was established in 1998 in the Department of Business and Economic Development to provide research and development of technologies to reduce nutrient content of animal waste or develop alternative animal waste utilization. Additionally, the Chesapeake Bay Program's report recommends requiring at least 20 percent of the total fertilizer, soil amendments, and compost used on State and federal lands to be composed of manure and litter from the bay watershed region. Although this is not currently a federal or State requirement, the draft implementation plan calls on the Department of Natural Resources to assess opportunities to expand the use of manure products on State-owned lands and replace the use of commercial fertilizers.

In other states, such as Vermont, financially strapped dairy farmers have transformed a former financial liability into a revenue-producing element of their operations by extracting methane from manure and selling it for energy consumption. Due to the fact that stimulating alternative markets for animal waste in Maryland may be complemented with programs designed to manage regional waste imbalances, there is potential for realizing significant cost-effective

reductions in the nutrient loads of animal waste while providing supplemental income for struggling farmers.

In *A Bigger Bang for the Buck*, the workshop notes that a large part of Maryland's agricultural nutrient pollution comes from poultry production on the Eastern Shore. The workshop made several recommendations regarding reducing agricultural nutrient pollution. First, the workshop suggests that the State prioritize business development funds to emphasize projects that use poultry manure. These types of projects could include the use of poultry manure for forest fertilization, cogeneration, composting, and electricity generation. Second, the workshop recommends continuing the 50 percent funding split under the Manure Transport Program with poultry processors operating in the State. According to the workshop, Maryland has the capacity to absorb the excess manure produced in Maryland, but the transport of manure needs improvement. Some advocates suggest that a regional approach to manure transport should be considered because two of the three major regions in the watershed that contribute nitrogen loads into the bay are located outside of Maryland.

Another recommendation from the workshop is that the State should create an offset policy to limit new chicken house construction until the excess poultry manure problem is resolved. Any new chicken houses would have to show zero manure runoff or else provide reductions from other sources to fully offset its nutrient impacts.

Innovative Approaches Are Needed

Creative Approaches That Target All Sectors, Such as DNR's Targeted Watershed Initiative, Will Be Critical

A new initiative to restore entire watersheds and remove them from EPA's List of Impaired Waters was initiated by Governor Robert L. Ehrlich, Jr. in September 2005. The Corsica River Pilot Project in Queen Anne's County was selected as the first targeted watershed project; since 2005, DNR has allocated $2.7 million to the watershed. In November 2006, Governor Ehrlich named the Magothy River in Anne Arundel County, the Lower Gunpowder River in Baltimore County, the Port Tobacco River in Charles County, and Bynum Run in Harford County as the four candidate watersheds for the State's second targeted watershed project.

Nutrient Trading Should Be Encouraged and Developed

Throughout *A Bigger Bang for the Buck*, a nutrient trading program is suggested to help meet the goals of C2K. MDE is currently working to establish a nutrient trading program, which may help to alleviate the costs of WWTP upgrades. Virginia and Pennsylvania have established similar programs. In principle, it would cap WWTP discharges and allow nutrient credits to be traded among various sources; the details of the program are still being formulated.

Nutrient trading could offer alternatives for local officials that find that their county's WWTPs cannot keep up with population growth. For example, officials in Cecil County have already expressed concern over such a plan because the county is on pace to hit its state-proposed cap within the next few years. Population growth in Cecil County is projected to increase nearly 50 percent over the next 20 years. According to the county, if its cap is not increased, new development will be forced to rely on septic systems in areas that were intended to remain rural. In addition, this undermines the county's planning efforts by prohibiting growth in its designated growth areas that are already serviced by WWTPs. Nutrient trading offers a potential solution for Cecil County; under a trading program, the county could purchase nutrient credits for nitrogen and phosphorus from another county that has reduced its nutrient loadings beyond what is required.

According to the workshop, a nutrient trading program could also be used in the agricultural sector. In this case, private funds from urban point and nonpoint source reductions could be redistributed to agricultural BMPs. The workshop suggests that this type of program may motivate farmers to participate because it allows them to recover their costs to implement BMPs or even to make a profit on the nutrient trades. In addition, the workshop recommends increases in funding for research regarding nutrient trading, consideration of a nutrient trading broker system, and the development of a regional nutrient exchange board to promote a bay-wide view and to protect against "hot spots" and other local issues that can result from trading.

Provide Incentives to Encourage Participation in Bay Restoration Efforts

In *A Bigger Bang for the Buck*, the workshop makes recommendations regarding the establishment of incentives to encourage businesses and citizens to contribute to the nutrient reduction effort. One recommendation is to provide automobile retirement and upgrade incentives, by creating a buy-back and rebate program that would retire older, more heavily polluting automobiles, and that would offer owners a rebate for retiring an old car and purchasing a newer, cleaner vehicle. Further, the workshop suggests a tax on cars with high emissions of nitrogen oxides or a nitrogen oxides offset program. One potential problem for this type of program is that while it may be innovative, it would likely require significant funding for implementation.

While well-managed farmland minimizes environmental impacts, implementing best management and conservation practices can be burdensome. According to CBF's *Legislative Blueprint*, to promote and reward agricultural stewardship, the General Assembly should consider transferable tax credits and tax relief tied to conservation. One recommendation is for the State to provide transferable tax credits, similar to those in Virginia and Pennsylvania (proposed), that reward agricultural stewardship while allowing the agricultural land to remain in production. Virginia currently allows a tax credit of an amount equal to 50 percent of the value of a gift of easement up to $100,000. The unused portion of this credit may be carried forward for up to five consecutive years. The Pennsylvania state legislature is considering a plan to support pollution reduction projects on Pennsylvania farms by providing tax credits to farmers to finance conservation practices. The proposed legislation allows a tax credit of an amount equal

to 25 to 75 percent of the project cost up to $150,000. The unused portion of this credit may be carried forward for up to 15 years. Another recommendation from CBF is that the State could tie tax relief to the level of conservation, with the greatest level of relief offered for the highest levels of land conservation and stewardship.

Both the legislative Agricultural Stewardship Commission as well as the Maryland Agricultural Commission have made recommendations regarding financial incentives for farmers. While CBF's options would likely receive wide-spread support by the agricultural sector, it is uncertain whether Maryland will alter its tax policy due to potential decreases in State revenues. In addition, the State already provides several tax incentives – both agricultural and non-agricultural – that farmers can qualify for. CBF's options will likely be studied by the Incentives for Agriculture Task Force. This task force was created in 2006 to, among other things, recommend changes in the tax structure to reward agricultural stewardship. The task force is due to issue its final report by October 1, 2007.

The Chesapeake Executive Council signed a directive in September 2006 to develop a collective goal for forest lands conservation and expansion in an effort to protect water quality. In October 2006, the Governor's Commission on Protecting the Chesapeake Bay through Sustainable Forestry issued its final report, *Maryland's Strategic Forest Resource Plan 2006*, which contains several recommendations. Among other things, the report suggests that financial incentives be offered to encourage landowner retention of forests, such as tax credits for forest easement donations.

A Coordinated Approach Is Necessary

A coordinated approach for bay restoration between State agencies and local governments is necessary. The draft implementation plan is a step in the right direction. Through this process, the State is learning about local government BMP implementation and local governments are learning about State regulations. As a result, State expectations and local capabilities can be aligned and new directions for implementing the State's tributary strategy can be more effectively executed.

Final Thoughts: Achieving and Maintaining Reduction Goals Will Be Difficult

While numerous efforts to restore the bay's water quality are underway, at this time Maryland is not well positioned to achieve its C2K commitments. According to DNR's draft tributary strategy funding analysis, Maryland's existing funding sources will cover only 39 percent of the estimated $10 billion needed to implement the State's implementation plan through 2010. Also, several of the strategies may not have an impact for several years, and others could end up costing more than originally anticipated. Finally, a lack of funding to

provide the technical assistance necessary to implement several of the strategies, as well as a lack of enforcement of existing laws, appears to be hindering bay restoration efforts.

Another significant challenge in meeting and maintaining the nutrient and sediment reductions is the anticipated increase in Maryland's population. By 2030, Maryland's population is expected to increase by over 1 million. Over the next few years, the Base Realignment and Closure recommendations are expected to bring an additional 40,000 to 60,000 defense-related personnel to the State. Maintaining nutrient reduction levels under the pressures of increasing population growth and rapid development will be difficult.

In January 2007, a representative of the EPA's Chesapeake Bay Program acknowledged that the C2K goals will not be met by 2010 and that a revitalized Chesapeake Bay may be decades away.

While progress has been made, the State still has a long way to go to meet its nutrient and sediment reduction goals and to maintain those goals in the face of continued growth and development. A significant increase in resources coupled with the implementation of innovative, high-impact bay restoration strategies could steer the State closer to meeting and maintaining the C2K goals. In addition, coordination among all levels of government, the private sector, and bay citizens will be necessary to achieve the C2K commitments.

Appendix 1
Watershed and State-by-state Reduction Goals, Pollutant Sources, and Progress

WATERSHED

Pollutant Reduction Goals

Pollutant	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	337.500	270.200	175.000
Phosphorus (million lbs/yr)	27.130	18.750	12.800
Sediment (million tons/yr)	5.834	4.922	4.150

Watershed Pollution Reduction Goals

Watershed-wide, the Chesapeake Bay Program has committed to the following reduction goals in the face of population growth:

- Reduce nitrogen loads by 95.0 million pounds per year from 2004 levels.
- Reduce phosphorus loads by 5.97 million pounds per year from 2004 levels.
- Reduce sediment loads by 0.775 million tons per year from 2004 levels.

Land Cover

- 58% of the watershed is forested.
- 22% of the watershed is agriculture.
- 20% of the watershed is urban/suburban.

Loads and Sources

- Agricultural land contributes the majority of nutrients (40% nitrogen, 45% phosphorus) and sediment (62%) to the Chesapeake Bay.

- Point sources contribute 21% of the nitrogen and 23% of the phosphorus load entering the Chesapeake Bay.

- Urban/suburban lands contribute 18% of the nitrogen, 29% of the phosphorus, and 18% of the sediment load entering the Chesapeake Bay.

- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Since 1985, we have:

    - reduced nitrogen loads to the bay by 20%,

    - reduced phosphorus loads to the bay by 31%; and

    - reduced sediment loads to the bay by 16%.

- Based on progress made from 1985 to 2004, we are 41% of the way there to reaching the watershed-wide nitrogen goal, 58% of the way there to meeting the phosphorus goal, and 54% of the way there to reaching the sediment goal. Progress is based on model predictions, using average year flows.

MARYLAND

Pollutant Reduction Goals

Maryland	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	82.400	56.900	37.300
Phosphorus (million lbs/yr)	6.770	3.820	2.920
Sediment (million tons/yr)	1.252	0.995	0.712

Land Cover

- Maryland is 46% forested, 29% urban/suburban, and 25% agriculture.

Loads and Sources

- Maryland's contribution to the total pollutant load entering the Chesapeake Bay in 2004 was 21% of the nitrogen and 20% of the phosphorus and sediment loads.
- Agriculture is the largest source of nutrients (37% nitrogen, 42% phosphorus) and sediment (70%).
- Urban/suburban lands contribute 21% of the nitrogen, 37% of the phosphorus, and 21% of the sediment coming from Maryland.
- Point sources in Maryland contribute 28% of the nitrogen and 19% of the phosphorus coming from Maryland.
- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Based on progress made from 1985 to 2004, Maryland is 57% of the way there to reaching its nitrogen goal, 77% of the way there to meeting its phosphorus goal, and 48% of the way there to reaching its sediment goal. Progress is based on model predictions, using average year flows.

PENNSYLVANIA

Pollutant Reduction Goals

Pollutant	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	120.100	106.600	71.900
Phosphorus (million lbs/yr)	4.440	3.610	2.260
Sediment (million tons/yr)	1.244	1.138	0.995

Land Cover

- The Pennsylvania portion of the Chesapeake Bay watershed is 64% forested, 22% agriculture, and 14% urban/suburban.

Loads and Sources

- Pennsylvania's contribution to the total pollutant load entering the Chesapeake Bay in 2004 was: 39% nitrogen, 19% phosphorus, and 23% sediment.

- Agriculture is the largest source of nutrients (48% nitrogen and 60% phosphorus) and sediment (73%) coming from Pennsylvania.

- Point sources in Pennsylvania contribute 11% of the nitrogen and 20% of the phosphorus loads coming from Pennsylvania.

- Urban/suburban lands contribute 14% of the nitrogen, 15% of the phosphorus, and 11% of the sediment loads coming from Pennsylvania.

- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Chesapeake Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Based on progress made from 1985 to 2004, Pennsylvania is 28% of the way there to reaching its nitrogen goal, 38% of the way there to meeting its phosphorus goal, and 43% of the way there to reaching its sediment goal. Progress is based on model predictions, using average year flows.

VIRGINIA

Pollutant Reduction Goals

Pollutant	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	92.200	74.400	51.400
Phosphorus (million lbs/yr)	13.460	9.210	6.000
Sediment (million tons/yr)	2.693	2.270	1.941

Land Cover

- Virginia is 57% forested, 22% urban/suburban, and 21% agriculture.

Loads and Sources

- Virginia's contribution to the total pollutant load entering the Chesapeake Bay in 2004 was 28% nitrogen, 49% phosphorus, and 46% sediment.
- Agricultural land contributes 28% of the nitrogen, 39% of the phosphorus, and 52% of the sediment load from Virginia.
- Urban/suburban lands contribute 24% of the nitrogen, 34% of the phosphorus, and 21% of the sediment loads from Virginia.
- Point sources contribute 31% of the nitrogen and 24% of the phosphorus loads from Virginia.
- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Chesapeake Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Based on progress made from 1985 to 2004, Virginia is 44% of the way there to reaching its nitrogen goal, 57% of the way there to meeting its phosphorus goal, and 56% of the way there to reaching its sediment goal. Progress is based on model predictions, using average year flows.

DISTRICT OF COLUMBIA

Pollutant Reduction Goals

District of Columbia	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	8.00	3.500	2.400
Phosphorus (million lbs/yr)	0.160	0.130	0.340
Sediment (million tons/yr)	0.006	0.006	0.006

Land Cover

- The District of Columbia is 92% urbanized and 8% forested.

Loads and Sources

- The District of Columbia's contribution to the total pollutant load entering the Chesapeake Bay in 2004 was: 1% nitrogen, 1% phosphorus, and 0% sediment.

- Point sources are the largest source of nutrient loads entering the Chesapeake Bay from the District of Columbia (90% nitrogen, 71% phosphorus). Blue Plains wastewater treatment plant is the most significant point source.

- Urban/suburban lands contribute 10% of the nitrogen, 29% of the phosphorus, and 98% of the sediment load from District of Columbia.

- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Chesapeake Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Based on progress made from 1985 to 2004, the District of Columbia is 81% of the way there to reaching its nitrogen goal and has already achieved its phosphorus and sediment goals. Progress is based on model predictions, using average year flows.

WEST VIRGINIA

Pollutant Reduction Goals

West Virginia	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	7.500	6.600	4.700
Phosphorus (million lbs/yr)	0.570	0.650	0.370
Sediment (million tons/yr)	0.413	0.323	0.320

Land Cover

- West Virginia is 65% forested, 24% agriculture, and 11% urban/suburban.

Loads and Sources

- West Virginia's contribution to the total pollutant load entering the Chesapeake Bay in 2004 was: 2% nitrogen, 3% phosphorus, and 7% sediment.
- Agriculture is the largest source of nutrients (43% nitrogen, 50% phosphorus) and sediment (67%) coming from West Virginia.
- Urban/suburban lands contribute 17% nitrogen and 13% of phosphorus and 17% of sediment from West Virginia.
- Point sources contribute 5% nitrogen and 33% phosphorus from West Virginia.
- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Chesapeake Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Based on progress made from 1985 to 2004, West Virginia is 33% of the way there to reaching its nitrogen goal and 97% of the way to reaching its sediment goal. Due to insufficient data, we cannot estimate progress in reducing phosphorus from 1985 to 2004.

DELAWARE

Pollutant Reduction Goals

Delaware	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	5.900	4.900	2.900
Phosphorus (million lbs/yr)	0.600	0.370	0.300
Sediment (million tons/yr)	0.054	0.055	0.042

Land Cover

- Delaware is 41% agriculture, 40% forested, and 19% urban/suburban.

Loads and Sources

- Delaware's contribution to the total pollutant load entering the Chesapeake Bay in 2004 was 2% nitrogen, 2% phosphorus and 1% sediment.
- Agricultural lands contribute the majority of nutrient (76% nitrogen, 74% phosphorus) and sediment (85%) loads from Delaware.
- Urban/suburban lands contribute 10% of the nitrogen, 22% of the phosphorus, and 8% of the sediment loads from Delaware.
- Point sources are responsible for 2 to 4% of the nutrient loads from Delaware.
- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Chesapeake Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Based on progress made from 1985 to 2004, Delaware is 32% of the way there to reaching its nitrogen goal, 78% of the way there to meeting its phosphorus goal. Progress is based on model predictions, using average year flows.

NEW YORK

Pollutant Reduction Goals

Pollutant	1985 Loads	2004 Loads	Healthy Bay Goal
Nitrogen (million lbs/yr)	21.000	17.200	12.600
Phosphorus (million lbs/yr)	1.140	0.950	0.590
Sediment (million tons/yr)	0.172	0.135	0.131

Land Cover

- New York portion of the watershed is 63% forested, 19% agriculture, and 18% urban/suburban.

Loads and Sources

- New York's contribution to the total pollutant load entering the Chesapeake Bay in 2004 was 6% nitrogen, 5% phosphorus, and 3% sediment.
- Agricultural land contributes 40% of the nitrogen, and 50% of the phosphorus, and 53% of the sediment loads coming from New York.
- Urban/suburban lands contribute 15 to 18% of nutrients and sediment loads coming from New York.
- Point sources in New York can be a significant source of nutrients, particularly phosphorus (28%).
- These load estimates include nitrogen from the air that is deposited onto the watershed and washed into the Chesapeake Bay. Watershed-wide, air pollutants comprise anywhere between a quarter to a third of the total nitrogen load entering the Chesapeake Bay each year.

Progress to Date

- Based on progress made from 1985 to 2004, New York is 45% of the way there to reaching its nitrogen goal, 35% of the way there to meeting its phosphorus goal, and 90% of the way there to reaching its sediment goal.

Source: Chesapeake Bay Program