MARYLAND'S

INTERIM

NUTRIENT CAP STRATEGY

MARYLAND NUTRIENT CAP WORKGROUP

March, 2001

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Executive Summary

Background

Excess levels of nitrogen and phosphorus are the primary pollution problem facing the Chesapeake Bay. Reducing these pollutants has been a major focus of the multi-state Chesapeake Bay Program over the past two decades. The 1987 Chesapeake Bay Agreement, as amended in 1992, set a goal to reduce levels of nitrogen and phosphorus by 40 percent by 2000, *and to maintain that reduction thereafter*. The Chesapeake 2000 Bay Agreement reaffirms this as the minimum commitment, and proposes to remove all nutrient and sediment impairments to the Bay by 2010. This goal will almost certainly require additional reductions. New reduction goals are to be developed by December 2001.

The Bay Program agreed to develop interim strategies by March 31, 2001 to achieve and/or maintain the capped nutrient loads between 2000 (or when they are achieved) and the completion of tributary strategies in two or more years to reach new reduction goals. In Maryland, a Nutrient Cap Strategy Workgroup, consisting of tributary teams, stakeholders, and state and local government staff, has been working to evaluate the issues and options and develop the interim strategy presented in this report.

Challenge of Meeting a Nutrient Cap

Achieving, and then maintaining our nutrient and sediment caps for the Bay – and the more stringent caps we expect to be set over the coming year -- will be a major challenge. Ultimately, if we are to succeed in restoring the Chesapeake Bay in the face of continued growth, we will need to change our lifestyles and ways of doing business so that each of us produces less of the pollution that ultimately impacts our Bay. Maintaining a nutrient cap requires a new approach to policies, programs, and the funding needed to implement them. New thinking, and substantial new resources will be needed to successfully implement all of the recommendations in this report. This funding will need to be identified from private, local, state and federal sources. This document is a first step in this process, which will continue through the development and implementation of Maryland's Tributary Strategies, and related efforts to protect and restore the Chesapeake Bay and its rivers.

"Ultimately, if we are to succeed in restoring the Chesapeake Bay in the face of continued growth, we will need to change our lifestyles and ways of doing business so that each of us produces less of the pollution that ultimately impacts our Bay."

Purposes of the Strategy

The interim strategy has four purposes:

To overcome gaps in reaching nutrient goals in some tributary basins. Statewide, Maryland has met its phosphorus goal, but is about 3 million pounds over the nitrogen goal.

To offset growth in load due to population, industrial and agricultural growth. For planning purposes, growth in load was projected through 2005. The interim cap strategy recommended in this report will overcome gaps in reaching current nutrient reduction goals and offset anticipated growth in load through 2005. This is largely accomplished through continued implementation of existing programs and practices in combination with new/recent initiatives such as "smart growth" and the agricultural "Water Quality Improvement Act of 1998." Maintaining the nutrient cap long term or achieving more ambitious goals will require much more than the current level of effort.

To begin to identify long term issues, needs and opportunities. Preventing any further growth in nutrient pollution (or achieving additional reductions) for the long term requires a great deal of anticipation and foresight. The workgroup began a process of looking at current trends and future projections to determine what are the problems likely to be encountered under a capped nutrient load. New or refined technologies, policy changes, and other opportunities were evaluated.

To serve as the transition between old and new goals and strategies. The 1987 nutrient reduction commitment and the tributary strategies of the 1990s were bold, historic steps in ecosystem restoration. We are now committed to maintaining that nutrient reduction, and likely reducing pollution further, in the face of population growth and development. We are now committed to permanently offsetting all nutrient load increases caused by growth or expansion. This requires that we continue to use, and go beyond the conventional BMP based approach. We must enhance technology but we must also change policy and governance approaches, individual and corporate behavior, and eventually even our definition of prosperity and quality of life.

Approaches

The Nutrient Cap Workgroup has identified seven general strategies for maintaining the cap. They are:

Point source options. Continue installation and optimization of BNR and achieve full Tributary Strategy implementation. At the same time, plan for additional nutrient reduction capabilities.

BMP implementation. Continue implementation of BMPs identified during the Tributary Strategies process. The document includes proposed implementation targets for BMPs that will enable us to close the gap to our current goals. More ambitious implementation targets will need to be set to achieve future nutrient reduction goals.

New and innovative BMPs. Maryland's Tracking Subcommittee examined 26 potential BMPs, and has identified those that can currently be tracked for nutrient reduction, and those with future potential that cannot currently be tracked.

Maintenance of existing BMPs. Structural BMPs, such as stormwater management facilities,

need ongoing maintenance to function properly. Many facilities do not receive needed maintenance, and fail to achieve optimal nutrient reduction. Funding and management mechanisms are needed to ensure ongoing maintenance.

Smart Growth and Transportation. Maryland's Smart Growth Program will help reduce nutrient and sediment pollution by reducing impervious surfaces, preserving forests, and reducing auto emissions. The workgroup developed a draft methodology for estimating the nutrient benefits of these practices, which can be adapted for use in the next Tributary Strategies.

Control of Atmospheric loads. The Federal Clean Air Act mandates reductions in NOx emissions as part of efforts to control "bad" ozone and acid rain. The extent of these reductions will depend on the State Implementation Plans for ozone mitigation, and will help reduce 10 to 17 percent of the total load that comes from atmospheric deposition.

Trading. The Chesapeake Bay Program has developed nutrient trading guidelines. Over the coming year, Maryland will review these guidelines and conditions within the State to determine whether a State nutrient trading program should be developed.

Recommendations

For Point Sources and Permits:

1) Establish a specific and realistic total statewide interim point source cap of 16.12 million pounds per year. This is the load that would result at current (2000) flows if all the major WWTPs were achieving 8 mg/l. Encourage individual WWTP to use the load generated by their 2000 flow x 8 mg/l as a guideline, and to achieve reductions to keep nutrient loads below this level.

2) Develop cooperative and consistent state and local policies to offset large increases in nutrient loads from new/expanded activities (point sources, large developments, concentrated animal feeding operations).

For Nonpoint Sources:

3) Identify opportunities to accelerate implementation of practices needed to achieve current reduction goals.

4) Continue BMP implementation to offset growth until new Tributary Strategies are completed.

5) Assure maintenance of existing BMPs so they will continue to function as designed and provide reductions.

6) Emphasize pollution prevention from all sources as the preferred approach to maintaining the cap.

For Tracking Progress:

7) Identify and track new or innovative BMPs (e.g. practices now tracked by local governments, new technologies, etc)

8) Improve tracking of existing practices (e.g., practices implemented by farmers without government assistance; behavior changes resulting from educational programs; improved sharing of urban BMP data among agencies and programs)

9) Refine and incorporate the draft methodology developed by the Growth and Transportation Workgroup to track the nutrient reductions associated with growth management and transportation options by 2002, so that they can be included in the revised Tributary Strategies.

For Upcoming Tributary Strategies:

10) Establish new nutrient loading goals, and allocate loads by watershed and/or loading source within the state.

11) Develop policies and programs to ensure that nutrient reduction policies are compatible with Smart Growth. Policies are needed to address nutrient loads from incremental, scattered low density development.

12) Expand the list of potential new practices by examining the full range of new technologies.

13) Identify policy and programmatic changes/opportunities that will expand our capacity to reduce nutrient pollution.

14) Develop creative funding approaches to provide resources for greatly expanded implementation.

15) Continue the Cap Strategy Workgroup as the Tributary Strategy Development Workgroup to work with tributary teams, citizens, and local and state governments to develop new tributary strategies based on new nutrient reduction goals.

For Research and Education:

16) Support educational programs that enhance citizen and interest group understanding and involvement in Tributary Strategy nutrient reduction efforts and other Bay restoration activities.

17) Support research and development activities to develop and/or evaluate new practices, programs and policies that expand our capacity to achieve needed nutrient and sediment reductions.

Maryland's Interim Cap Strategy

Background of Interim Cap Strategies

The nutrient reduction goals set by the Chesapeake Bay Program are the keystone of regional efforts to restore the Bay. Excess nutrients contribute to excessive algal growth which deplete dissolved oxygen in the Bay, reducing habitat for living resources. The algae also shades out Bay grasses, preventing these critical habitats from thriving.

"In 1992, it was agreed that once these nutrient reductions were achieved, the Bay Partners would *maintain that reduced load thereafter*. "

In 1987, the Bay Program set a goal to reduce nitrogen and phosphorus pollution by 40 percent by 2000 from 1985 levels. In 1992, it was agreed that once these nutrient reductions were achieved, the Bay Partners would *maintain that reduced load thereafter*. This concept of the cap on nutrient loads was adopted to ensure that the gains achieved would not be eroded in the future by growth, land use changes, or other changes leading to load increases.

In 1999, the Bay Program established a basin-wide task force to evaluate the implications of a capped nutrient load and to recommend policies and actions needed to maintain the capped nutrient load. That group submitted a report in August 1999 that identified issues and recommended guidelines for states to follow in developing a cap strategy. The Principals' Staff Committee endorsed the report and asked the jurisdictions to develop cap strategies by January 1, 2001. Difficulty in finalizing upgrades to the Chesapeake Bay Watershed Model resulted in major delays in obtaining the model output needed to estimate current progress and future growth in load. As a result, the timeline for completing the cap strategies was extended until March 31, 2001.

In Maryland, the Cap Strategy Workgroup was composed of tributary team members, state and local government staff, university representatives, and various interest groups. The Workgroup established four task groups to develop more specific, detailed information. The task groups included Point Sources, Tracking and BMP Implementation, Growth and Transportation and Bay Policy and Coordination. The Workgroup and Task groups met from September 1999 through February 2001 to identify issues and develop approaches for Maryland's Cap Strategy. This effort has resulted in the report that follows.

The draft report was reviewed by Maryland's ten Tributary Teams and other interested stakeholders. A final draft was again reviewed by the Teams and endorsed by the Maryland Bay Cabinet for submission to the Chesapeake Bay Program. This report will serve as a starting point for efforts to maintain and expand progress in restoring the Bay after 2000.

Why a Nutrient Cap?

Thanks to the hard work on innumerable individuals and organizations, we have made major gains over the past two decades to restore the Chesapeake Bay and its rivers. Nutrient caps are essential to protect these gains. Nutrient loads stem from nonpoint sources – runoff from agricultural and urban lands and atmospheric deposition -- and point sources (mostly municipal wastewater treatment plants). Both of these are influenced, but not determined by, population growth. Simply put, more people means more development and more flow from wastewater treatment plants.

"Our challenge is to maintain a focus on the total nutrient loads entering the bay in order to ensure that our goals for the restoration of the ecosystem are met."

Over the past two decades, we have worked to reduce the impact of each additional person living in the Chesapeake Bay watershed. For example, despite increasing flows, the nutrient loads from point sources have dropped. While data are not yet available to document urban loads on a per acre basis, new stormwater regulations and the new design manual in Maryland are expected to lead to further reductions. However, these reductions can be offset by sheer growth in population. Our challenge is to maintain a focus on the total nutrient loads entering the bay in order to ensure that our goals for the restoration of the ecosystem are met.

Challenge of Meeting a Nutrient Cap

Capping nutrient loads at a level that restores and maintains water quality and living resources is the only logical option for a restoration effort. However, the very concept of a limit on nutrient loads is counter to our historical approach to pollution control. To-date, we have focused on reducing our nutrient loads by installing best management practices and upgrading our wastewater treatment plants. Now, the most readily available reductions have already been achieved, and we are faced with the challenge of smaller reductions at higher costs to prevent any growth in nutrient loads (and, as we will discuss later, in all likelihood to achieve even greater reductions). We are now committed to "no net increase" in nitrogen and phosphorus loads in Maryland and the Chesapeake Bay watershed in the foreseeable future. What this means is that every time we allow a new source of nutrient pollution, we must either ask it to completely offset or control all the nutrient pollution it would generate or we must get additional nutrient reductions from an existing source. Ultimately, if we are to succeed in restoring the Chesapeake Bay in the face of continued growth, we will need to change our lifestyles and ways of doing business so that each of us produces less of the pollution that ultimately impacts our Bay.

"...we strongly recommend that the State begin immediately to develop comprehensive and consistent statewide policies and approaches to offset major new sources of nutrient loads as well as the more general impacts of population growth on nutrient pollution."

Purpose of the Interim Cap Strategy

The interim cap strategy in this report continues the conventional approach of obtaining reductions from existing sources to offset growth in nutrient load. The brief time available to develop the interim strategy did not allow time to decide how to completely offset new sources of nutrient loads for the long term. This strategy is designed to maintain progress until new goals and tributary strategies are developed in two or three years. In order to avoid ad hoc actions on a case-by-case basis that my eventually prove to be counterproductive, we strongly recommend that the State begin immediately to develop comprehensive and consistent statewide policies and approaches to offset major new sources of nutrient loads as well as the more general impacts of population growth on nutrient pollution. This recommendation has been accepted by the Governor's Chesapeake Bay Cabinet, and interim recommendations will be developed and presented to the Cabinet for discussion by September 2001.

The Maryland Interim Cap Strategy serves four primary purposes:

1) ***Overcoming gaps*** - Some tributary basins did not meet their nutrient reduction goals by 2000 and there is a Statewide gap in meeting the nitrogen goal. The first emphasis of the cap strategy is to identify the gaps and to find practices/ approaches that will allow us in the near future to fully achieve our tributary strategy reductions statewide and in each basin.

2) ***Offsetting growth in load*** - Increasing population and expanding development and business activity create growth in nutrient loads. The cap strategies are designed to offset growth in load through 2005. New goals and strategies are anticipated prior to that time that will supersede these interim strategies. Specific practices as well as more general approaches, such as growth management, have been identified that will allow us to offset growth in loads.

3) ***Identification of longer term issues, opportunities and policy needs*** - Capping nutrient pollution to maintain progress while determining if new goals are needed seems obvious but it is not necessarily how we have managed nutrients in the past. To-date, we have achieved substantial reductions in nutrient pollution, but have rarely managed to completely offset new sources. A capped load means we stop the growth of nutrient pollution. The workgroup identified several major issues that should be addressed before new strategies are in place if we are to maintain the capped nutrient load, or go further.

4) ***Making a transition from current reduction goals to new goals and updated tools***. The Chesapeake 2000 Agreement commits us to a living resource based water quality goal that removes all human related impairments by 2010. Our 1987 goal was based on improvement in oxygen levels in deeper water. Clearly, the new goals will challenge us to reach even greater nutrient reductions (and achieve substantial reductions in sediment delivery). We also have an updated, improved watershed model that helps us better assess human impacts on the Bay and the benefits of practices and programs.

In this Interim Cap Strategy, we honor our commitments through the Tributary Strategies but recognize that those commitments must be evaluated using the new tools. Past modeling tools (and associated nutrient caps) have worked well but it is now time to replace them as we move toward new goals.

Maryland's Interim Cap Strategy is being used to provide the transition between old and new goals. Our nutrient caps will change, both to remove impairments, and as a result of model upgrades based on a better understanding of nutrients. We will also need to meet newly established sediment caps. We will use the strategy to reach and maintain our commitments and to recognize the tremendous effort it has taken by all involved to get to reach current goals. But we will also identify new

approaches and practices with high potential to jumpstart our efforts to achieve new goals to remove all nutrient impairments to Chesapeake Bay.

Current Nutrient Reduction Progress

Maryland has made considerable progress in reducing nutrient loads delivered to the Chesapeake Bay over the past 15 years, particularly in the face of continued growth. Total nitrogen loads have dropped by 28 percent, from 82.5 M lbs in 1985 to 59.0 M lbs in 2000. Total phosphorus loads have dropped by 39 percent, from 6.8 M lbs in 1985 to 4.1 M lbs in 2000. (It is important to note that these figures cannot be directly compared to the 40 percent nutrient reduction goal, which was only for controllable, not total, loads. Projected loads in 2000 are based on projected implementation of best management practices.)

When comparing our nutrient reduction progress to the reductions we pledged to achieve through implementation of our Tributary Strategies, Maryland has achieved this goal for phosphorus, but has not yet achieved it for nitrogen.

Point source loads have dropped significantly. The success of the point source program is due to successful voluntary implementation of nutrient removal programs at the major facilities, availability of the state cost-share grant funds, strong local support, the phosphate ban, and other phosphorus controls. Statewide, point source nitrogen loads have changed from 31.38 million M lbs to 16.97 M lbs (-46 percent), and phosphorus loads from 2.38 M lbs to 0.96 M lbs (-59 percent).

Agricultural loads are also dropping. Nitrogen has dropped from 32.2 M lbs to 21.1 M lbs (-34 percent), and phosphorus from 2.74 M lbs to 1.52 M lbs (-45 percent). Agricultural loads are dropping for three reasons: implementation of BMPs, changing land use, and, statewide, a steady decline in farm animal production. Agricultural land acres have decreased by 13 percent, from an estimated 1,846,000 acres in 1985 to 1,622,800 acres in 2000. Farm animal production has also changed from 1982 to 1997, generating 15 percent less nitrogen and 11 percent less phosphorus. Statewide, beef and swine production is dropping, and poultry production is increasing. (Since 1997, poultry production appears to be leveling off.) Only the Upper Eastern Shore and the Choptank basins have higher nitrogen loads from farm animals in 1997 than they had in 1982.

Conversely, urban loads are growing, despite modest success in implementing urban best management practices. Urban acres have grown 22 percent, from 844,300 acres to 1,045,500 acres. Urban nitrogen loads have grown 19 percent, from 11.81 M lbs to 14.05 M lbs, and phosphorus loads have grown 16 percent, from 1.15 M lbs to 1.34 M lbs.

The load reduction information above was derived from the Chesapeake Bay Program Watershed Model, a computer model that estimates nutrient loads from the Bay's 64,000 square mile watershed, and is linked to a models that estimates contributions from the air. The Bay Program also relies on water quality monitoring data to assess progress. Monitoring data show that while nutrient loads to tidal waters have decreased and water quality has improved in some localized areas, it has not improved everywhere. In many

"**In many places water quality has not improved enough to meet goals which are based on the requirements for healthy biological communities.**"

places water quality has not improved enough to meet goals which are based on the requirements for healthy biological communities. Across the tidal Bay, nutrient concentrations are still too high to adequately limit algal growth. In the mainstem of the Bay and in the lower Potomac estuary dissolved oxygen still approaches zero in the summer. In many places the water still is not clear enough to support growth of underwater grasses, which are critical habitat for crabs and young fish.

Developing and implementing strategies to achieve the Bay Program nutrient goals was an enormous challenge and we recognize tremendous efforts, political will and cooperation it has taken to achieve the nutrient goals. Local governments, farmers, businesses and citizens all have made this progress possible through their commitment and sacrifices. Clearly, no one signatory could have done this alone, and government alone, across the watershed could not have succeeded.

Tables 1 and 2:

The following two tables summarize current nutrient reduction progress for nitrogen and phosphorus. All figures were estimated using the current version of the Chesapeake Bay Program's watershed model (version 4.3).

Baseline loads *(1985)* are the loads against which nutrient reduction progress is being measured.

Projected loads *(2000)* are estimated loads for 2000, based on current land use and BMP implementation.

Projected Growth in Load *(2000-2005)* is a net growth in load based on land use and point sources over the next five years. Statewide this is approximately .6 percent for nitrogen and 1.4 percent for phosphorus.

Anticipated Reductions with Ongoing Implementation of Existing Programs *(2000-2005)* are the reductions expected through implementation of BMPs and wastewater treatment plant upgrades. Implementation of BMPs was expected to continue at current rates.

Projected Loads *(2005)* are the loads expected in 2005, taking into account the implementation of existing programs and growth in load.

Interim Goal, or Full Implementation of Tributary Strategies is the load that would exist when the 1995 Tributary Strategies have been fully implemented, according to the latest version of the watershed model.

Projected Gap (2000) is the amount by which the projected 2000 loads exceed the interim goal (full implementation of tributary strategies). In 2000, seven of the tributary basins will not meet their interim nitrogen goals, and two will not meet interim phosphorus goals (by a very narrow margin). Statewide, Maryland meets its phosphorus goal, but exceeds its nitrogen goal by 2.41 million pounds (4 percent).

Projected Gap (2005) is the amount by which the projected 2005 loads exceed the interim goal (full implementation of tributary strategies). In 2005, five of the tributary basins will not meet the interim nitrogen goal, and three will not meet the interim phosphorus goal (by a very narrow margin). Statewide, Maryland will have met its interim goal for both nitrogen and phosphorus.

Figures 1 and 2

Figures 1 and 2 show the reduction in nitrogen and phosphorus loads Statewide over the past 15 years. The bar graphs illustrate the drop in loads from 1985-2000, from the various sources. The pie charts show the changing composition of nutrient loads from 1985-2000. Most notable is the growing proportion of nutrient loads from urban sources, and the shrinking proportion from point sources and agricultural loads. This information points to a need to make greater efforts to control urban nonpoint sources in the future.

Several of the larger local governments in Maryland feel that the Chesapeake Bay Program's watershed model overestimates urban nutrient loads when compared with local water quality monitoring data. These loads are now being reviewed to address this issue.

Maryland's Tributary Strategies

Total Nitrogen, Delivered to Bay (M lbs/year)								
Tributary Basin	Baseline Loads (1985)	Projected Loads (2000)	Projected Growth in Load (2000 - 2005)	Anticipated Reductions with Ongoing Implementation of Existing Programs (2000-2005)	Projected Loads (2005)	Interim Goal, or Full Implementation of Tributary Strategies	Projected Gap (2000)	Projected Gap (2005)
Choptank	6.15	4.08	0.03	-0.32	3.80	4.04	0.04	-0.24
Lower Eastern Shore	9.46	7.14	0.05	-0.54	6.64	6.73	0.41	-0.09
Lower Potomac	3.35	3.11	-0.03	-0.09	2.98	2.78	0.33	0.20
Lower Western Shore	2.01	1.76	0.06	0.03	1.86	1.81	-0.05	0.05
Middle Potomac	10.38	7.26	0.59	-0.54	7.31	7.67	-0.40	-0.36
Patapsco/Back River	22.44	12.12	0.07	-0.50	11.69	10.57	1.55	1.12
Patuxent	5.02	4.26	-0.09	0.37	4.55	4.34	-0.08	0.20
Upper Eastern Shore	8.07	6.16	0.08	-0.88	5.37	6.06	0.10	-0.70
Upper Potomac	10.24	8.64	-0.35	-0.20	8.09	8.43	0.21	-0.34
Upper Western Shore	5.36	4.45	-0.04	-0.09	4.32	4.16	0.29	0.16
MARYLAND	82.46	58.99	0.36	-3.86	55.50	56.59	2.41	-1.09

NOTE: Includes reductions from coastal BMPs.

GROWTH IN LOAD (2000-2005) is calculated by subtracting 2005PR(2000 BMPs) Scenario from 2000PR (2000 BMPs) Scenario.

ANTICIPATED REDUCTIONS (2000-2005) is calculated by subtracting 2005(2000BMPs) Scenario from 2005PR (2005 BMPs) Scenario.

GAP is calculated by subtracting the Net Load in 2005 from the Interim Goal. A positive number indicates a shortfall and a negative number indicates that the goal has been met or exceeded.

PROJECTED GROWTH IN LOAD is considered to be conservative. Actual growth in load will probably be higher.

Maryland's Tributary Strategies

Total Phosphorus, Delivered to Bay (M lbs/year)								
Tributary Basin	Baseline Loads (1985)	Projected Loads (2000)	Projected Growth in Load (2000 - 2005)	Anticipated Reductions with Ongoing Implementation of Existing Programs (2000-2005)	Projected Loads (2005)	Interim Goal, or Full Implementation of Tributary Strategies	Projected Gap (2000)	Projected Gap (2005)
Choptank	0.64	0.37	0.00	-0.02	0.35	0.41	-0.04	-0.06
Lower Eastern Shore	1.10	0.57	0.01	-0.02	0.56	0.57	-0.00	-0.02
Lower Potomac	0.32	0.22	0.00	-0.00	0.22	0.22	0.01	0.00
Lower Western Shore	0.26	0.12	0.01	-0.01	0.11	0.14	-0.02	-0.03
Middle Potomac	0.46	0.43	0.02	-0.01	0.44	0.43	0.00	0.01
Patapsco/Back River	1.39	0.69	0.01	-0.00	0.69	0.68	0.00	0.01
Patuxent	0.51	0.31	0.01	-0.00	0.32	0.32	-0.01	-0.00
Upper Eastern Shore	0.69	0.38	0.01	-0.07	0.32	0.49	-0.11	-0.17
Upper Potomac	1.02	0.70	0.00	-0.02	0.69	0.70	0.00	-0.01
Upper Western Shore	0.40	0.31	0.00	-0.00	0.31	0.30	0.01	0.01
MARYLAND	6.78	4.11	0.06	-0.17	4.00	4.26	-0.15	-0.26

NOTE: Includes reductions from coastal BMPs.

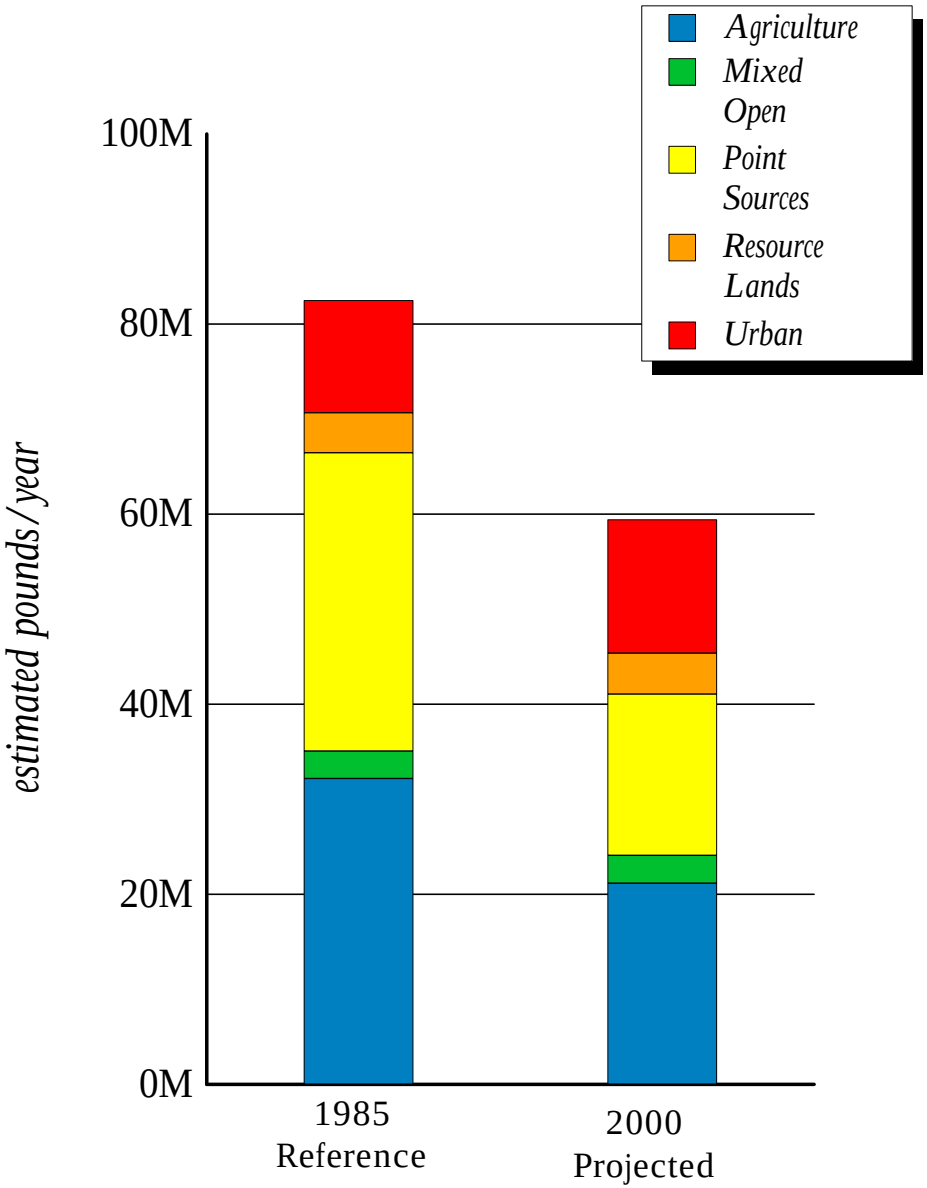
GROWTH IN LOAD (2000-2005) is calculated by subtracting 2005PR(2000 BMPs) Scenario from 2000PR (2000 BMPs) Scenario.

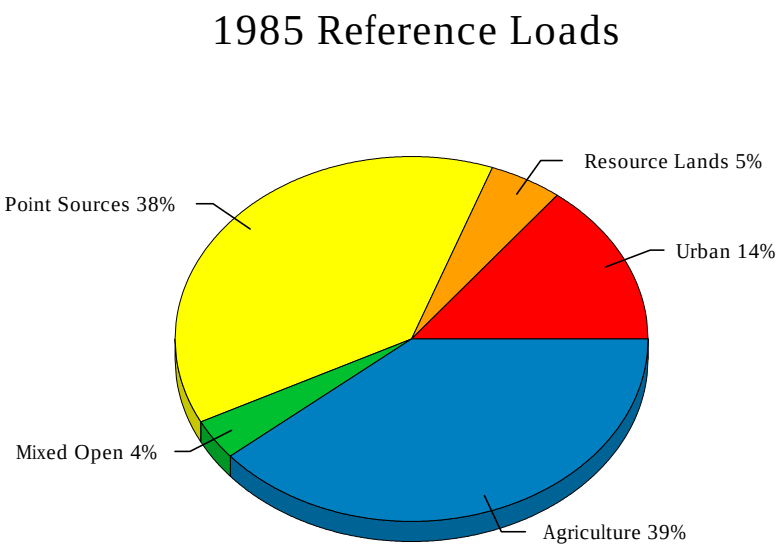
ANTICIPATED REDUCTIONS (2000-2005) is calculated by subtracting 2005(2000BMPs) Scenario from 2005PR (2005 BMPs) Scenario.

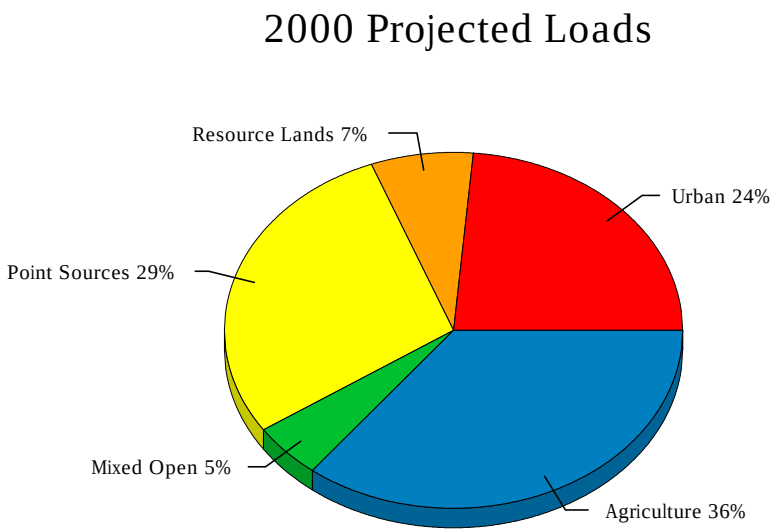
GAP is calculated by subtracting the Net Load in 2005 from the Interim Goal. A positive number indicates a shortfall and a negative number indicates that the goal has been met or exceeded.

PROJECTED GROWTH IN LOAD is considered to be conservative. Actual growth in load will probably be higher.

Maryland : Nitrogen Loads

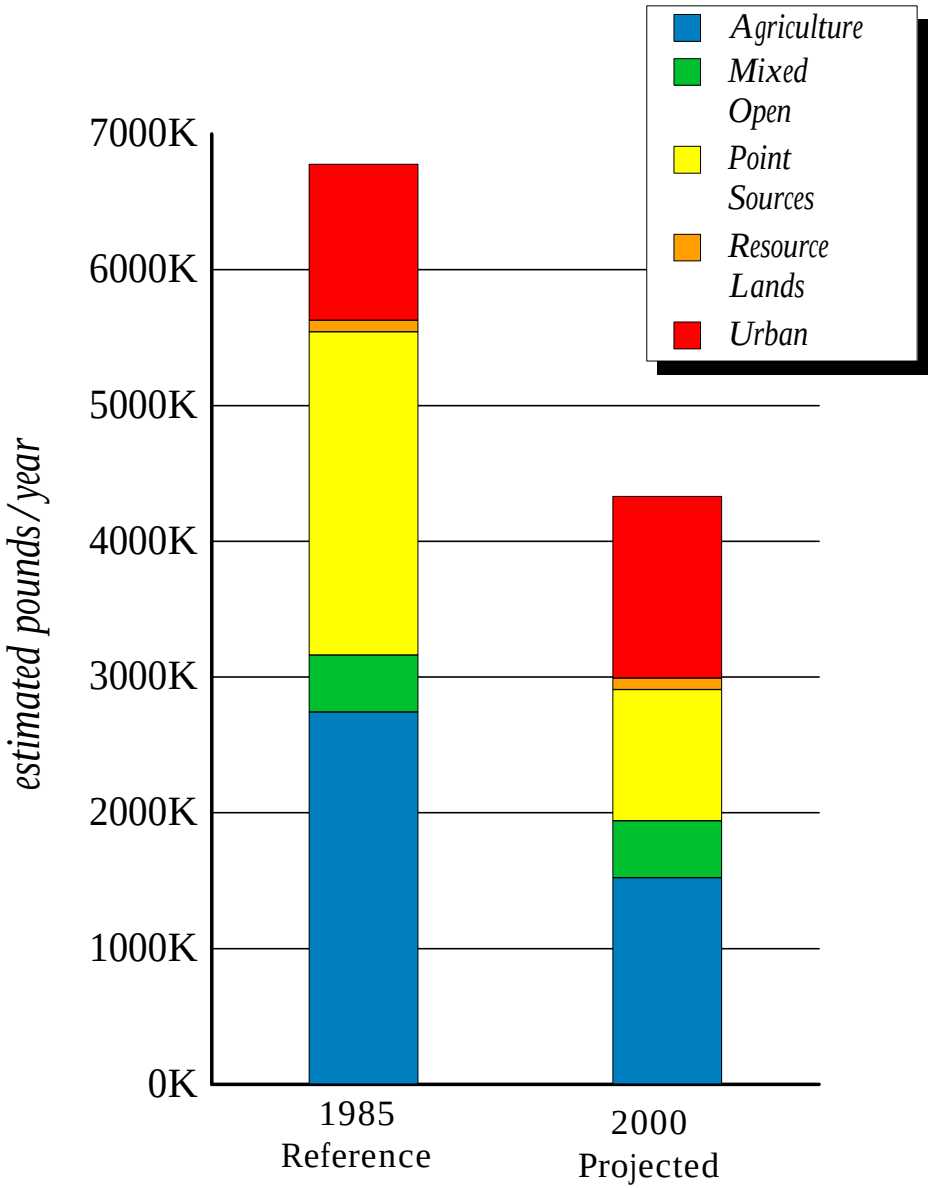


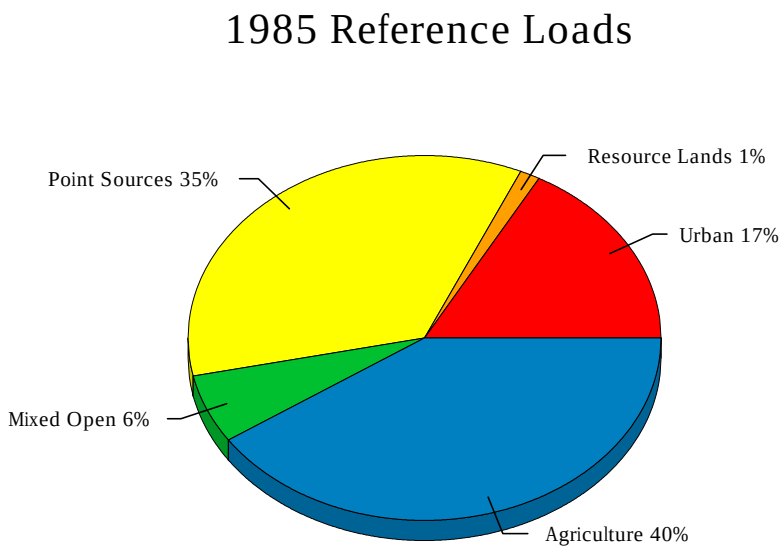


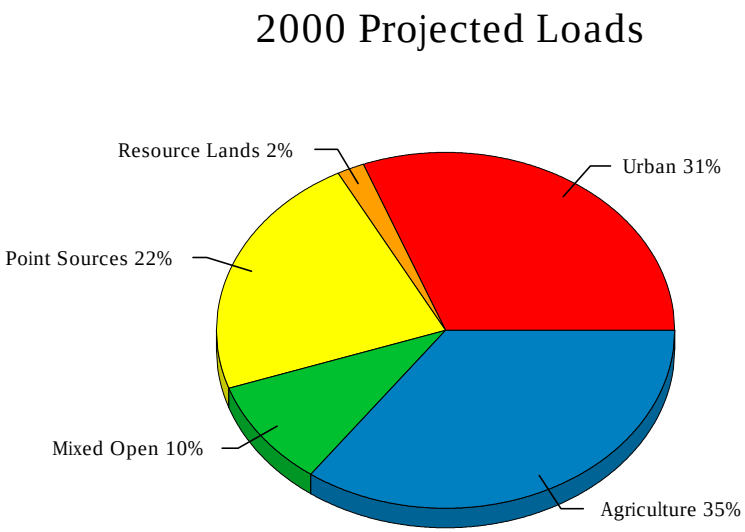


* Does not include reductions from estuarine BMPs.

Maryland : Phosphorus Loads







* Does not include reductions from estuarine BMPs.

Allocating Loads

In Maryland's original Tributary Strategies (developed in 1993-94), loads were allocated by tributary basin -- all were assigned the goal of reducing nitrogen and phosphorus by 40 percent.. However, loads were not then further allocated by source category (e.g. point sources, agriculture, or urban nonpoint source). Rather, the implementation targets for different practices were set through a process of negotiation with key stakeholders, and the requirements of existing regulatory programs. For example, State policy was to work with all point sources over 0.5 million gallons per day to install biological nutrient removal (BNR) in order to achieve nitrogen concentrations of 8 mg/liter.

"... all sectors should focus on achieving the original reductions called for in the Tributary Strategies, offsetting current growth in loads and planning for no net growth in the future."

For the agricultural community, the Maryland Department of Agriculture worked with "agricultural workgroups" for each tributary basin to obtain their input on the feasibility and acceptability of implementation targets for specific best management practices. These workgroups were essential to the widespread acceptance of the tributary strategies by farmers. Targets for other practices were set by assuming that all regulatory practices would be fully implemented, and that other voluntary programs would continue at least at current funding levels. Cost effectiveness, equity, applicability and ability to implement were all considered in setting implementation targets.

For the nutrient cap, Maryland's Cap Workgroup has made the working assumption that all sectors should focus on achieving the original reductions called for in the Tributary Strategies, offsetting current growth in loads (2000 through 2005) and planning for no net growth in the future. Initial proposals to maintain reductions for each source category are included below. Specific load allocations by source are not recommended at this time, as it was felt that it would be more practical to avoid confusion among stakeholders by waiting until new, living resource-based nutrient and sediment goals are set in 2002. Because these goals are based on the conditions and needs of living resources in each basin, the percentage reduction is likely to be different across basins.

The workgroup recommends that further allocation be made prior to the development of new Tributary Strategies. Loads will also need to be allocated among jurisdictions for shared watersheds (e.g. the Potomac). These allocations should be contained in the revised Tributary Strategies.

The Workgroup considered two possible approaches for allocation that may be revisited when new nutrient and sediment goals are set.

By County and Watershed Segment. Several workgroup members suggested this allocation because it would allow caps to be allocated both by tributary basin and by county. This would allow for a continued focus on the living resource needs in each basin, while at the same time providing accountability to counties by providing them

with an allocation which they could meet as they felt appropriate.

By Source. Members of the point source workgroup suggested an allocation by point and nonpoint source. This would have the advantage of allowing those responsible for the cap (in this case, wastewater treatment plant operators, and those responsible for implementing urban and agricultural nonpoint source controls) to plan for their allocation. However, workgroup members had questions about how to address issues of equity, cost effectiveness, and implementability, and no consensus was reached.

Cap Strategy Approaches

The Nutrient Cap Workgroup has identified seven general strategies for maintaining the cap. They are:

- Point source options
- BMP implementation
- New and innovative BMPs
- Maintenance of existing BMPs
- Smart Growth and Transportation
- Control of atmospheric loads
- Trading

Point Source Options

Maryland's Tributary Strategies call for the implementation of the Biological Nutrient Removal (BNR) at all WWTPs that currently have a design flow equal to or greater than 500,000 gallons per day (gpd). To achieve this goal, the State of Maryland provides 50 percent cost-share funding for BNR and chemical phosphorus removal (CPR) at all wastewater treatment plants (WWTPs) with the flow equal or greater than 500,000 gallons per day (gpd).

The BNR program was implemented as a voluntary program and requires the full cooperation and participation of Maryland's local governments. The success of this voluntary approach is evident from the level of participation in the BNR program. Of 66 WWTPs identified as eligible to obtain funding, all but one have either installed BNR or have signed cost-share agreements with MDE to do so. This is greater than a 98 percent voluntary participation rate.

Under the statewide nutrient reduction strategy, 34 wastewater treatment plants have placed BNR into operation. Another 32 BNR modifications are in design, construction, or preliminary engineering.

Nitrogen reduction goals in the strategy are based on facilities upgraded with BNR achieving an annual average total nitrogen effluent concentration of 8 mg/l. Phosphorus is to average 2 mg/l, although many facilities produce much less due to local water quality requirements. While additional WWTPs will come on line, work at the plants currently operating with BNR will need to focus on achieving and maintaining 8 mg/l and below for nitrogen.

Point sources have already achieved significant reductions With the help of BNR, the point source nitrogen load has decreased by 46 percent since 1985. Phosphorus loads have declined from the 1985 level by 59 percent. At full implementation of BNR, the decreases from 1985 levels are projected to be 50 percent for nitrogen and over 61 percent for phosphorus.

The growth of the communities they serve is the primary problem facing point sources. All the major treatment plants serve growth areas. To achieve further reductions in effluent nutrient loads, the increase in nutrient load due to effluent flow increases associated with growth has to be offset. In addition to offsetting growth, a new goal facing point sources will be the Nutrient Reduction Strategy modifications due at the end of 2002. Engineers designing new or expanded BNR systems will have to provide flexibility in their designs for meeting the new nutrient load goals and implementation strategies.

Recommendations

The recommendations for a point source strategy can be divided into two groups - interim and long-term. The interim

recommendations apply to the period until new nutrient reduction goals are adopted and the tributary strategies undergo revision. The long-term recommendations deal with the permanent maintenance of the cap once adopted. However, they also incorporate actions or planning strategies that prudent jurisdictions would want to implement immediately.

The interim recommendations are:

1) Complete BNR installation at major treatment facilities.

2) Ensure that completed BNR installations are operated in a manner that optimizes nutrient removal efficiency. Optimization will further reduce the nutrient loads to the Bay and in most instances offset for several years the load increase expected from growth. Several municipal facilities are achieving nitrogen concentrations well below 8 mg/l. Optimal performance should be achieved by as many facilities as possible.

1) Establish a specific and realistic interim point source nitrogen cap of 16.12 million pounds per year. This is the load that would result at current (2000) flows if all the major WWTPs were achieving 8 mg/l. Appendix 1 shows all Maryland WWTPs, their estimated 2000 flows, and the nitrogen and phosphorus concentrations and loads that would result from full implementation of the tributary strategies. The flows and loads in this table are not intended to represent individual allocations or caps, but serve as guidelines for individual plants and illustrate the derivation of the proposed interim goal.

The long-term recommendations are:

1) Encourage the installation of more effective BNR processes or chemical nutrient removal processes to supplement or augment existing BNR facilities where required. Some BNR facilities are not good candidates for optimization and will need to be supplemented with other technology to obtain nitrogen concentration averages below 8 mg/l. Also, at some WWTPs, growth will increase nutrient loads beyond what can be offset by the existing BNR facilities. In these situations, more effective BNR processes would have to be installed to achieve the lower concentrations needed to maintain the cap.

2) Design BNR enhancement and BNR expansion projects keeping in mind the possible eventual need to achieve the limit of technology.

3) Encourage the development and utilization of alternative disposal technologies, (e.g. land treatment and wastewater reuse).

The recommended measures would help meet the nutrient goals of the Statewide Tributary Strategy for Nutrient Reduction, offset load increases needed to accommodate Smart Growth, and position point sources to be able to meet the new water quality goals for the Chesapeake Bay now being developed.

BMP Implementation

In the Tributary Strategies, implementation of nonpoint source practices -- urban, agricultural and resource protection BMPs -- account for 39 percent of the nitrogen reductions and 47 percent of the phosphorus reductions. To-date, significant progress has been made to reduce agricultural loads. Nitrogen has dropped by 34 percent and phosphorus by 45 percent since 1985. This is due to the implementation of BMPs, loss of agricultural land, and a decrease in farm animal production. However, urban lands are expanding and corresponding loads are increasing. The workgroup discussed both incremental increases in these loads, as well as potential new sources of loads, such as concentrated animal feeding operations (CAFO) or a new subdivision.

For agriculture, we expect some new animal operators that are currently not under the state/federal definition of a CAFO will need State National Pollution Discharge Elimination System (NPDES) permits. Currently, CAFO operations must install practices and implement a nutrient management plan. In the future, all farms will be required to comply with the requirements of the State's Water Quality Improvement Act (WQIA) for nutrient management planning. If new CAFOs are established in the State, they will be required to have an NPDES permit, and Maryland will need to determine how to offset the new nutrient loads they will create.

For urban lands, the second phase of federal/state regulation of stormwater is now underway through the NPDES permits. All counties with populations over 100,000 have previously been required to have a permit. In Maryland, this includes ten jurisdictions: Frederick, Carroll, Baltimore, Baltimore City, Harford, Howard, Anne Arundel, Montgomery, Prince George's, and Charles.

While there will be exemptions for places under 1,000 in population, Phase II of the NPDES stormwater program affects all localities in "urbanized areas." An "urbanized area" is defined as an incorporated place and any surrounding unincorporated area together having a population over 50,000. More simply stated, Phase II affects typically those places not included in Phase I that are located in the urban counties of Maryland. These permits will cover both existing and new development and require local government to develop programs to control pollutant discharges. These programs include sediment control, stormwater management, illegal dumping and spill prevention, and public education.

The State's stormwater management program has recently been modified to improve the control of urban runoff. Separate from the federal NPDES permit program, Maryland's efforts include performance goals of 80 percent removal of total suspended solids, and 40 percent removal of phosphorus using both structural and nonstructural management practices. New stormwater management regulations including the "2000 Maryland Stormwater Design Manual" have just been adopted statewide. In addition to many design techniques that will help reduce urban runoff, the design manual calls for a 20 percent *decrease* in impervious surface for redevelopment projects. These changes will go into effect in July 2001, and will be evaluated through monitoring data over the coming five years. Monitoring data now being collected by local governments (through NPDES municipal stormwater permits) will be a valuable tool in estimating the total nutrient reductions associated with a suite of urban BMPs, many of which are currently unquantified.

Pollution prevention is an essential

component of Maryland's Interim Cap Strategy. Prevention is generally more effective and less costly than other removal methods, and can be practiced in all sectors by all who contribute to nutrient and sediment pollution. Pollution prevention is a key component of counties'NPDES programs, and of many practices on the farm and in the home. These practices need to be emphasized and increased through education and incentive programs.

Table 4 shows the projected implementation of BMPs statewide through 2005. Projected Implementation 2000-2005 assumes that practices will continue to be implemented at current levels. The column entitled "Projected implementation 1985-2005 as percent of LOT" refers to the percentage of implementation compared to the "limit of technology." "Limit of technology" is a term defined by modelers that refers to the maximum amount of implementation of a particular practice. It is limited by the acres available on which to apply a particular practice, but does not take into account current or expected funding, or by the cultural acceptability of a practice. However, "limits of technology" is an evolving term and will change as new technologies emerge and are applied in the Bay watershed.

Recommendations:

1) Implement BMPs at least at the levels recommended by the Tracking Subcommittee, which has developed implementation targets for nonpoint source practices for 2000-2005 that will close existing gaps and offset growth in loads. These are expected implementation based on current programmatic budgets and level of effort.

2) Identify the potential for expanded implementation of existing BMPs in cooperation with the Tributary Teams.

3) Focus on additional reductions from urban lands, as the proportion of nutrient loads from this source are increasing. There is a particular need for additional funds to address retrofits of older urban areas, and maintenance of existing urban stormwater facilities. Provide incentives for redevelopment of urban areas.

4) Develop guidelines or policies to address significant new sources of nutrient loads from urban and agricultural sources.

5) Work with NPDES counties to improve estimates of nutrient reduction from urban BMPs, including currently unquantified practices.

6) Emphasize pollution prevention as the preferred approach for meeting nutrient and sediment caps and new goals.

New and Innovative BMPs

There are a wide range of best management practices (BMPs) for controlling pollution and improving habitat. Some are specifically designed for nutrient and/or sediment reduction. Others, like many stormwater practices, are designed for other purposes (control of excess flows) and have nutrient and sediment reduction as a secondary benefit. Maryland's Tributary Strategies

aim to track as many of these practices as possible, in order to account for reductions in nutrient and sediment loads.

Maryland's Tracking Subcommittee has reviewed 26 BMPs that could be included in future Tributary Strategies. Of these BMPs, several were determined to have adequate information to be included in future tracking efforts. For the remainder, we lack either nutrient reduction efficiencies or the ability to track implementation.

Additional BMPs currently being implemented that we expect to be able to track in the next Tributary Strategies include:

- Wetland creation
- Shore erosion control (greatly expanded from original Tributary Strategies tracking)
- Small grain commodities
- Smart Growth
- Forest harvesting BMPs
- Septic system management
- Urban nutrient management
- Stream restoration
- Street sweeping
- Inlet cleaning
- CSO & SSO elimination
- Horse pasture management

The following BMPs were examined, but lack adequate information A full discussion of these practices is included in the Tracking Subcommittee's report (which can be found online at http://www.dnr.state.md.us/bay/tribstrat/index.html)

- Green Building
- Low Impact Development (or environmentally sensitive design)
- Oyster and menhaden management
- Public outreach/education
- New stormwater regulations
- Mine reclamation
- Roadside drainage systems

MARYLAND

Agricultural Best Management Practices

BMP Name and Description	Tributary Strategy Goal	Implemented through 2000	Projected Impl. 2000-2005	Projected 1985-2005, as % of LOT
Animal Waste Management Systems: Livestock - Systems for the proper handling, storage, and use of waste generated by confined animal facilities. These include ponds, lagoons, and tanks for liquid waste, and sheds or pits for solid waste.	1,328 systems	923 systems	144 systems	1,067 systems , or 100% of LOT
Animal Waste Management Systems: Poultry - Systems for the proper handling, storage, and use of waste generated by confined animal facilities. These include ponds, lagoons, and tanks for liquid waste, and sheds or pits for solid waste.	576 systems	702 systems	426 systems	1,128 systems , or 100% of LOT
Forested Buffers - A linear strip of forest along rivers and streams that filters nutrients and sediment and enhances stream habitat.	3,204 acres	2,892 acres	2,066 acres	4,958 acres , or 3% of LOT
Grassed Buffers - A linear strip of grass along rivers and streams that filters nutrients and sediment and enhances stream habitat.	4,173 acres	624 acres	471 acres	1,095 acres , or 17% of LOT
Cover Crops - Small grains planted in September or early October on land otherwise fallow with no fertilizer applied. This practice reduces nitrate leaching losses during the winter, and also reduces erosion.	167,178 acres	125,583 acres	135,127 acres	260,710 acres , or 30% of LOT
Conservation Tillage - A process that uses tillage equipment to seed the crop directly into the vegetative cover or crop residue on the surface, with minimal soil disturbance.	1,188,716 acres	755,288 acres	7,354 acres	762,642 acres , or 100% of LOT
Nutrient Management Plan Implementation - A comprehensive plan to manage the amount, placement, timing and application of animal waste, fertilizer, sludge, or other plant nutrients.	1,284,829 acres	1,184,829 acres	1,056,431 acres	2,241,260 acres , or 100% of LOT
Runoff Control - Systems for the proper handling, storage, and use of waste generated by confined animal facilities. These include ponds, lagoons, and tanks for liquid waste, and sheds or pits for solid waste.	953 systems	560 systems	203 systems	763 systems , or 100% of LOT
Retirement of Highly Erodible Land - An accelerated application of practices used in SCWQPs on lands with a high potential for soil loss.	6,698 acres	6,319 acres	3,596 acres	9,915 acres , or 5% of LOT
SCWQP Implementation and Treatment of Highly Erodible Land - A comprehensive plan addressing natural resource management of farmland directed toward the control of erosion and sediment loss, and management of animal waste or agricultural chemicals.	1,450,107 acres	1,357,950 acres	60,179 acres	1,418,129 acres , or 98% of LOT
Stream Protection with Fencing - Fencing along streams to completely exclude livestock from the stream. Also improves streambank stability and reduces sedimentation.	10,215 acres	9,462 acres	3,518 acres	12,980 acres , or 25% of LOT
Stream Protection without Fencing - Providing troughs or other watering devices in remote locations away from the stream to discourage animals from entering the stream, and the provision of some fencing adjacent to stream crossings to limit access points.	30,735 acres	25,392 acres	2,464 acres	27,856 acres , or 100% of LOT

MARYLAND

Resource Best Management Practices

BMP Name and Description	Tributary Strategy Goal	Implemented through 2000	Projected Impl. 2000-2005	Projected 1985-2005, as % of LOT
Forest Harvesting Practices - Application of regulatory and voluntary best management practices applied to timber harvests, including erosion and sediment control and streamside management zones.	19,530 acres	0 acres	0 acres	0 acres , or 0% of LOT
Marine Pumpouts (installation) - A facility sited at marinas for pumping sewage from boat holding tanks to a dockside storage facility.	164 marinas	152 marinas	204 marinas	356 marinas , or 100% of LOT
Nonstructural Shore Erosion Control - A practice for stabilizing eroding shorelines by establishing marsh grasses; suitable for sites with lower wave energy. Also creates wetland habitat.	76,810 linear feet	153,228 linear feet	46,000 linear feet	199,228 linear feet , or 100% of LOT
Structural Shore Erosion Control - A practice for stabilizing eroding shorelines using stone riprap or timber bulkheads. Suitable for sites with high wave energy.	37,782 linear feet	106,330 linear feet	23,200 linear feet	129,530 linear feet , or 100% of LOT

MARYLAND

Urban Best Management Practices

BMP Name and Description	Tributary Strategy Goal	Implemented through 2000	Projected Impl. 2000-2005	Projected 1985-2005, as % of LOT
Erosion and Sediment Control - The regulatory requirement for erosion and sediment control on all new development over 5,000 square feet. Reduces the high nutrient and suspended sediment loads during the transitory construction phase.	19,272 acres	10,450 acres	43,883 acres	54,333 acres , or 100% of LOT
Enhanced Stormwater Management - The regulatory requirement for the control of Stormwater on all new development, including maintenance on new and existing facilities. Enhancements emphasize water quality controls in addition to water quantity controls.	189,034 acres	82,293 acres	20,115 acres	102,408 acres , or 49% of LOT
Forest Conservation - Implementation of the Forest Conservation Act, which requires the retention of a portion of forested lands on any newly developed site.	18,334 acres	11,495 acres	6,891 acres	18,386 acres , or 100% of LOT
Septic Connections - The connection of failing septic systems to sewer lines.	5,946 systems	10,979 systems	7,842 systems	18,821 systems , or 100% of LOT
Septic Denitrification - The installation of new systems or retrofitting of existing systems with technology to remove nitrogen from individual systems.	101 systems	312 systems	223 systems	535 systems , or 0% of LOT
Stormwater Management Conversion - Conversion of dry ponds for Stormwater management to extended detention or retention facilities which are more effective at nutrient removal.	3,426 acres	3,374 acres	2,410 acres	5,784 acres , or 100% of LOT
Stormwater Management Retrofits - Construction of Stormwater facilities on lands previously developed without such facilities.	7,553 acres	4,811 acres	3,435 acres	8,246 acres , or 100% of LOT
Septic Pumping - Pumping individual septic systems once every three years, the average routine maintenance of these systems.	3,269 systems	0 systems	0 systems	0 systems , or 0% of LOT
Tree Planting - Includes any tree plantings on any site except those along rivers and streams.	10,290 acres	6,363 acres	4,545 acres	10,908 acres , or 100% of LOT
Urban Nutrient Management - A public education program to reduce excess lawn fertilizer use, targeted at suburban residents and businesses.	49,818 acres	0 acres	0 acres	0 acres , or 0% of LOT

Maryland's Tracking Subcommittee is currently exploring the potential of developing a composite "urban BMP" that would include many of the regulatory and nonregulatory practices now being adopted, especially in more urban jurisdictions. This approach would allow us to move away from the approach of counting individual BMPs (which has proven difficult and problematic over the years) to a more programmatic estimate of a jurisdiction's urban nutrient reduction efforts.

Recommendations:

1) Work with local governments and other implementors to begin incorporating new BMPs that have sufficient nutrient reduction information and can be tracked.

2) Continue to evaluate the potential for additional supplemental BMPs listed in the Tracking Subcommittee's report.

Maintenance of BMPs

Many of the practices implemented to achieve current reductions require some level of maintenance and may eventually need to be upgraded or replaced. The design life for most practices is ten to twenty years (certain agronomic practices must be done annually (e.g. cover crops). We are approaching the design life for many practices installed as part of the Bay restoration effort since 1983. It is critical that these practices be maintained or much of our progress will be lost. It is also important that current status and function of implemented practices be determined and that they be maintained or enhanced to provide the expected reductions.

Recommendations:

1) ***Maintain at least current levels of all BMP implementation and performance.*** If current levels are not maintained, the nutrient reductions that would not be achieved must be offset by implementation of other practices. This requires a two prong approach. For long term practices, such as stormwater or animal waste management, it requires an assessment of current status and a commitment to maintain the practices as described below. For short term (annual) practices (e.g. cover crops), it requires a commitment to continue to provide financial and technical assistance at levels that will maintain or enhance reductions.

2) ***Continue to assess BMP coverage and performance.*** Nutrient reductions for many BMPs are known to decline with lack of proper maintenance. This is a major concern with stormwater management facilities and septic systems, many of which are not adequately inspected or maintained. Additional information on the performance of stormwater and other BMPs is needed.

3) ***Identify resources and mechanisms needed to maintain existing BMPs.*** The revised Tributary Strategies should contain specific recommendations to address BMP maintenance. Again, using stormwater management facilities as an example, significant new resources are needed to ensure that maintenance on these facilities occurs so that they can function as designed.

4) ***Adjust current progress estimates to reflect declining performance of BMPs.*** Our goal is to ensure that BMPs are functioning properly and achieving expected nutrient reductions. However, until this is the case, we should not overestimate our current progress. Tracking of BMP implementation should be modified where necessary to reflect the impact of poor maintenance on our nutrient reduction efforts. This will help highlight the importance of maintenance to our overall efforts.

Smart Growth and Transportation

Maryland's population will continue to grow and low density residential development is projected to continue to be the dominant land use pattern based on current zoning and development policies. The challenge is to grow in a manner that allows economic growth while protecting our environment. Thus, growth management and transportation options are essential to maintain the nutrient "cap" and preserve resource land and address the goals of the Chesapeake Bay 2000 Agreement. Transportation needs to be well coordinated with local planning efforts to provide for future growth that consumes fewer resources, and produces less pollution. By directing growth in appropriate ways, we can:

- Reduce nutrient pollution from new development and septic systems
- Reduce vehicle miles traveled reducing air pollution
- Accommodate projected growth on fewer acres of land, and direct growth away from watersheds designated for water resource conservation
- Conserve more resource and environmentally sensitive land, such as forest, farmland, and riparian buffers along streams
- Direct growth to relatively few local watersheds in areas designated for growth
- In designated growth areas, limit nutrient and sediment impacts and seek reduction opportunities.

The options presented in this report provide local governments and other land planners with a menu of options that can reduce nutrient loads from new development as well as preserve resource land. It is not intended to be an exhaustive list. The options must be selected by local jurisdictions to ensure that they address local needs and concerns. Many growth management and transportation options consist of techniques that local governments in Maryland have long used to varying degrees. Their purpose has been to encourage an orderly development pattern, create effective public services, and provide safe communities, efficient transportation, and a variety of quality of life benefits. These planning and management techniques are also essential if we are to protect watershed successfully and limit nutrient pollution over the long term. Thus, achieving and maintaining nutrient and natural resource objectives, depends on local comprehensive plans and implementation programs increasingly planning for and managing growth by watershed.

The Growth and Transportation Workgroup has identified several ways in which local land use tools can affect the nutrient cap. The primary responsibility of land use planning is with local governments. Local governments through their county and municipal plans and related zoning and subdivision ordinances and expenditures for infrastructure by State and local governments manage how and where new development

will occur.

- Permanent reduction in the future number of dwelling units as currently planned (e.g. downzoning)
- Spatial reallocation or transfer of development to designated growth areas and the land outside the designated growth areas placed in permanent easements (e.g. Transfer of Development Rights)
- Moratoria to allow appropriate planning
- Reduction in the impact of development on nutrient load generation through environmentally sensitive development (e.g. buffers, clustering)
- Reduction in the impact of existing development on nutrient load generation through environmentally sensitive retrofitting and through innovative requirements for redevelopment.
- Increase development potential in designated growth areas by ensuring that required infrastructure is in place.
- Reduce vehicle miles traveled through the concentration of development and proximity of various uses

Transportation strategies to support the nutrient cap include:

- Transit oriented development
- The Neighborhood Conservation Program (funds improvements such as streetscaping, pedestrian safety improvements and improved storm drainage)
- Retrofit Sidewalk Program (to build or reconstruct sidewalks along state highways within revitalization areas -- may be expanded to additional areas)
- Transportation Enhancement Program (provides cost share to local governments for bicycle and pedestrian facilities, landscaping, etc
- Sound Barrier Program (improves livability in older neighborhoods affected by highway noise)
- Planting Partnership Program (works with local governments and volunteer groups to fund and coordinate landscape planting and maintenance)
- Commute Smart Programs for teleworking and car/van pooling
- Transit 2000, which provides tax incentives to employers and employees for transit use
- Increase transit ridership by expanding service areas and adding capacity
- Improve access to main-line bus routes from spread out neighborhoods through the Neighborhood Bus Routes Program.

Recommendations

1) Work to ensure that community amenities, including healthy local streams, are in place to create attractive sustainable communities that will attract and keep people in our urban communities.

2) State and local governments need to work together to ensure that the defined densities for growth areas (PFAs) are achieved.

3) Promote redevelopment and remove barriers to investment in underutilized urban, suburban, and rural communities by working with localities and development interests.

4) Promote environmentally sensitive design for new development and

retrofitting (where feasible).

5) Concentrate new residential development in areas supported by adequate water resources and infrastructure to minimize impacts on water quality.

6) Promote rural economies.

7) Promote the establishment of urban stream buffers.

8) Support local government adoption of policies and financing friendly to "transit oriented development" in order to reduce vehicle miles travelled.

9) Develop policies and programs to ensure that nutrient reduction policies support Smart Growth. Policies are needed to address nutrient loads from incremental, scattered low density development.

Controlling Atmospheric Loads

Atmospheric deposition is recognized to be a significant source of nutrients to the Chesapeake Bay -- about 21 percent of the total nitrogen load. Deposition may occur directly to the tidal Bay surface where it is counted directly in the overall load, or to the watershed and areas above the fall line, where it becomes part of the indirect, nonpoint source load. At the time of the 1987 Chesapeake Bay Agreement, atmospheric sources were considered "uncontrollable" because some of them originated outside of the Bay watershed. However, current modeling efforts are tracking both atmospheric loads and anticipated reductions in those loads due to the Clean Air Act.

The Clean Air Act Amendments (CAAA) of 1990 requires certain emission sources to reduce their NOx emissions. NOx, a byproduct of fossil fuel combustion, is a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2) and is implicated in the formation of "bad" ozone and smog and acid rain. The NOx reductions are mandated to improve ozone and reduce acid deposition, and as a collateral benefit, are expected to result in a reduction in atmospheric loads to the Bay and its watershed. The extent of these reductions will depend on the nature of the State Implementation Plans that the US Environmental Protection Agency deems adequate for ozone mitigation. However, the upper Bay area is required to be in compliance by 2007 which means that controls should be in place by about 2004.

The NOx State Implementation Plan requires reductions from all source categories: large stationary (such as fossil fired electricity generators), mobile source (such as cars and trucks) and area sources (a "catch-all" category). It is notable that for all these affected sources contributing to deposition in the upper Bay, Maryland contributes about three percent of the total emissions, but it contributes about 16 percent of the total nitrate-N deposition. Estimates for emissions reductions under the State Implementation Plan for Maryland are on the order of 20 percent by 2004 and may reach 65 percent by 2007 for the electricity generation sector.

The Air Subcommittee of the Bay Program has investigated the reductions in the Bay load due to the CAAA. Based on early runs of the Regional Air Deposition Model combined with the Chesapeake Bay Watershed Model, they estimated a reduction in the total load from the atmosphere of about 10 percent starting in 2004. These estimates may change with the more recent

model revisions, but these data are not yet available. The Ozone Transport Commission was established in the CAAA and is responsible for addressing the issue of the interstate transport of ozone forming pollutants. Their recommended actions for achieving the ozone standard shows a reduction of 17 percent by 2007 in the total atmospheric load due to deeper emissions reductions over a wider geographic region. However, the emission reductions expected from the CAAA occur only in the summer months when ozone levels are high.

It is important to note that reduced nitrogen (ammonia/ammonium), a nutrient observed to be increasing in wet deposition, is not regulated in the CAAA. However, ammonia is a precursor to the formation of fine particulate matter (PM), and PM is considered a criteria air pollutant under the CAAA Title I national ambient air quality standards.

Recommendations:

1. Chesapeake Bay Program should develop a better assessment and quantification of the contributions from ammonia sources to the overall nutrient load. Agriculture is believed to be the largest source of ammonia emissions in the Chesapeake Bay region. However, urban areas may be expected to be significant contributors as well because of the numerous, concentrated ammonia sources (industries and automobiles).

2. The Chesapeake Bay Program should develop and use models to allocate nitrogen loadings back to emission sources for incorporation into tributary strategies and nutrient reduction accounting.

3. Develop improved ammonia emissions inventories.

4. Investigate the costs and benefits of year-round NOx reductions.

Trading

In 1998, the Chesapeake Bay Program established a Nutrient Trading Negotiation Team, consisting of 38 individuals representing diverse stakeholder groups throughout the Chesapeake Bay watershed. The team was charged with exploring the concept of nutrient trading, and if appropriate, developing recommendations for nutrient trading guidelines.

In August 2000, the team reached consensus on the *Draft Chesapeake Bay Program Nutrient Trading Guidance Document*, which outlines eight fundamental principles that the team views as essential to a successful and environmentally sound trading program. The document also contains recommended trading guidelines which will provide a consistent approach for the Chesapeake Bay Agreement jurisdictions to voluntarily develop, as they deem appropriate, state-specific nutrient trading programs. This document is not a regulation, but rather guidance that states can use on a voluntary basis to ensure that nutrient trading approaches in the Chesapeake Bay watershed are consistent and compatible between jurisdictions, and fully supportive of Chesapeake Bay Program goals. The document is available at www.chesapeakebay.net

Maryland held three public workshops about the trading document in September 2000. The document was completed in February 2001. Maryland will then evaluate whether and how to develop a nutrient trading program for the State. Below are the principles outlined in the Chesapeake Bay Program guidance document.

Fundamental Principle #1: Trades must not produce water quality effects locally, downstream or Baywide that: violate water quality standards or criteria; do not protect designated uses; or, adversely impact living resources and habitat.

Fundamental Principle #2: The nutrient trading program must be consistent with federal, state and local laws and regulations, be flexible enough to adapt to future changes in these laws and regulations, and enable participation of all potential sources as determined by the market place.

Fundamental Principle #3: The nutrient trading program must be consistent with the Chesapeake Bay Program=s nutrient reduction goals and state tributary strategies.

Fundamental Principle #4: Each trade must achieve no change in nutrient loadings or a net reduction in nutrient loadings.

Fundamental Principle #5: Every source should strive to do its part in reaching the 40 percent reduction goal prior to considering the nutrient trading option.

Fundamental Principle #6: Trading must be allowed only within each major Bay tributary (i.e. Susquehanna, Potomac, Rappahannock, York, James, Patuxent, MD Western Shore, VA Western Shore, MD Eastern Shore, Va Eastern Shore, among all signatory states and non-signatory states if they adopt the appropriate allowance and are consistent with the Chesapeake Bay Program's nutrient trading guidelines and state tributary strategies.

Fundamental Principle #7: Traders must be in substantial compliance with all local, state, and federal environmental laws, regulations and programs.

Fundamental Principle #8: The involvement of a diverse group of stakeholders must be sought in the design and implementation of state trading programs and related public education initiatives.

Additional Challenges

Managing Large Increases in Nutrient Loads

Growth in nutrient load from new activities will occur. Much of this growth involves small increases due to limited change such as a new house, a new septic system, a few more cows at a dairy or a minor shift in crop production. These types of growth in load are difficult to track individually and their impact is best estimated cumulatively. It is likely that an approach comparable to our current tributary strategies will best address these individually sources of growth in load.

"Currently, there is no formal process to evaluate [activities that increase nutrient loads] in light of their impact on the nutrient cap, and no mechanism to ensure that the loads are completely offset..."

Other new activities could generate substantial increases in nutrient loads in the future. These include expanded or new municipal or industrial treatment plants, new large scale animal operations and large scale development. Treatment plants and large scale animal operations (above 1000 animal units) require state permits. Large scale development requires local approval and certain permits. The implementation of federal stormwater management regulations will likely bring the runoff from most major new developments under a stormwater management permit.

One challenge we face is how to implement our commitment to a nutrient cap in the face of ongoing activities that will increase nutrient loads. For example, a wastewater treatment plant may request a permit to increase flow, or a new subdivision may request approval through local planning and permit processes. Currently, there is no formal process to evaluate these requests in light of their impact on the nutrient cap, and no mechanism to ensure that the loads are completely offset, as required by a cap. This appears to conflict with the intent of the nutrient cap and goal of removing water quality impairments to Chesapeake Bay and raises a substantial policy issue.

Who should be responsible for completely offsetting the growth in nutrient load remaining after the practices and controls required in the permit are implemented? If we are to maintain the current or (as anticipated in some areas) even a lower capped nutrient load, the options appear limited. State or local government could develop an approach that completely offsets all growth in load. This would probably be a more targeted version of the current approach to tributary strategies, which may be difficult to do because we have already implemented the most cost-effective practices to reach our current load goals. In some cases, local governments may wish to offset increases in nutrient loads to allow for planned growth.

Another option would be to require the entity obtaining the permit to completely offset increases in nutrient load. This could be accomplished through nutrient trading, on-site practices or land use change, credits from nutrient banks or off-site land use change. This would create an additional cost for the expanding entity but it would place the responsibility for offsetting load increases

on those responsible for them. It would also encourage expanding entities to minimize their increase in nutrient pollution. These questions will need to be further explored in order to ensure that existing policies do not sanction growth in nutrient loads into the future.

Financing Nutrient Reduction Activities

To-date, actions taken to reduce nutrients have been paid for by many sources. In 1995, a Blue Ribbon Panel on Financing Tributary Strategies was convened to identify potential sources and strategies for additional nutrient reduction efforts. The Panel found that in Maryland, about $200 million is spent each year from federal, state, local and private sources. (This amount has probably increased over the past five years.) Further, the Panel estimated that an additional $60 million per year would be needed from all sources to implement the actions called for in the Tributary Strategies. This funding shortfall has never been closed. Today, we are now planning for new strategies to meet new nutrient goals that are expected to be more ambitious, as well as meeting the nutrient cap by maintaining existing practices and completely offsetting new growth. How can this be done? What are the financing options?

"Creating a broad-base of support derived from multiple funding sources can strengthen a watershed plan."

Communities often focus their funding efforts on just a few programs, because finding new sources for funding takes time. Public funding has been a critical component of our progress to-date -- such as the State grants program that pays for 50 percent of the installation of BNR at major wastewater treatment plants. However, it is important to realize that there is never enough public funding to protect and restore watersheds. Creating a watershed financing plan that incorporates both public and private sources can pay big dividends.

Creating a broad-base of support derived from multiple funding sources can strengthen a watershed plan. While Maryland uses watersheds as the organizing context for identifying and prioritizing restoration projects through the Tributary Teams, we don't take the same approach with funding those projects. From a land use and ownership perspective, a watershed is simply a mosaic of public, private and nonprofit land ownerships and land uses. A watershed financing plan should mirror this mosaic by using the skills and strengths of stakeholders, and various funding sources, to realize a group's goals and objectives.

Creating a watershed financing plan involves many of the same principles used in the strategic planning of a watershed's assessment and restoration, and those steps that were done for restoration planning may either inform the financing plan, or be used directly in developing a financing plan.

Financial planning begins with creating a *vision* for what people want the watershed to look like in the future. Often, these vision statements are created as part of a Tributary Team's mission statement, or a watershed group's restoration plan. Once there is agreement on the future vision for the watershed, then projects or activities need to be *prioritized*. After a prioritized list of actions is developed, *planning* which financial tools and sources will be used follows. Developing *cooperation* between stakeholders and funders

in order to create the *partnerships* needed for success is essential. Finally, the plan needs to *leverage* funding resources in order to maximize available financing.

The primary tools used in creating a watershed financing plan are: (1) public funding through public programs; and (2) private funding through a variety of funding techniques.

Public funds are the first set of tools, and include federal and state programs that either address specific tasks, such as funds for planning projects, educational projects, or capital projects, or address specific issues such as stormwater, wetlands or riparian buffers. There is a funding source and financing technique for most issues in a watershed. The key to successfully crafting a planning approach to funding is in thinking about the tasks involved in each project and using these tasks to plan for funding.

The second set of tools, private funding through funding techniques, should be better incorporated into financial planning. Funding techniques include innovative fee structures for drinking water systems that encourage conservation, wetlands mitigation banking for developers to help repair degraded areas, and awards or recognition programs for good stewards of streambanks.

A financial plan could be thought of as a "community quilt" for funding. The first step in creating this quilt is to identify the stakeholders, many of whom are represented on Maryland's Tributary Teams. Stakeholders can include citizens, community groups, businesses and industry, federal, state and local governments, nonprofit organizations, as well as colleges, universities, and schools.

How do these different stakeholders contribute to a watershed financing plan? Citizens and community groups may be involved in native species landscaping at home and office, or developing a market demand for environmentally friendly products, or in replacing impervious surfaces at the home and office. They may also be active in reducing or eliminating pesticide and insecticide use at home and office. Business and industries may be engaged in environmental audits, or partnering with other businesses to reuse waste streams, or planting native species landscaping. They also may have tree planting programs on behalf of employees, or promote car-pooling and environmental awareness at home and office.

Federal, state and local governments may offer tax credits as incentives for pollution control technologies or in-fill development. They might also use and promote innovative stormwater management techniques, or create revolving loan funds for small business pollution control technologies, septic system repairs, or agricultural best management practices.

Once stakeholders, landowners and land uses are identified within a watershed, they are used to create a patchwork of funding opportunities. There is a funding source and financing technique for most issues in a watershed: wetlands, forest buffers, agriculture, drinking water needs, brownfields, environmental justice issues, economic development needs, and habitat opportunities.

Watershed teams and communities need to think creatively and take apart a proposed project to look for funding opportunities within them that may not be readily obvious. By using a broader collection of terms to describe a watershed, we can broaden the sources of funding for watershed plans.

Even if one innovative financing idea is not appropriate for a community, it may spark ideas and discussion about priorities and needs and other ways of addressing issues.

Next Steps – Revising Maryland's Tributary Strategies

The New Chesapeake Bay Agreement calls for the removal of all nutrient and sediment-related water quality problems so that the Bay can be removed from the EPA's list of impaired waters under the Clean Water Act by 2010. It also lays out steps over the next decade to achieve this ambitious goal. By 2001, new nutrient and sediment goals will be set for each major tributary, based on the water quality conditions needed to protect living resources. By the following year, each state's Tributary Strategies are to be revised to meet the new goals. These new goals will also serve as caps, and will not be allowed to increase once they have been achieved. In Maryland, the revised Tributary Strategies will also address habitat goals and other issues related to overall watershed health.

"The Tributary Teams have provided important perspectives on equity, cost, the ability to implement recommended practices, and the need for continued improvement and innovation."

Maryland's Cap Strategy will be an important link in the transition between old and new goals. Our nutrient caps will change, both to remove impairments, and as a result of model upgrades. We will use this strategy to reach and maintain our commitments and to recognize the tremendous effort it has taken by all involved to get to reach current goals. But we will also identify new approaches and practices with high potential to jumpstart our efforts to achieve new goals to remove all nutrient impairments to Chesapeake Bay.

Maryland's Tributary Teams will be essential partners in this effort. We plan to work closely with the Teams, and the stakeholder groups they represent, to identify practices that will help us achieve nutrient and sediment reductions, and maintain the caps. The Tributary Teams have provided important perspectives on equity, cost, the ability to implement recommended practices, and the need for continued improvement and innovation. A new workgroup, Maryland's Tributary Strategies Development Workgroup, is now being formed, and will coordinate the next stage of this ongoing process.

Conclusion

Maintaining the current progress in restoring the Chesapeake Bay is a major challenge. Achieving substantial additional nutrient and sediment reductions to fully restore living resources is an even greater challenge. These both require offsetting all increases in nutrient pollution related to population growth and development, as well as further reductions from existing sources. However, there is no choice but to accept and accomplish this challenge. Anything less will leave us with a greatly diminished Chesapeake Bay that will continue to decline in health and diversity of living resources.

The tremendous effort and accomplishment of the last decade cannot be overlooked. The Chesapeake Bay would be in far worse condition were it not for the immense cooperative efforts of citizens, businesses and government during the last decade. This effort has become a national model and positions us well to undertake the next challenge. We will achieve and maintain nutrient loading caps while developing and implementing plans to remove all impairments to Chesapeake Bay.

This Interim Cap Strategy Report serves as the transition between old goals and new challenges. It suggests specific approaches to achieving nutrient loading caps, where gaps in meeting interim goals exist, and offers a plan to maintain these capped loads for up to five years. The report sets the stage for developing new tributary strategies to achieve even more challenging goals.

The diverse stakeholder and agency workgroup that developed this report, identified and discussed many policy issues that must be addressed during development of new tributary strategies. Substantial work remains before acceptable policy solutions can be found for many of these issues. These issues and recommendations were discussed in the report. Major recommendations are in the front of this report following the Executive Summary.

Maryland has a long history of leadership in restoring the Chesapeake. This Nutrient Cap Strategy positions us to move to the next level: to remove all nutrient and sediment impairments to the living resources of Chesapeake Bay. This is an enormous challenge. Our only choice is to accept that challenge and finish the job of restoring the Chesapeake Bay.

2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	MAJOR					
CHOPTANK RIVER	EASTON	2.05	8.00	8.00	49,840	49,840
	DENTON	0.48	8.00	8.00	11,746	11,746
	CAMBRIDGE	5.13	8.00	7.98	124,903	124,609
	Total	**7.65**			**186,489**	**186,195**
LOWER EASTERN SHORE	CRISFIELD	0.67	8.00	13.44	16,320	27,409
	FEDERALSBURG	0.34	8.00	18.18	8,274	18,808
	DELMAR	0.52	8.00	8.00	12,555	12,555
	PRINCESS ANNE	0.78	8.00	8.00	19,108	19,108
	SALISBURY	5.30	8.00	29.52	129,203	476,684
	POCOMOKE CITY	0.88	8.00	10.16	21,498	27,303
	HURLOCK	0.76	8.00	8.00	18,462	18,462
	SNOW HILL	0.36	8.00	18.24	8,666	19,755
	FRUITLAND	0.48	8.00	18.00	11,625	26,155
	Total	**10.08**			**245,710**	**646,238**
LOWER POTOMAC RIVER	INDIAN HEAD	0.34	8.00	18.03	8,293	18,691
	LA PLATA	0.74	8.00	7.39	17,959	16,582
	MATTAWOMAN	8.51	8.00	11.97	207,270	310,026
	LEONARDTOWN	0.40	8.00	5.41	9,736	6,583
	Total	**9.98**			**243,259**	**351,882**
LOWER WESTERN SHORE	CHESAPEAKE BEACH	0.63	8.00	4.97	15,409	9,579
	BROADNECK	4.92	8.00	3.04	119,937	45,521
	ANNAPOLIS	8.09	8.00	8.00	197,177	197,177
	MARLAY-TAYLOR (PINE HILL RUN)	3.31	8.00	8.00	80,624	80,624
	BROADWATER	0.97	8.00	5.49	23,579	16,183
	Total	**17.92**			**436,726**	**349,084**
MIDDLE POTOMAC RIVER	BLUE PLAINS (MD portion)	153.96	8.00	7.50	3,751,092	3,516,649
	DAMASCUS	0.73	8.00	7.48	17,735	16,577
	SENECA CREEK	4.70	8.00	7.56	114,599	108,346
	PISCATAWAY	21.68	8.00	8.00	528,106	528,106
	POOLESVILLE	0.62	8.00	7.96	15,064	14,982
	Total	**181.68**			**4,426,597**	**4,184,660**
PATAPSCO/BACK RIVER	FREEDOM DISTRICT	1.98	8.00	7.38	48,306	44,552
	BACK RIVER (001)	82.65	8.00	10.00	2,013,822	2,517,277
	BACK RIVER 002 (BETH STEEL)	91.99	8.00	8.43	2,241,289	2,359,785
	PATAPSCO	69.60	8.00	13.19	1,695,808	2,795,343

* For major WWTP only. No concentration goals have been set for smaller WWTP.

2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	COX CREEK	11.16	8.00	12.78	271,800	434,107
	MOUNT AIRY	0.50	8.00	8.00	12,154	12,154
	Total	**257.88**			**6,283,179**	**8,163,220**
PATUXENT RIVER	BOWIE	2.16	8.00	5.48	52,686	36,068
	PATUXENT	4.62	8.00	1.84	112,498	25,806
	FORT MEADE	2.15	8.00	3.34	52,363	21,876
	PARKWAY	6.03	8.00	3.90	147,002	71,581
	WESTERN BRANCH	17.66	8.00	7.30	430,364	392,537
	LITTLE PATUXENT	17.52	8.00	7.30	426,908	389,362
	MARYLAND CITY	1.01	8.00	5.33	24,592	16,392
	DORSEY RUN	1.45	8.00	7.16	35,392	31,679
	Total	**52.61**			**1,281,805**	**985,299**
UPPER EASTERN SHORE	CHESTERTOWN	0.60	8.00	9.82	14,542	17,849
	PERRYVILLE	1.01	8.00	6.16	24,584	18,917
	ELKTON	1.35	8.00	18.90	32,938	77,828
	CENTREVILLE	0.32	8.00	14.94	7,881	14,722
	KENT ISLAND	1.56	8.00	19.03	37,987	90,347
	NORTHEAST RIVER	0.42	8.00	18.15	10,270	23,304
	Total	**5.26**			**128,202**	**242,966**
UPPER POTOMAC RIVER	WINEBRENNER (FORT RICHIE)	0.30	8.00	15.17	7,315	13,873
	NICODEMUS	0.58	8.00	23.18	14,202	41,148
	EMMITSBURG	0.43	8.00	6.75	10,511	8,874
	TANEYTOWN	0.61	8.00	8.00	14,855	14,855
	BRUNSWICK	0.54	8.00	18.69	13,181	30,795
	THURMONT	0.84	8.00	4.88	20,502	12,517
	CUMBERLAND	12.83	8.00	11.79	312,603	460,770
	FREDERICK	6.62	8.00	8.00	161,368	161,368
	HAGERSTOWN	7.91	8.00	8.00	192,737	192,737
	BALLENGER CREEK	3.76	8.00	5.65	91,689	64,742
	WESTMINSTER	4.05	8.00	6.71	98,615	82,686
	MARYLAND CORRECTIONAL INSTITUTE	0.89	8.00	3.46	21,733	9,401
	GEORGES CREEK	0.88	8.00	14.10	21,382	37,687
	CONOCOCHEAGUE	1.06	8.00	4.49	25,715	14,428
	CELANESE	1.05	8.00	6.49	25,501	20,678
	Total	**42.35**			**1,031,911**	**1,166,559**
UPPER WESTERN SHORE	ABERDEEN PROVING GROUNDS-EDGEWOOD	0.86	8.00	7.09	20,874	18,495
	ABERDEEN PROVING GROUNDS-ABERDEEN	0.87	8.00	8.00	21,191	21,191

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow**	**Goal for Nitrogen**	**Estimated Nitrogen**	**Goal for Nitrogen**	**Estimated Nitrogen**
		Million Gallons	**Concentrations***	**Concentrations (2000)**	**Loads**	**Loads (2000)**
		per day	**(miligrams/liter)**	**(miligrams/liter)**	**(pounds/year)**	**(pounds/year)**
	ABERDEEN	1.76	8.00	8.00	42,836	42,836
	HAVRE DE GRACE	1.53	8.00	20.80	37,218	96,784
	JOPPATOWNE	0.83	8.00	6.32	20,227	15,969
	SOD RUN	10.66	8.00	8.00	259,664	259,664
	Total	**16.50**			**402,010**	**454,939**
Major Total		**601.94**			**14,665,887**	**16,731,042**
	INDUSTRIAL					
CHOPTANK RIVER	ALLEN FAMILY FOODS	0.26	4.69	4.69	3,657	3,657
LOWER POTOMAC RIVER	NSWC-INDIAN HEAD	1.96	2.62	2.62	15,664	15,664
						0
PATAPSCO/BACK RIVER	CHEMETALS	0.10	445.83	445.83	131,303	131,303
	CONGOLEUM	0.19	0.06	0.06	36	36
	W R GRACE	3.85	45.59	45.59	534,325	534,325
						0
PATUXENT RIVER	MD & VA MILK PRODUCERS	0.21	9.17	9.17	5,902	5,902
						0
UPPER POTOMAC RIVER	GARDEN STATE TANNING	0.54	77.81	77.81	127,967	127,967
	UPPER POTOMAC RIVER COMMISSION	20.72	1.23	1.23	77,613	77,613
	WESTVACO CORPORATION-LUKE	2.51	1.92	1.92	14,675	14,675
Industrial Total		**30.34**			**911,141**	**911,141**
	MINOR					
CHOPTANK RIVER	GREENSBORO	0.18	21.02	21.02	11,771	11,771
	TRAPPE	0.12	18.00	18.00	6,840	6,840
	PRESTON	0.13	18.00	18.00	7,197	7,197
	OXFORD	0.11	18.00	18.00	5,932	5,932

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	NORTH CAROLINE HIGH	0.00	18.00	18.00	84	84
	TWIN CITIES	0.19	18.00	18.00	10,510	10,510
	WALKERS TRAILER PARK	0.01	22.30	22.30	931	931
	TALBOT COUNTY REGION V	0.08	18.00	18.00	4,157	4,157
LOWER EASTERN SHORE	VIENNA	0.05	19.28	19.28	2,713	2,713
	TAWES VOCATIONAL-TECHNICAL	0.00	18.00	18.00	235	235
	BUDGET MOTEL	0.00	18.00	18.00	163	163
	MARDELA HIGH	0.00	8.66	8.66	85	85
	WILLARDS	0.08	18.00	18.00	4,364	4,364
	SHARPTOWN	0.15	26.00	26.00	11,680	11,680
	EWELL	0.03	18.00	18.00	1,660	1,660
	TYLERTON	0.01	18.00	18.00	314	314
	FAIRMOUNT	0.04	18.00	18.00	2,420	2,420
	ENGLISH GRILL	0.00	18.00	18.00	174	174
	POCOMOKE TRUCK STOP	0.00	18.33	18.33	105	105
	COLONEL RICHARDSON MIDDLE&HIGH	0.01	18.00	18.00	599	599
	HEBRON	0.08	18.00	18.00	4,571	4,571
	PITTSVILLE	0.09	14.72	14.72	3,833	3,833
	EASTERN CORRECTIONAL INSTITUTE	0.36	2.01	2.01	2,216	2,216

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
LOWER POTOMAC RIVER	NAS-PATUXENT	0.03	8.00	8.00	698	698
	NSWC-INDIAN HEAD	0.34	8.21	8.21	8,482	8,482
	POTOMAC HEIGHTS	0.20	16.48	16.48	9,851	9,851
	LACKEY HIGH	0.01	18.00	18.00	485	485
	PICCOWAXIN MIDDLE	0.00	18.00	18.00	224	224
	SOUTHERN CORRECTIONAL CAMP	0.02	20.37	20.37	953	953
	BRANDYWINE RECEIVING STATION	0.00	5.55	5.55	29	29
	THUNDERBIRD APARTMENTS	0.01	32.36	32.36	1,007	1,007
	CHOPTICAN HIGH	0.00	18.00	18.00	272	272
	CHARLES COUNTY COMMUNITY COLLEGE	0.03	28.30	28.30	2,874	2,874
	THUNDERBIRD MOTEL	0.00	18.00	18.00	245	245
	LAFAYETTE MOTEL	0.00	18.00	18.00	119	119
	MT CARMEL WOODS	0.01	13.95	13.95	533	533
	CLIFFTON ON THE POTOMAC	0.07	18.00	18.00	3,820	3,820
	WHITE HOUSE MOTEL	0.00	18.00	18.00	267	267
	SWAN POINT	0.03	18.00	18.00	1,854	1,854
	WINTERS APARTMENTS	0.00	18.00	18.00	21	21
	JUDE HOUSE	0.00				0
						0
LOWER WESTERN SHORE	RANDLE CLIFFS NAVAL	0.06	18.00	18.00	3,262	3,262

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	ROSE HAVEN	0.05	20.59	20.59	3,064	3,064
	SUMMER HILL TRAILER PARK	0.02	13.87	13.87	773	773
	US NAVAL ACADEMY	0.36	3.91	3.91	4,285	4,285
	DREAMS LANDING	0.01	16.03	16.03	463	463
	MAYO LARGE COMMUNAL	0.52	11.50	11.50	18,318	18,318
						0
MIDDLE POTOMAC RIVER	BELTSVILLE USDA EAST	0.17	8.00	8.00	4,237	4,237
	BELTSVILLE USDA WEST	0.11	0.67	0.67	231	231
	NATIONAL INSTITUTE OF HEALTH	0.04	18.00	18.00	2,406	2,406
	CHELTENHAM BOYS VILLAGE	0.05	10.53	10.53	1,514	1,514
	BRETTON WOODS	0.00	18.00	18.00	230	230
						0
PATAPSCO/BACK RIVER	GAITHER MANOR	0.02	3.10	3.10	189	189
	WOODSTOCK TRAINING CENTER	0.01	18.00	18.00	684	684
	PHEASANT RIDGE	0.02	12.97	12.97	974	974
	SOUTH CARROLL HIGH SCHOOL	0.01	18.00	18.00	349	349
	HOLIDAY MOBILE ESTATES	0.09	7.32	7.32	1,961	1,961
	ST TIMOTHY SCHOOL	0.01	18.00	18.00	290	290
	VILLA JULIE COLLEGE	0.01	2.19	2.19	65	65
						0
PATUXENT RIVER	MARLBORO MEADOWS	0.31	12.90	12.90	12,121	12,116

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	ST LOUIS CATHOLIC CHURCH	0.00				
	WAYSONS MOBILE	0.05	19.16	19.16	2,947	2,947
	HARWOOD SOUTHERN HIGH SCHOOL	0.00	6.70	6.70	78	78
	POINT LOOKOUT STATE PARK	0.02	18.00	18.00	989	989
	MARYLAND MANOR MOBILE	0.08	11.00	11.00	2,817	2,817
	PATUXENT MOBILE	0.03	15.09	15.09	1,510	1,510
	PATUXENT WILDLIFE HQ	0.01	2.08	2.08	38	38
	USAF TRANSMITTER STATION	0.00				
	USAF BRANDYWINE HOUSING	0.00	19.03	19.03	179	179
	EMERGENCY MANAGEMENT	0.00	19.56	19.56	66	66
	BOONES MOBILE	0.06	18.01	18.01	3,345	3,345
	NORTHERN HIGH SCHOOL	0.02	18.00	18.00	1,036	1,036
	PARKWAY INN	0.01	9.40	9.40	391	391
	EDGEMEADE RESIDENTIAL SITE	0.01	26.59	26.59	426	426
	LYONS CREEK MOBILE	0.08	10.21	10.21	2,397	2,397
	PINEY ORCHARD	0.17	5.92	5.92	3,146	3,146
UPPER EASTERN SHORE	U.S. ARMY-CHESAPEAKE CITY	0.00	18.00	18.00	185	185
	ROCK HALL	0.25	13.77	13.77	10,285	10,285
	CHESAPEAKE CITY SOUTH	0.03	10.23	10.23	920	920

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	CHESAPEAKE CITY NORTH	0.10	8.17	8.17	2,517	2,517
	MILLINGTON	0.04	18.00	18.00	2,450	2,450
	CECILTON	0.04	18.00	18.00	2,263	2,263
	SUDLERSVILLE	0.13	18.00	18.00	6,959	6,959
	BETTERTON	0.03	18.00	18.00	1,720	1,720
	GALENA	0.04	26.26	26.26	2,933	2,933
	MANCHESTER PARK	0.03	16.75	16.75	1,389	1,389
	WOODLAWN MOBILE HOME PARK	0.00	18.00	18.00	87	87
	QUEENSTOWN	0.08	15.54	15.54	3,974	3,974
	BOHEMIA MANOR HIGH	0.01	18.00	18.00	275	275
	TALBOT COUNTY REGION II	0.31	15.08	15.08	14,336	14,336
	ELK NECK STATE PARK	0.01	17.21	17.21	727	727
	EASTERN CORRECTIONAL CAMP	0.02	18.00	18.00	921	921
	HARBOUR VIEW	0.01	18.00	18.00	404	404
	CHESAPEAKE COLLEGE	0.00	18.00	18.00	236	236
	TRIUMPH INDUSTRIAL PARK	0.02	18.00	18.00	1,337	1,337
	GREAT OAKS LANDING	0.01	18.00	18.00	609	609
	CHURCH HILL	0.06	6.90	6.90	1,203	1,203
	MORNING CHEER	0.02	18.00	18.00	1,055	1,055
	KENNEDYVILLE	0.00				

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	CHERRY HILL	0.16	18.00	18.00	8,657	8,657
	FOREST GREEN	0.01	18.00	18.00	548	548
	WORTON-BUTLERTON	0.06	18.00	18.00	3,098	3,098
	TOLCHESTER	0.07	18.00	18.00	4,039	4,039
						0
UPPER POTOMAC RIVER	BOONSBORO	0.45	18.00	18.00	24,654	24,654
	FUNKSTOWN	0.08	40.53	40.53	9,500	9,500
	MYERSVILLE	0.16	15.25	15.25	7,235	7,235
	NEW MARKET	0.12	23.40	23.40	8,563	8,563
	JEFFERSON	0.15	3.94	3.94	1,765	1,765
	POINT OF ROCKS	0.09	17.63	17.63	4,588	4,588
	UNION BRIDGE	0.12	28.07	28.07	10,235	10,235
	NEW WINDSOR	0.08	15.07	15.07	3,791	3,791
	CRESTVIEW	0.03	13.64	13.64	1,359	1,359
	FOUNTAINDALE	0.26	19.66	19.66	15,279	15,279
	PINTO	0.27	9.94	9.94	8,237	8,237
	SPRINGVIEW ESTATES	0.00	21.13	21.13	289	289
	LEWISTOWN ELEMENTARY	0.00	18.00	18.00	100	100
	HUNTER HILL APARTMENTS	0.01	18.00	18.00	819	819
	CONCORD TRAILER PARK	0.01	12.31	12.31	200	200

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	RAWLINGS HEIGHTS	0.11	14.36	14.36	5,020	5,020
	MT ST MARYS COLLEGE	0.05	25.49	25.49	4,010	4,010
	I-70 REST AREA	0.03	26.77	26.77	2,741	2,741
	DAN-DEE INC.	0.00	18.00	18.00	142	142
	GREENBRIAR STATE PARK	0.02	18.00	18.00	829	829
	VICTOR CULLEN CENTER	0.04	10.69	10.69	1,156	1,156
	NEW GERMANY STATE PARK	0.00	18.00	18.00	187	187
	PETER PAN INN	0.00	4.15	4.15	38	38
	SMITHSBURG	0.24	14.94	14.94	10,939	10,939
	MIDDLETOWN	0.29	26.02	26.02	22,941	22,941
	HANCOCK	0.22	20.70	20.70	14,101	14,101
	HIGHLAND VIEW	0.01	18.00	18.00	817	817
	OLDTOWN	0.02	18.00	18.00	895	895
	TRI-TOWN PLAZA	0.01	18.00	18.00	698	698
	MAPLE RUN	0.00	2.20	2.20	20	20
	GREEN RIDGE FORESTRY CAMP	0.00	18.00	18.00	248	248
	WHITE ROCK	0.02	12.45	12.45	627	627
	FOXVILLE US NAVAL SUPPORT	0.03	18.00	18.00	1,450	1,450
	BROADFORDING	0.00	18.00	18.00	103	103

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	ROCKY GAP STATE PARK	0.03	6.48	6.48	544	544
	CAMP AIRY	0.00	18.00	18.00	175	175
	FAHRNEY-KEEDY MEMORIAL HOME	0.03	18.00	18.00	1,486	1,486
	BROOK LANE	0.01	18.00	18.00	311	311
	CLEARSPRING	0.15	18.00	18.00	8,377	8,377
	OLD SOUTH MOUNTAIN INN	0.00	18.00	18.00	257	257
	FLINTSTONE	0.07	16.59	16.59	3,500	3,500
	FORT DETRICK	1.05	6.40	6.40	20,498	20,498
	KEMPTOWN SCHOOL	0.00	29.00	29.00	88	88
	NEW LIFE FOURSQUARE CHURCH	0.00	18.00	18.00	97	97
	SHAMROCK RESTAURANT	0.00	18.00	18.00	71	71
	WOODSBORO	0.07	18.25	18.25	3,860	3,860
	BUCKINGHAM HILLS	0.01	18.00	18.00	608	608
	LIBERTYTOWN	0.03	21.45	21.45	2,052	2,052
	BLOOMINGTON	0.03	18.00	18.00	1,463	1,463
	KITZMILLER	0.02	18.00	18.00	991	991
	GORMAN	0.00	18.00	18.00	210	210
	ANTIETAM	0.11	18.00	18.00	6,303	6,303
	SIDELING HILL REST AREA	0.01	21.00	21.00	439	439
	SANDY HOOK	0.01	18.00	18.00	458	458

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow Million Gallons per day**	**Goal for Nitrogen Concentrations* (miligrams/liter)**	**Estimated Nitrogen Concentrations (2000) (miligrams/liter)**	**Goal for Nitrogen Loads (pounds/year)**	**Estimated Nitrogen Loads (2000) (pounds/year)**
	PLEASANT BRANCH	0.03	7.94	7.94	687	687
	MILL BOTTOM	0.01	0.33	0.33	14	14
	ST. JAMES SCHOOL	0.01	18.00	18.00	276	276
	BIERS LANE	0.00	18.00	18.00	252	252
	RUNNYMEADE SCHOOL	0.00	18.00	18.00	73	73
	URBANA HIGH SCHOOL	0.00	18.00	18.00	114	114
	SHEPPARD PRATT WESTERN MIDDLE	0.00	18.00	18.00	89	89
						0
UPPER WESTERN SHORE	RISING SUN	0.24	18.00	18.00	13,391	13,391
	PORT DEPOSIT	0.14	18.00	18.00	7,415	7,415
	HAMPSTEAD	0.54	14.23	14.23	23,551	23,551
	MANCHESTER	0.27	18.15	18.15	14,773	14,773
	RICHLYN MANOR	0.06	13.43	13.43	2,392	2,392
	NOTCHCLIFF	0.03	18.00	18.00	1,659	1,659
	SWAN HARBOR PARK	0.02	18.00	18.00	1,303	1,303
	NORTH HARFORD JR&SR HIGH SCHOOL	0.02	18.00	18.00	1,294	1,294
	UNITED CONTAINER	0.01	18.74	18.74	615	615
	SPRING MEADOWS	0.01	18.00	18.00	566	566
	BENJAMINS TRAILER PARK	0.01	18.00	18.00	674	674
	CAMP SHADOWBROOK	0.00	18.00	18.00	15	15

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2000 NITROGEN GOALS & ESTIMATED FLOWS FOR WASTEWATER TREATMENT PLANTS

(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRIBUTARY	**Wastewater Treatment Plant**	**2000 Flow**	**Goal for Nitrogen**	**Estimated Nitrogen**	**Goal for Nitrogen**	**Estimated Nitrogen**
		Million Gallons	**Concentrations***	**Concentrations (2000)**	**Loads**	**Loads (2000)**
		per day	**(miligrams/liter)**	**(miligrams/liter)**	**(pounds/year)**	**(pounds/year)**
	MAPLE HILL PARK	0.01	18.00	18.00	440	440
	BALTIMORE YACHT CLUB	0.00	18.00	18.00	46	46
	MT ARARAT FARMS	0.00	18.00	18.00	118	118
	BOWLEYS QUARTERS	0.00	18.00	18.00	166	166
Minor Total		**12.48**			**547,482**	**547,476**
TOTAL MAJOR		**601.94**			**14,665,887**	**16,731,042**
TOTAL INDUSTRIAL		**30.34**			**911,141**	**911,141**
TOTAL MINOR		**12.48**			**547,482**	**547,476**
TOTAL STATE		**644.76**			**16,124,510**	**18,189,659**

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