REPORT OF THE
JOINT SUBCOMMITTEE STUDYING

The Problems Associated With Nutrient Enrichment and Related Water Quality Standards In The Waters Of The Commonwealth

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

Senate Document No. 24

COMMONWEALTH OF VIRGINIA
RICHMOND
1987

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Report of the
Joint Subcommittee Studying
Nutrient Enrichment in the Waters
of the Commonwealth (SJR 65)
to
The Governor and the General Assembly of Virginia
Richmond, Virginia
November, 1986

To: Honorable Gerald L. Baliles, Governor of Virginia
and
The General Assembly of Virginia

I. INTRODUCTION

Nutrients were identified by the U.S. Environmental Protection Agency in its Chesapeake Bay Program studies as one of the major causes of decline in the resources of the Chesapeake Bay. Starting in 1985 with the passage of Senate Joint Resolution No. 116, which created a joint subcommittee to study nutrient problems, the General Assembly has been examining ways in which the Commonwealth can reduce the load of nutrients entering the Bay and its tributaries. The term "nutrients" refers to the chemicals nitrogen and phosphorus. Excessive amounts of nutrients enhance the growth of nuisance algae in the water, sometimes to the point of causing unsightly and odorous blooms. Even when algae concentrations do not reach this level, they can cause the water to be turbid, inhibiting the growth of submerged grasses such as eelgrass. When the algae die and decay they use up oxygen, causing an "anoxic" or low oxygen condition which is harmful to aquatic life. Nutrients enter the Bay in a variety of forms from a variety of sources. The two primary means of control of the amount of these substances entering the Bay are (1) the implementation of "best management practices" on farmland, and (2) the limitation, in permits issued by the State Water Control Board (SWCB), of the concentration of these substances discharged from sewage treatment plants and industries. The extent of the nutrient problems and the relative importance of various sources are described in detail in Senate Document No. 16, submitted by this subcommittee to the 1986 Session of the General Assembly.

The subcommittee found, in the first year of its study, that the scarcity of funds to control point sources of nutrient discharge was a significant barrier to implementing a comprehensive strategy to deal with nutrients, and it recommended that the 1986 General Assembly create a Revolving Loan Fund. The Fund, which was created by S.B. 232, received an initial appropriation of $20 million for the 1986-88 Biennium. This, together with similar appropriations for the next three biennial budget cycles, and the use of federal funds available under the Clean Water Act, should be sufficient to meet Virginia's sewage treatment needs.

The 1986 Session of the General Assembly passed Senate Joint Resolution No. 65 continuing the study by the joint subcommittee examining the problems associated with nutrient enrichment and related

water quality standards in the waters of the Commonwealth. The joint subcommittee was to examine and make recommendations to the General Assembly concerning the following:

1. The establishment of specific nutrient target loads, in terms of pounds of nitrogen and phosphorus entering the Chesapeake Bay and each of its tributaries;

2. How best to coordinate point and nonpoint source control strategies in order to achieve such target loads and mitigate the effects of nutrient enrichment; and

3. Changes in existing laws, regulations and administrative programs to achieve target nutrient loads.

II. CHESAPEAKE BAY PROGRAM'S NUTRIENT MANAGEMENT INITIATIVE

Controlling nutrients is a baywide effort. Many of Pennsylvania's and Maryland's Chesapeake Bay Initiatives, as well as Virginia's, are aimed at putting point or nonpoint source nutrient controls in place. The Commonwealth's efforts to develop a nutrient standard and establish target loadings for the major tributaries is to be coordinated with the Chesapeake Bay Program's restoration planning effort. Under Phase I of that planning effort, states implemented initiatives that were recognized as being immediately desirable to improve the water quality and living resource habitat of the Bay. Programs such as financing sewage treatment plant construction, and implementing agricultural best management practices are known to be steps in the right direction, even though it was not possible to say in 1984 that they would be sufficient to cure the Bay's ills. Phase II of the planning process is to recommend specific strategies for reducing nutrient and toxic loads and improving living resource habitat - strategies that would be sufficient in magnitude and scope to actually produce the desired restoration results.

One of the problems in devising a nutrient reduction strategy for the Bay is determining how much, Bay-wide, nutrients should be reduced, and where the reductions should take place. Is it more important to reduce nonpoint source loads of nutrients coming down the Susquehanna River from Pennsylvania into the head of the Bay, or is it more important to control point sources on the James River? The effort is further complicated because there is limited understanding of how nutrients move from one area of the Bay to another and how, and to what degree, they move from the water into the sediments on the bottom of the Bay and back into the water column again. Further, we lack a firm estimate of how much of each nutrient, nitrogen and phosphorus, needs to be removed to achieve desired water quality results.

To answer questions such as these, it is necessary to develop and use computerized mathematical water quality models of the Chesapeake Bay. A water quality model is a simulation of what is happening in a particular body of water and serves as a predictive tool which projects the anticipated effects of nutrients loadings from point and nonpoint sources. Reliable estimates of the amount that nutrient loads should be

reduced and what level of control is needed to meet this target reduction depends, in part, on the development of these mathematical water quality models.

Mathematical models of the Chesapeake Bay are being developed by the Chesapeake Bay Program. This interstate effort is producing three models. The first, a watershed model, allows managers to determine the effects of changes in land use, such as a change from regular tillage to low tillage farming practices, in any region of the Bay's drainage basin. Thus, managers can predict the reduction in nutrient load which will result from the implementation of best management practices on a given number of acres in a particular river basin. The watershed model is also useful in determing how much of the pollution from a distant point source (i.e., above the fall line) will actually get to the Bay. This model is currently being used to evaluate nonpoint source and point source strategies.

The watershed model, however, does not evaluate the impact of nutrient loads, once they reach the Bay system. The second model being developed is a two dimensional, steady state, hydrodynamic and water quality model. It is usually referred to simply as the 2-D model. It is useful in determing how nutrients and other pollutants move within the Bay system, and also will provide an assessment on the effect of nutrient loads on the anoxia problem. The development of this model is nearing completion, and analyses based on its use will be available in the spring or summer of 1987. Based on these analyses, the Chesapeake Bay Program will produce an "Interim Report" in the summer of 1987. The Interim Report will discuss both the economic cost and environmental benefits of various control strategies, and make recommendations for nutrient load reductions by the participating jurisdictions.

Because the 2-D model will not provide answers to nutrient questions in as precise a manner as managers would like, a more sophisticated model will eventually be produced. The three dimensional, time variable model, usually referred to as the 3-D model, will take several years and several million dollars to produce. The U.S. Army Corps of Engineers is providing nearly half of the funding for this effort, and the Chesapeake Bay Program will provide the remainder. It will be completed in 1989 or 1990. This model will help managers fine tune their nutrient control strategies. It is hoped that this more sophisticated model will also aid in toxic pollution control strategies.

The purpose and intent of this interstate planning and evaluation process is to develop the information base upon which state managers can agree to implement a baywide nutrient control strategy, with portions of the load reduction allocated to each jurisdiction. The process of obtaining this agreement is likely to be a difficult one, but one that is important if the Bay is to recover.

Water quality models are also used on a smaller scale to determine localized strategies to meet water quality goals. The SWCB has conducted or sponsored various modeling efforts in recent years for the tidal fresh portions of the James and Appomattox Rivers as well as the Potomac Embayments. In the case of the Embayments, the SWCB has recently contracted with the Northern Virginia Planning District Commission

(NVPDC) to conduct waste load allocation modeling. It is anticipated that the model will be developed by March 1989. After reviewing the results of this modeling effort, the SWCB will then begin the process of allocating wasteloads among the various dischargers.

III. CURRENT EFFORTS TO REDUCE NUTRIENT ENRICHMENT

There is currently no agreement as to precisely how much nitrogen and phosphorus must be reduced, Bay-wide, to restore the condition of the Bay to its former productivity. In certain portions of the Bay and its tributaries, however, control strategies have been implemented. These strategies are in place in areas where nutrient enrichment was particularly severe. The strategies include the Upper Chesapeake Bay Phosphorus Policy, which calls for phosphorus limitations at sewage treatment plants in the lower Susquehanna River Basin in Pennsylvania and in the northern Bay in Maryland, the Patuxent River Strategy, which calls for both nitrogen and phosphorus controls at sewage treatment plants and for nonpoint source controls, the Potomac River Strategy, which involves point source phosphorus controls in Virginia, Maryland and the District of Columbia, and the Occoquan and Chickahominy strategies discussed below. In addition to these area specific strategies, however, the Bay jurisdictions realized in 1984 that some additional nutrient control activities would have to be undertaken. An agricultural cost share program was designed to encourage the implementation of best management practices. In addition, a closer look was taken at the need for point source controls.

A. Point Source Programs

Point source nutrient control in the Commonwealth currently consists of two elements: (1) regional standards and limits for the discharge of nutrients from sewage treatment plants, and (2) financial assistance for the demonstration of new removal technologies. The State Water Control Board has developed nutrient control plans in the form of nutrient effluent limits for dischargers in three water bodies in the Bay drainage area: the Potomac Embayments, the Occoquan Reservoir and the Chickahominy River.

The Potomac Embayment standards have undergone modification. When they were originally adopted in 1971, they called for an effluent phosphorus limit of 0.2 mg/l. Now permits are being revised to require a discharge limit for phosphorus at .18 mg/l. This makes Virginia's phosphorus limit in the Potomac consistent with those of Maryland and the District of Columbia. According to officials of the State Water Control Board (SWCB), when technology is available that will reduce total nitrogen to 1.0 mg/l, this effluent value will become part of the standards for the Embayments[1]. The substantial reduction in phosphorus load to the Potomac River that has occurred as a result of the interstate Potomac River Strategy has been responsible for the dramatic water quality improvements seen in the upper tidal portion of the river. Further improvements will require either nonpoint source controls on phosphorus, point source controls on nitrogen, or both.

The Occoquan Reservoir Policy limits phosphorus to 0.1 mg/l and unoxidized nitrogen (ammonia)[2] to 1.0 mg/l. The goal of the Occoquan Reservoir Policy is to protect the Reservoir as a drinking water source. The goal of the nutrient control policy for the Chickahominy is to reduce eutrophication problems in the river. Holly Farms is currently the only point source discharger to the Chickahominy. The company is required to meet an effluent phosphorus limit of 0.3 mg/l and ammonia nitrogen limit of 2.0 mg/l.

A critical review of the effectiveness of existing nutrient control strategies and limitations is provided as Appendix A.

Currently, there are sixteen treatment facilities within the state which are removing nutrients or are designed with such a capability (Appendix B). Three of these facilities are part of the Pilot Nutrient Removal Initiative. These demonstration projects, funded at a total cost of $360,000, will investigate the effectiveness of two removal technologies: simultaneous precipitation and biological treatment. The Fredericksburg project involves the retrofitting of an existing sewage treatment plant for simultaneous precipitation phosphorus removal and the monitoring of its results. The monitoring will take place over a twenty-week period at a cost of $11,850. A second project at Kilmarnock tests the effectiveness of biological phosphorus and nitrogen removal at a minor facility. This project will be evaluated over an eighteen-month period at a cost of $160,189. A similar nutrient removal technology is being tested at the larger Hampton Roads Sanitation District York plant. Preliminary data indicates a signficant decrease in the level of phosphorus effluent from 8.6 mg/l to 2 mg/l as of late September. Nitrogen removal, also possible with this technology, has not yet been tested. The demonstration is scheduled to last for twenty months at a cost of $187,961.

According to Richard Burton, Executive Director of the SWCB, these demonstration projects will allow his agency to:

* evaluate the Commonwealth's ability to achieve various effluent levels of phosphorus and nitrogen;

* analyze the reliability of the treatment process at various effluent levels;

* estimate capital, operation and maintenance costs;

* develop design criteria; and

* examine the feasibility of retrofitting existing sewage treatment plants.

The SWCB has committed EPA construction grant funding to the Virginia Initiative Plant (VIP), which will treat the combined wastewater flows from areas served by existing primary plants at Lamberts Point (in Norfolk) and Portsmouth. In addition to upgrading this plant to secondary treatment, the Hampton Roads Sanitation District (HRSD) proposes to install biological nutrient removal technology for approximately the same capital costs as conventional secondary

treatment. It has been estimated the capital cost should be $84 million with the SWCB pledging $40.9 million in construction grants plus a supplement for the innovative technology. The HRSD operated a pilot plant under various conditions for 15 months in order to develop specific design criteria for the VIP. It removed 65-80% of the phosphorus down to an effluent concentration of 1-2 mg/l. Approximately, 60-75% of the nitrogen was removed resulting in a concentration of 6-8 mg/l.

If biological nutrient removal proves to be feasible and practicable in this geographical area, as it has in other parts of the world, it could result in considerable cost savings over conventional nutrient removal technologies, and make point source nutrient controls less of a financial burden. While it appears that biological nutrient removal will be useful in many areas, it is not currently capable of meeting the very strict nutrient standards which have been required in the Potomac River, the Occoquan, or the Chickahominy. More traditional means of removing both phosphorus and nitrogen to much lower levels have been extensively demonstrated, and are currently available, although at much higher cost.

B. Nonpoint Source Programs

Prior to 1984, the Commonwealth did not have a nonpoint source nutrient control strategy. Although the Erosion and Sediment Control Law and the Soil and Water Conservation Division's efforts to encourage agricultural best management practices predate the Chesapeake Bay Initiatives, their primary emphasis, until 1984, was on reducing the load of sediment into the waters of the Commonwealth. While there is a good deal of overlap between nonpoint source sediment control programs and nonpoint source nutrient control programs, they are not identical.

The Division's total funding for the nonpoint program from both federal and state sources is $3.5 million for the 1986-87 Fiscal Year. Of this figure, $1,260,000 has been allocated specifically for the agricultural cost sharing program. Because there are not enough funds to deal with soil erosion in all river basins equally, the Division has targeted those basins dominated by nonpoint sources such as the York, the Rappahannock and the Eastern Shore. The remainder of the funding is being used for demonstrations of best management practices, technical assistance and education, and for urban best management practice pilot projects.

1. Agriculture

While the reduction of loadings from point sources can be achieved by settling limits on the concentration of nutrients present in the effluence of municipal and industrial discharges, the problems associated with documenting nonpoint loading and designing a control strategy are more complex. The subcommittee was cautioned by officials of the Division of Soil and Water Conservation that the calculation of "gross erosion is based on long-term annual averages and does not reflect a range of estimates for wet and average years" or the amount of phosphorus currently on the land. Division Director Roland Geddes noted in his letter to Senator Gartlan "simply put, reductions of phosphorus and nitrogen pounds are not directly convertible to water quality protection to a given threshold limit" (Appendix C). Models, such as the watershed

model discussed in Section II, and the monitoring of small, intensively managed agricultural watersheds, are designed to provide this predictive capability and allow development of comprehensive strategy.

An essential element of a nonpoint control strategy is the identification of highly erodible land. The Virginia Geographic Information System (VirGIS) developed by the Division of Soil and Water Conservation allows the state to target those farms where the greatest potential for erosion exists. Cost sharing funds are offered as an incentive for the adoption of various soil conservation practices (BMPs). The goal of such an effort is to have Virginia's agricultural land reach "T" or the tolerable soil loss limit. The "T" is the point at which soil erodes at the same rate it is being regenerated. The subcommittee was informed that approximately one half of the cropland in the Chesapeake Bay drainage basin is highly erodible with a "T" level in some areas as high as 4-8 "T," which means the soil is eroding at a rate four to eight times faster than it is being regenerated. Thus, having such a system in place will enable the Division to target its conservation practices to specific farmland in those watershed areas which the SWCB has identified as exceeding desired nutrient levels.

In Virginia, ninety-seven conservation practices have been identified as being applicable to the state's soil, topography, climate and resource problems. Of these, fourteen practices have the highest potential for significantly improving water quality. While these conservation techniques or best management practices (BMPs) are voluntary, an incentive in the form of state cost sharing is provided if a farmer adopts a recommended practice.[3] (For a description of BMPs, see Appendix C.)

It is estimated by the Division of Soil and Water Conservation that cropland erosion accounts for 27% of the phosphorus which reaches the streams in a "dry year" and over 50% in a "wet year." Control of nonpoint source phosphorus from agricultural land has been traditionally tied to erosion control practices. Most phosphorus binds to the soil particles, and, thus, if soil is held in place, little phosphorus gets to the river or stream. The Division of Soil and Water Conservation has developed a methodology which allows personnel to estimate how much phosphorus will be prevented from entering the river if a specific BMP is adopted. Using this methodology, the Division estimates that 1.2% of the total phosphorus load will be prevented from entering the waters of the Bay in the Commonwealth by 1990. The proportion of the load reduced by nonpoint source strategies is higher, however, in particular targeted river basins. In the Rappahannock River, for example, 5% of the load will be eliminated, while in the coastal basins, the figure is close to 10%.

Nitrogen is a more intractable problem. Approximately 14% of the nitrogen load in Virginia's portion of the Bay comes from agricultural sources. Since nitrogen is soluble, traditional soil conservation practices will not reduce nitrogen loads. The only proven way to limit the amount of nitrogen getting into the water is to limit the amount applied to the land to no more than the desired crop needs. Wide (100 feet or more) forested buffer strips have also been shown to be useful in reducing nitrogen flows. There are currently no means of estimating the

reduction in nitrogen load that will result from best management practices.

A new nutrient management initiative has been undertaken by the Division in response to the concerns of state officials that farmers are applying more fertilizer than can be justified to satisfy crop needs. Application of animal waste and practices such as planting of nitrogen fixing legumes, in addition to commercial fertilizer, can satisfy crop needs. Often, however, farmers do not "count" the fertilizer value of these practices when determining the amount of commercial fertilizer to apply. Excessive application of animal waste can be a particularly severe problem. This pilot program will focus on those operators who apply the greatest amount of fertilizer and animal waste. Detailed management plans for the storage, handling and proper land application will be prepared for participating farms. The plans will emphasize timely and appropriate fertilizer applications which best utilize the nutrient value of the waste, thereby reducing the use of more expensive commercial fertilizer.

2. Urban

The EPA's National Urban Runoff Program study states that on an annual basis, nutrient loadings resulting from urban runoff are significantly less than contributions from public owned treatment works; however, "total suspended solids concentrations in urban runoff are fairly high in comparison with treatment plan discharge." While this study calls attention to the fact that "these solids are more likely to have other contaminants, such as phosphorus, absorbed onto them," recent studies of the Bay have indicated that non-cropland nonpoint sources contribute only approximately 12% of phosphorus loading and 7% of the nitrogen loading. Because of the relatively small contributions from these sources, the Division has concentrated the majority of its limited resources on the agricultural conservation programs, although several urban best management practices, such as porous pavement, have been demonstrated in demonstration projects funded by the Chesapeake Bay Initiative. The control of urban runoff usually involves erosion and sediment control and stormwater management controls.

IV. ESTABLISHING A NUTRIENT STANDARD

One step vital to the Commonwealth's establishment of nutrient reduction goals is the establishment of a nutrient standard. The SWCB is currently analyzing the relative merits of each of the following types of nutrient standards:

* Effluent nutrient standard. - Using this approach, a specific limit would be set on the concentration of nutrients (i.e., phosphorus, nitrogen) which could be discharged by a municipal or industrial facility at a given time of the year. The drawback of an effluent based standard is that it does not take into account nonpoint sources of nutrient runoff, which may be the source of a significant portion of the loadings entering the particular body of water.

* In-stream nutrient standard. - This approach establishes a level for specific concentrations of selected nutrients in specific waters. The standard would be designed to prevent excessive algae growth. According to the SWCB, when water quality monitoring indicates violations of the upper limit of the standard, a range of reduction strategies would be implemented to bring in-stream concentrations under control. A possible shortcoming is that this type of standard does not reflect those nutrients which may be temporarily tied up in sediments or algae biomass. Thus, even during an algae bloom, the waters may be in compliance with the standard.

* In-stream chlorophyll standard. - Such a standard depends on measurement of the level of chlorophyll as indicator of the presence of algae. This would provide a more direct measurement of the impact of nutrient enrichment on water quality. Such a standard is favored by VIMS "because the base of the food web is formed by the primary producers (the carbon-fixing, photosynthetic micro-organisms), an in-stream chlorophyll standard relates directly to the fisheries via the food web." The standard could also be used to trigger appropriate nutrient management programs.

It should be noted that the establishment of an instream standard, the setting of an effluent standard, and the establishment of a nutrient load reduction goal are not mutually exclusive activities. Rather, all should be viewed as part of a process designed to achieve desirable water quality. Defining desired water quality parameters (in-stream standard) is the first step. Determining load reductions needed to achieve this water quality through modeling techniques is the second step. Developing a strategy which allocates the needed load reductions to various users through effluent limitations and/or nonpoint source controls, is the third step. Water quality monitoring should then be performed to determine whether the strategy is having the desired results.

In June 1986, the SWCB authorized its staff to begin the process of developing a standard to control the effects of nutrients. As part of this process, two public hearings have been held. The SWCB is currently analyzing existing nutrient standards enacted by various states. In addition, data generated from the comprehensive Bay-wide water quality and habitat monitoring program will also provide the basis for the final recommendation of a nutrient standard by the SWCB's Office of Environmental Research and Standards. The schedule for standard development calls for a draft standard to be presented to the SWCB by September 1987 and in place by July 1988. (See Appendix A, Attachment 4).

V. RECOMMENDATION

The subcommittee received testimony that if Virginia is to have an effective program for controlling nutrient enrichment, it is essential to reduce loadings from both point and nonpoint sources. The subcommittee endorses the establishment of target nutrient loadings in the Chesapeake Bay system. It agrees that efforts underway by the Soil and Water Conservation Division and the State Water Control Board, in conjunction

with the planning process of the Chesapeake Bay Program, will lead to the establishment and implementation of such goals.

Establishing a nutrient water quality standard is a necessary step in the process of controlling nutrient loads, but it is only one step. Just as important will be the setting of goals and timetables to meet the standard, the appropriation of funding, and the coordination of Virginia's efforts with the other Bay jurisdictions. Therefore, the subcommittee recommends that the General Assembly pass a resolution requesting the State Water Control Board and the Division of Soil and Water Conservation to develop a coordinated point and nonpoint source nutrient control strategy for the Chesapeake Bay and its tributaries, and to report regularly to the General Assembly concerning its progress in developing and implementing this strategy. (Appendix F)

Respectfully submitted,

Joseph V. Gartlan, Chairman
J. Paul Councill, Jr., Vice-Chairman
Charles J. Colgan
Elmo G. Cross, Jr.
V. Thomas Forehand, Jr.
Raymond R. Guest, Jr.
Richard J. Holland
J. W. O'Brien
S. Wallace Stieffen
A. Victor Thomas

FOOTNOTES

[1]Technology is currently available to meet an effluent nitrogen standard of 3 mg/l. Without nitrogen removal, sewage effluent has a nitrogen concentration of approximately 18 mg/l.

[2]Many sewage treatment plants are required to limit the discharge of unoxidized nitrogen, or ammonia. The oxidation of ammonia (NH_3) to nitrite (NO_2 or NO_3), is the first step in nitrogen removal, and is called "nitrification." While it does not actually reduce the nitrogen load, it does reduce the adverse impacts of discharge of sewage effluent. The ammonia exerts an oxygen demand, which contributes directly to anoxic conditions. Ammonia is also toxic to aquatic life in high concentrations. The second step in nitrogen removal, called "denitrification," is accomplished when nitrate is converted to nitrogen gas (N_2), thus removing it altogether from the wastewater.

[3]Virginia's agricultural best management practices cost share program is very similar to programs put in place in Pennsylvania and Maryland. In those states, however, in order to receive cost share funds, a farmer must have a Soil and Water Conservation plan for his entire farm, and must implement the entire plan (over a course of several years) as part of the cost share agreement. In addition, in both Pennsylvania and Maryland, enforcement action is taken against farmers who refuse to remedy agricultural pollution problems, even after being offered technical and financial assistance. Most farmers who are cited with pollution problems eventually comply without the need for court action; however, the programs are not strictly voluntary.

APPENDIX A

COMMONWEALTH OF VIRGINIA

JOSEPH V. GARTLAN, JR.
36TH SENATORIAL DISTRICT
SOUTHERN PART OF
FAIRFAX COUNTY
1801 K STREET, N.W.
WASHINGTON, D.C. 20006

COMMITTEE ASSIGNMENTS
PRIVILEGES AND ELECTIONS, CHAIRMAN
COURTS OF JUSTICE
FINANCE
REHABILITATION AND SOCIAL SERVICES
RULES

SENATE

August 1, 1986

Mr. Richard N. Burton
Executive Director
State Water Control Board
2107 - 2111 N. Hamilton Street
Richmond, VA 23230

Dear Richard:

Following up on our conversation in my office on July 28, I am setting out below a list of the information we discussed for review by the Nutrient Study Committee pursuant to SJR 65 of the 1986 session.

1. An inventory of all existing and planned municipal and industrial sewage treatment plants discharging into the Bay or its tributaries, indicating which plants have nutrient removal capabilities. This may be limited to those plants which are major dischargers. I understand that you may not be aware of all of the plans of these dischargers and this request is of course limited to those as to which the Board has any knowledge.

2. Describe the plans and priorities for requiring nutrient removal at any such plants or the allocation of funds towards nutrient removal at these plants or both. Please advise what level of nutrient load reduction is anticipated in each tributary through these regulatory or funding decisions.

3. Provide a critical review of the effectiveness of nutrient control strategies and limitations where they exist; e.g., the Occoquan, the Potomac.

4. Update the committee on the financial outlook for meeting the national municipal policy and for implementing nutrient reduction strategies given recent action (or inaction) by the federal government.

5. Progress made toward developing a chlorophyll or other nutrient standard, including:

(a) what actual standards as criteria would be eligible for consideration for the various areas of the Bay and its tributaries, and

(b) what research, monitoring and/or modeling will be required to develop, adopt and implement a chlorophyll standard, including a timetable for accomplishing it.

With regard to the immediately foregoing item, we recognize that legal constraints prohibit consideration of alternatives until a public hearing process is completed.

I am anxious that the study committee complete its 1986 work as soon as possible and will appreciate your furnishing this information at your earliest convenience.

With kind personal regards and best wishes,
I am,

Very truly yours,

Joseph V. Gartlan, Jr.

JVG:nmn

COMMONWEALTH of VIRGINIA

STATE WATER CONTROL BOARD
2111 Hamilton Street

Richard N. Burton
Executive Director

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SEP 19 1986

Senator Joseph V. Gartlan, Jr.
36th Senatorial District
Southern Part of Fairfax County
1801 K Street, N.W.
Washington, D.C. 20006

Dear Senator Gartlan:

We have prepared the attached response to the questions contained in your letter of August 1, 1986. I hope this information will be useful to the Nutrient Study Committee established by Senate Joint Resolution 65.

If you have any questions about the enclosed information or are in need of any additional information, do not hesitate to contact me.

Sincerely,

Richard N. Burton
Executive Director

RNB:GARTLAN1:jmv

Attachment

1. Inventory all existing and planned municipal and industrial sewage treatment plants (limited to majors) discharging into the Bay or its tributaries, indicating which plants have nutrient removal capabilities.

CHESAPEAKE BAY DRAINAGE AREA
MAJOR MUNICIPAL DISCHARGERS

FACILITY	DESIGN FLOW (MGD)	NUTRIENT REMOVAL CAPABILITY/COMMENTS
POTOMAC BASIN		
Waynesboro STP	4.0	None
Fisherville STP	2.0	None
Staunton STP	4.5	None
H'burg/Rockingham STP	8.0	None
Frederick/Winchester Service Auth. STP	5.0	None (new facility under construction)
Front Royal STP	2.0	None
Leesburg STP	2.5	None
Arlington STP	30.0	P-removal in use; N-removal capability, but not in use
Alexandria STP	54.0	P-removal in use; N-removal designed
L. Hunting Creek STP	6.6	P-removal in use
Lower Potomac STP	36.0	P-removal in use; N-removal capability, but not in use; (Expanding to 54 MGD)
Upper Occoquon STP	15.0	P-removal in use; N-removal capability, but not in use; (Expanding to 22.5 MGD)
Mooney STP	12.0	P-removal in use; N-conversion available (nitrification basin)
Dale City #1 STP	4.0	P-removal in use
Dale City #8 STP	2.0	P-removal in use
Quantico Mainside STP	2.0	P-removal in use; N-conversion available (nitrification)
Aquia STP	3.0	P-removal in use
RAPPAHANNOCK BASIN		
Warrenton STP	1.0	None
Culpeper STP	3.0	None
Claiborne Run STP	1.5	None
Fredericksburg STP	3.5	P-removal incidental to chemical addition for BOD removal (reducing to 1.49 MGD)
FMC STP	2.6	None
Massaponax STP	3.0	None (reducing to 1.47 MGD)

CHESAPEAKE BAY DRAINAGE AREA
MAJOR MUNICIPAL DISCHARGERS
(cont.)

FACILITY	DESIGN FLOW (MGD)	NUTRIENT REMOVAL CAPABILITY/COMMENTS
YORK BASIN		
Ashland STP	1.2	None
Doswell STP	2.5	None
HRSD-York STP	15.0	None; site of 20-month biological nutrient removal demonstration project
JAMES BASIN		
Covington STP	3.0	None (Upgrading to Secondary)
Clifton Forge STP	2.0	None
Lexington STP	2.0	None
Buena Vista STP	2.25	None
Lynchburg STP	22.0	None
Moores Creek STP	15.0	None
Farmville STP	1.05	None
Richmond STP	70.0	None
Falling Creek STP	9.0	None
Proctors Creek STP	4.0	None (Expanding to 12 MGD)
Henrico STP (planned)	30.0	None
Petersburg STP	15.0	None
Hopewell STP	50.0	None
HRSD-W'msburg STP	9.6	None
Ft. Eustis/N. News STP	3.0	None
HRSD-James River STP	20.0	None
HRSD-Nansemond STP	10.0	None
Portsmouth STP	15.0	None (Going off line upon completion of Virginia Initiative Plant (V.I.P.))
HRSD-Lamberts Pt. STP	33.0	None (Upgrading and expanding to V.I.P.; 40 MGD-Phase I)
HRSD-Army Base STP	14.0	None
CHES. BAY/E. SHORE BASIN		
HRSD-Ches/Eliz STP	30.0	None

CHESAPEAKE BAY DRAINAGE AREA
MAJOR INDUSTRIAL DISCHARGERS

FACILITY	NUTRIENT REMOVAL CAPABILITY/COMMENTS
POTOMAC BASIN	
O'Sullivan Corp.	None
Reynolds Metals (Grottoes)	None
Waynetex	Has monitoring (not control) requirement for NH3 and TKN
Aileen Inc.	None
E. I. DuPont (Waynesboro)	Has monitoring (not control) requirement for NH3 and TKN

CHESAPEAKE BAY DRAINAGE AREA
MAJOR INDUSTRIAL DISCHARGERS
(cont.)

FACILITY	NUTRIENT REMOVAL CAPABILITY/COMMENTS
POTOMAC BASIN (cont.)	
Merck, Inc.	Has monitoring (not control) requirement for NH3 and TKN
Coors (planned)	Will have effluent limits established
Avtex Fibers (Front Royal)	None
Genicom Corp.	None
VEPCO-Possum Point	Has Embayment Standards for P (0.2 mg/l) and N (1.0 mg/l) on non-discharging outfall
USMC-Quantico	None
RAPPAHANNOCK BASIN	
None	
YORK BASIN	
Emerson Electric Co.	None
VEPCO-North Anna	None
Chesapeake Corp.	None
Amoco (Yorktown)	NPDES limits: NH3 = 106 kg/day (avg) 234 kg/day (max)
VEPCO-Yorktown	None
JAMES BASIN	
Modine Co. (Buena Vista)	None
VEPCO-Bremo Station	None
Burlington (Glasgow)	Has monitoring (not control) requirement for NH3 and TKN
Crouse-Hinds Co.	None
General Electric (C'ville)	None
Owens-Illinois, Inc.	None
Babcock and Wilcox	None
Virginia Fibre (Riverville)	None
Westvaco (Covington)	None
Hercules (Covington)	None
American Tobacco	None
ICI Americas	Has monitoring (not control) requirement for NH3 and TKN
Firestone Fibers	None
VEPCO-Surry	None
VEPCO-Chesterfield	None
E. I. DuPont (Spruance)	Has monitoring (not control) requirement for NH3 and TKN
Allied Chemical (Hopewell)	Has monitoring (not control) requirement for NH3 and TKN
Allied Chemical (Ch'field)	Has monitoring (not control) requirement for NH3 and TKN
Phillip Morris	Has monitoring (not control) requirement for NH3 and TKN

CHESAPEAKE BAY DRAINAGE AREA
MAJOR INDUSTRIAL DISCHARGERS
(cont.)

FACILITY	NUTRIENT REMOVAL CAPABILITY/COMMENTS
JAMES BASIN (cont.)	
Reynolds Metals (Richmond)	None
Hercules (Hopewell)	None
Holly Farms (Glen Allen)	Minor Industrial - included because it is the only industrial discharger in the State with P-removal system - P-limit = 0.3 mg/l; also has NH3-removal - NH3-limit = 2.0 mg/l
Gwaltney of Smithfield	Has monitoring (not control) requirement for NH3; TKN limit = 152 lb/day (avg) 304 lb/day (max)
Smithfield Packing	Has monitoring (not control) requirement for NH3; TKN limit = 152 lb/day (avg) 304 lb/day (max)
Virginia Chemicals	NH3 limit = 122 lb/day (avg) 244 lb/day (max)
Badische Corp.	None
VEPCO-Portsmouth	None
Atlantic Wood Industries	None
Naval Air Rework Station	None
U.S. Navy - Sewells Pt.	None
N. News Shipbuilding	None
U.S. Navy - Norfolk	None
Navy Fuel Depot (Craney)	None
Holly Farms (Kempsville)	Has monitoring (not control) requirement for NH3 and TKN
CHES. BAY/E. SHORE BASIN	
Standard Products	None
Zapata Haynie	None

2.a. Describe the plans and priorities for requiring nutrient removal at any such plants, or

b. The allocation of funds towards nutrient removal at these plants, or both.

c. What level of nutrient load reduction is anticipated in each tributary through these regulatory or funding decisions?

a. Generally, the plans and priorities for nutrient reduction in the Chesapeake Bay Drainage area (as well as other areas of the State) will be driven off the nutrient standard currently under development. It is difficult to project the effect that this standard will have on dischargers until the following is known: (1) the form of standard (in-stream standard or technology based effluent limit); (2) the type of standard (nitrogen, phosphorus, chlorophyll or other); (3) the amount of nutrient(s) that must be controlled in a particular basin. We are in agreement with Dr. Perkins' letter to you, dated August 13, 1986, which stated, "until that standard has been adopted it would be unwise to try and achieve specific nutrient reductions unless the costs to achieve those reductions are small."

Presently, the only areas of the State that have nutrient control plans that translate into effluent nutrient controls for the dischargers are the Potomac Embayments, Occoquan Reservoir, Smith Mountain Lake (Roanoke River), and the Chickahominy River. The Chowan Basin is another area identified as having nutrient enrichment problems, but effluent nutrient controls for the dischargers in this basin are not yet required.

2. (cont.)

Depending on the final form that the statewide nutrient standard takes, the plants in the Chowan Basin may have their permits revised to include nutrient control.

The following is a brief status report of the three areas which are tributary to the Chesapeake Bay - the Potomac Embayments, the Occoquan Reservoir and the Chickahominy River.

The Potomac Embayment Standards (PES) are currently under revision. An interim modification of the phosphorus limit (0.18 mg/l instead of 0.2 mg/l) has been agreed to by the dischargers so that Virginia's dischargers are consistent with those in Maryland and DC. This slightly more stringent standard will not cause the plants to provide treatment that is not already in progress - only increase the level of phosphorus removal with increased costs for operation (more chemicals, more sludge disposal). To date, all of the major municipal dischargers situated on the Potomac Embayments have had the interim modification added to their permit in the form of a consent order, with a schedule for compliance.

The VWCB has contracted with the Northern Virginia Planning District Commission to conduct waste load allocation modeling for the Potomac Embayments. The NVPDC will use models developed by the Virginia Institute of Marine Science specifically for these embayments. The modeling effort should be completed by March, 1987 at which time the VWCB will review the results and begin th process of allocating wasteloads to the affected dischargers.

2. (cont.)

The Occoquan Reservoir Policy remains in effect as written in 1971 and revised in 1981. The phosphorus limit in the Policy is 0.1 mg/l, and the unoxidized nitrogen limit is 1.0 mg/l. The only item of note in this area is the planned expansion of the UOSA sewage treatment plant. This advanced waste treatment facility is increasing its design flow from 15 MGD to 22.5 MGD (monthly average), with effluent concentrations for phosphorus and nitrogen remaining the same.

There is a nutrient control policy for the Chickahominy River that is intended to reduce eutrophication problems in the river. At present, Holly Farms (a minor industrial discharger) is the only point source discharger to the Chickahominy River. The owner operates a phosphorus removal system (chemical addition and tertiary filtration) to meet an effluent P-limit of 0.3 mg/l, and a nitrogen conversion system (nitrification) to meet the effluent NH3-limit of 2.0 mg/l.

b. Regarding funding for nutrient removal, it is almost certain that any industrial dischargers which might have to install nutrient removal will receive no financial assistance directly from the State or EPA. The municipal dischargers may have several funding alternatives if money is needed to meet a nutrient standard. These include the EPA Construction Grants Program, the Virginia Resources Authority, and the Virginia Water Facilities Revolving Fund (these programs detailed on page 17).

2. (cont.)

The VWCB recently committed EPA construction grant funding to a project that includes nutrient control - HRSD's Virginia Initiative Plant (VIP) at Lamberts Point. In addition to upgrading this plant to secondary treatment, HRSD proposes to include biological nutrient removal at the VIP for about the same capital cost as a conventional secondary treatment plant. The VWCB has pledged $40.9 million to this project and designated part of the plan as "innovative technology". When the cost associated with the innovative technology is determined, a supplemental grant will be added for that portion.

The VWCB has also obligated $360,000 in State funds to three plants under the Pilot Nutrient Removal Initiative. These demonstrations will investigate the effectiveness of two control technologies - Simultaneous Precipitation and Biological Nutrient Removal. The plants involved are Fredericksburg STP, Kilmarnock STP and HRSD-York STP. These projects have just gotten underway and should be generating data for analysis beginning this Fall.

The Upper Occoquan Sewage Authority received $28 million in the VRA's 1985 bond issue to increase the design flow of their AWT plant. The project includes expansion of the UOSA plant's nutrient removal system to treat the increased flows.

The Virginia Water Facilities Revolving Fund is a new program, established by the 1986 General Assembly. Because the program is just starting, no loans have been made from the fund yet, but the VWCB plans to receive applications this October wit loans being made in December.

2. (cont.)

c. The level of nutrient load reduction anticipated in each Bay tributary can't be stated directly until the nutrient standard has been developed. For comparative purposes only, we have developed several tables and illustrative graphs (Attachment 1) which present the changes in total river basin loadings which would be expected under several point source control alternatives. The total nutrient loadings in the tables are a sum of the following:

1. Municipal Point Sources(Majors plus significant minors below the fall line)

   Loads are calculated for 1985 flows, for the NPDES permit flow, and for the indicated treatment level using the NPDES permit flow.

2. Major Industrial Point Sources

   Loads are taken from the EPA Chesapeake Bay reports; therefore, are 1980 loadings.

3. Non-Point Sources

   Loads are taken from the EPA Chesapeake Bay reports; therefore, are 1980 loadings.

The industrial and non-point source loads are dated, but they are the most recent information we have. Nevertheless, we believe this analysis illustrates the range of basin load reductions we would expect from the hypothetical reductions in municipal point source phosphorus and nitrogen effluent concentrations (P Values = 2 and 1 MG/L; N Value = 6 MG/L) at total permitted flow. These effluent values were selected because they represent levels that are achievable using low cost technology (biological phosphorus removal, for P = 2 mg/l; combined biological/chemical treatment for P = 1 mg/l and biological nitrogen removal for N = 6 mg/l).

3. Provide critical review of the effectiveness of nutrient control strategies and limitations where they exist (e.g., the Occoquan, Potomac Embayments).

OCCOQUAN WATERSHED POLICY

This Policy (adopted July, 1971 and last revised March, 1981) limits the number of high-performance regional treatment plants in the watershed to a maximum of three, with a preference for no more than two. Discharges must be located a minimum of 15 miles upstream of the Fairfax County Water Authority raw water intake. The Policy set a 10 MGD initial discharge allotment for the UOSA facility, provided that other specified treatment plants were removed from service. Incremental increases may be allowed if monitoring shows that no damage to the public water supply reservoirs will occur. Design and plant performance requirements are also specified. The UOSA plant is currently at 15 MGD with plans to expand capacity to 22.5 MGD (monthly average). The degree of treatment will remain the same, and the effluent concentrations for all reported parameters will be unchanged.

To date, eleven low-performance STP's have been removed from service in favor of the UOSA facility. Some smaller point sources still discharge into the drainage basin due to their distance from the UOSA facility and the resultant difficulty in making the required connections. The Policy states that upgrades and plant expansions in these remaining facilities may be permitted only if the treatment level proposed will result in no loading increases to the basin.

3. (cont.)

Chlorophyll levels in the reservoir, since the UOSA facility began operation in 1979, have dropped from summer highs of greater than 150 ug/l in 1975-78 to less than 60 ug/l in the summers of 1979-82 (the most recent year that monitoring data has been analyzed for is 1982). This reduction in chlorophyll levels reflects a substantial improvement in the reservoir's water quality, but this improvement can't be solely attributed to the point source upgrade. One factor to be considered is the addition of copper sulfate to the reservoir for algae control in the vicinity of the raw water intake. Restricting algae growth in this way is not a desirable long-term solution to the problem. This practice only addresses the symptoms and not the problem itself, which is nutrient enrichment.

Data collected by VPI's Occoquan Watershed Monitoring Lab over nearly a decade shows the duality of external factors affecting water quality in the reservoir. During dry periods the water quality is controlled by point source nutrient inputs, whereas non-point sources are the dominant influence during wet periods. Analyses from 1975-80 revealed that stormwater runoff contributed nearly 90% of the phosphorus and 80% of the nitrogen entering the reservoir. The highest average chlorophyll concentration observed (175 ug/l in Bull Run arm of the reservoir) was during the extremely wet year of 1975. The next highest measurement (160 ug/l at same location) was seen during an extreme drought period in 1977, prior to start-up of the UOSA plant. Lack of nutrient removal at the existing eleven point sources on-line at the time contributed to this condition.

3. (cont.)

The impact of UOSA's advanced treatment is reflected in 1980 average chlorophyll levels (June-October = 10 ug/l), which was a dry year. This is about half of the average concentration for the same period in 1977. The effectiveness of the UOSA facility in preserving water quality under dry conditions has been demonstrated, but reducing non-point source nutrient inputs appears essential in order to preserve long term water quality.

POTOMAC EMBAYMENT STANDARDS

The VWCB adopted the Potomac Embayment Standards (PES) in June, 1971. They originally applied from Jones Point to Marlboro Point (Aquia Creek). In June, 1974 the VWCB extended the standards to the Route 301 Bridge. The PES require that dischargers into the Virginia embayments must adhere to ultimate BOD and total suspended solids limits of 10 mg/l. The PES also require that total-P discharges be not greater than 0.2 mg/l (now modified to 0.18 mg/l). When technology is available that can reduce total-N to 1.0 mg/l, this effluent value will be applied as part of the PES in the future.

Waste loadings to the Potomac have greatly decreased since adoption of the PES, along with the upgrades at the Maryland and D.C. facilities. Point source loadings of total-P and suspended solids are estimated to have decreased by 96% and 90% respectively. BOD and Total Kjeldahl Nitrogen (TKN = organic-nitrogen + ammonia) have decreased by 88% and 64% respectively. These reductions have occurred in spite of increased flows since 1970.

3. (cont.)

Corresponding reductions in both chlorophyll concentrations and the severity of nuisance algal blooms have also been observed. In the upper 30 miles, the average concentration of algae in the Potomac was reduced about 30% from 1969-79. Further south, the maximum chlorophyll concentration at mile 40 near Quantico was reduced from 333 ug/l in 1977 to 136 ug/l in 1978, and further to 59 ug/l in 1979. The latter two years were high flow years; therefore actual reductions may have been somewhat less than the data indicate, but appear higher due to dilution.

In the summer of 1982, average chlorophyll concentrations recorded in the Potomac were below 20 ug/l. During the period August-October, 1983 a severe algal bloom occurred in the lower Potomac. Chlorophyll levels in excess of 200 ug/l were observed, which indicated a severe eutrophication problem. Comparison of data from 1977-81 showed a significantly higher level of phosphorus and total nitrogen in the Potomac beginning in 1982. The 1983 bloom also occurred under unusual conditions of pH and alkalinity. However, this bloom was much less severe than the foot-thick algal mats observed near the Wilson Bridge in the late 1960's and early 1970's.

A major concern in the 1983 bloom was the reappearance of blue-green algae. These algae float in dense mats on the surface rather than dispersing in the water column. This detracts from the aesthetic appeal of the water for recreational use, and eventually they decompose on shore or in the bottom waters causing severe oxygen depletion.

3. (cont.)

Some species of blue-greens have toxic strains, and have caused mortality in mammals, birds and fish. In the early 1970's about 66% of bloom algae in the Potomac were blue-greens. In the late 1970's a shift to green algae occurred, with blue-green forms reduced to 14%. In 1983 blue-green algae represented 70 to 92% of the bloom. An expert panel concluded that this bloom resulted from a combination of factors contributing to produce ideal growth conditions. These conditions were lower than normal flows, high levels of available solar energy, low wind speeds and a net flux of phosphorus from the sediments.

The panel also concluded that the existing discharges from the basin's treatment plants had not contributed directly to the bloom. They felt that a normally expected bloom in the Potomac, under its present conditions and in the absence of the phosphorus released by the sediments, would not exceed 100 ug/l.

Caution should be taken when attempting to link point source nutrient controls to reductions in ambient chlorophyll levels. Other factors such as non-point source input of nutrients, the ratio of nitrogen to phosphorus in the water column, the concentration of nutrients other than N and P, light penetration and salinity are also important determinants of excessive algae growth. Because rivers and estuaries are extremely complex ecosystems, unusual conditions that prompted the unexpected 1983 bloom may possibly reoccur, regardless of the control programs. Long-term monitoring will help our understanding of the linkage between trends in nutrient reduction and water quality.

4. Update the financial outlook for meeting the NMP and for implementing nutrient reduction strategies, given recent action (or inaction) by the federal government.

As of July 31, 1986, there were 108 municipal dischargers statewide affected by the provisions of the National Municipal Policy. Basically, this policy states that all municipal dischargers must meet final effluent limits by July 1, 1988, even if grant funds are unavailable. Of these 108, 49 are located in the Chesapeake Bay drainage area and 11 of these 49 are major dischargers. The status of these 108 dischargers is as follows:

a. 78 have entered into voluntary agreements with the VWCB to meet federal requirements by July 1, 1988.

b. 6 have entered into voluntary agreements with the VWCB to meet requirements after July 1, 1988.

c. 4 have been ordered to comply without their voluntary consent.

d. 20 have not yet had their plans finalized.

All will have their discharge permits amended to include the requirements of the NMP in the form of an enforceable document (Consent Order, Special Order or Consent Decree). The VWCB staff may recommend that a discharger receive an extension, but only an appropriate court can actually grant an extension to the deadline.

4. (cont.)

We estimate that the cost of compliance with the NMP in Virginia will be about $248 million. Of this figure, $94 million is associated with discharges directly into the Bay and tributaries below the fall line; $69 million is associated with discharges to the Bay tributaries above the fall line; and $85 million is associated with other discharges statewide. The federal share of the $248 million should be approximately $25 million, based on the assumption that the grants program will continue in its present form until at least 1988.

Although some of the affected facilities may receive a grant between now and July, 1988, recent action/inaction on the part of the federal government should have no affect on meeting the provisions of the NMP. The NMP states that compliance will be achieved regardless of the availability of grant funds, and plans for compliance must not be based on receipt of a construction grant. Action or inaction by Congress which changes the grants program will have an impact on the local share to be paid for compliance with the NMP, but the deadline should still be met unless an extension is granted.

The 1985 General Assembly provided $3.3 million for a State Grant Program to help localities in meeting needs under the NMP, plant design and infiltration/inflow correction. Five facilities received funds for NMP projects out of this appropriation, and three of these are in the Chesapeake Bay drainage area (Shenandoah, Iron Gate and Edinburg).

4. (cont.)

In addition to supplying information on the NMP, we thought it would be useful to summarize the present financing outlook faced by Virginia's localities for funding wastewater treatment works. Although the traditional method for financing these projects (EPA's Construction Grant Program) is being scaled down, there are now two State programs that may assist the localities. These programs could be used for any wastewater project in general, and may aid in implementing the nutrient standard in particular. They are the Virginia Resources Authority (VRA) and the Virginia Water Facilities Revolving Fund (VWFRF).

Financial assistance may be available through the VRA for nutrient control at competitive market rates. The VRA was established July 1, 1984 and is authorized to issue up to $300 million in bonds. During 1985, the VRA held three bond issues, totaling over $63 million. Of the nine localities which participated in 1985, six are located in the Chesapeake Bay drainage area. In July, 1986, the VRA went to market in a "blind pool" and secured $100 million dollars for use by Virginia localities. No loans have been made out of this $100 million to date, but the VRA is seeking applicants for its allocation.

The VWFRF was established in 1986 by the General Assembly, and $10 million per year was appropriated for this fund in the FY 1986-88 biennium. Federal and State funds will be deposited in the VWFRF, with financial services provided by the VRA. Policy decisions about allocation of funds will be made by the VWCB, and nutrient removal may be considered an eligible project.

4. (cont.)

Interest rates could range from 0% to the current market rate depending on the hardship demonstrated by the applicant. One major impediment to construction assistance in Virginia would be federal participation at a level too low to provide sufficient capital to "seed" the revolving loan fund program.

The EPA Construction Grants Program is becoming less of a possibility for funding because Congress is shifting financial responsibility for meeting the mandates of the Clean Water Act to the States. Recently, the grant percentage dropped from 75% to 55%, and less money is being budgeted for the program in each succeeding fiscal year. One version of the bill before Congress to reauthorize the Clean Water Act would replace the EPA grants program by 1990 with a State revolving loan program.

Even though the State has taken the lead in moving towards loan programs versus grants, the present EPA grants program has a restrictive policy regarding funding of advanced wastewater treatment (AWT), which includes nutrient control. We don't know if this policy will continue as a part of any State loan program capitalized with federal funds. Under the current EPA grants program, there is a very critical review process prior to approval for funding AWT projects. EPA has an exception to the AWT review policy, which applies only in the Upper-Bay Policy (UBP) area (MD and PA). EPA has already reviewed and approved an overall nutrient control plan for the area, and will approve funding automatically for phosphorus removal projects consistent with the UBP.

4. (cont.)

EPA is considering extending this exception to the Virginia portion of the Bay, but an overall plan similar to the UBP would have to be developed first. Perhaps this automatic approval should apply for nitrogen removal also, but to date EPA hasn't applied the exception in those cases.

EPA Region III staff in Philadelphia and the States of Maryland and Pennsylvania are discussing extension of this policy to nitrogen control projects. One problem involves the question of whether or not nitrogen control is as important a water quality consideration as phosphorus control in the Bay area. An illustration of this is EPA Headquarter's recent disapproval of grant funding for total nitrogen removal at Maryland's Patuxent River Plant. After AWT review, EPA ruled that the water quality improvements to be attained by nitrogen control were not sufficiently demonstrated and therefore did not merit funding.

Even before a Virginia project gets to the AWT review hurdle, the VWCB has its own policy regarding AWT funding under the EPA grants program. The VWCB policy states that secondary treatment projects will receive priority for funds and the AWT portions, if required, will be deferred until all the secondary needs in the State are met.

To date, EPA's grants to the States under the Chesapeake Bay Program have been used for water quality monitoring and non-point source (NPS) nutrient control. Virginia received about $2.6 million during FY 1984-86 for NPS pollution control. Maryland has recently asked EPA for approval to use some of these funds

for point source nutrient control. Indications are that EPA favors this approach, but they have not yet acted formally on the request.

5. What progress has been made toward developing a chlorophyll or other nutrient standard, including:

   a. What actual standards as criteria would be eligible for consideration for the various areas of the Bay and its tributaries.

   b. What research, monitoring and/or modeling will be required to develop, adopt and implement a chlorophyll standard, including a timetable for accomplishing it.

a. The following would be eligible for consideration as nutrient standards :

1. In-stream chlorophyll standard: Such a standard can be basin-specific or a fixed number statewide. A basin-specific standard is the most flexible because the acceptable chlorophyll level could be specified for the segments within each basin. When monitoring indicated violations of the upper limit for the standard, a range of nutrient reduction policies could be implemented to bring chlorophyll levels under control. Such measures could include a mixture of both point and non-point source controls.

2. In-stream nutrient standard: These are specific concentrations of the selected nutrient not to be exceeded in the water column. In-stream nutrient levels would be selected that are expected to prevent the uncontrolled growth of aquatic plant life. When ambient monitoring indicated violations of the upper limit for the standard, a range of reduction policies could be implemented to bring the in-stream concentration under control.

5. (cont.)

3. Effluent nutrient standard: These are limits specified in discharge permits, and are either technology or water quality based effluent concentrations. Such a standard would set limits on the amount of nutrients which could be discharged by a plant at a given time of the year. The major disadvantage of this type of standard is that it does not address non-point source nutrient runoff, which may account for the majority of nutrients entering State waters, under wet weather conditions.

As described below, we will be holding public meetings to receive comments on the establishment of nutrient standards. Following these meetings, we will be in a better position to outline which of these options, or combination of options, will be pursued in development of the standard.

b. At its June, 1986 meeting, the VWCB authorized the staff to begin the process of developing a statewide standard to control the effects of nutrients (Attachment 2). As part of this effort, public meetings will be held at 2:00 PM on September 30, 1986, in Prince William County and October 2, 1986, in the City of Norfolk. Public announcements for these meetings were sent during the last week of August (Attachment 3).

The VWCB is researching all existing nutrient standards in the U.S. to aid in developing and implementing a standard for Virginia. Some States have effluent discharge limits, or in-stream chlorophyll levels not to be exceeded, and others have simply stated goals to prevent nuisance aquatic growth.

5. (cont.)

The VWCB has been participating in the comprehensive Bay-wide water quality and habitat monitoring programs since July, 1984. Data from this effort will be used by the VWCB's Office of Environmental Research and Standards to assist in the nutrient standard development. This data includes nutrient and chlorophyll levels as well as measures of other standard water quality parameters. Additional monitoring was conducted in August, 1986 at selected stations above the fall line in the major river basins. This data will be used to supplement the existing database as the alternative approaches to a nutrient standard are evaluated. This monitoring is short term in nature but may be repeated in April, 1987 if more information is required. Analysis of the data from the August monitoring will be completed before March 1, 1987.

With regards to modeling, the VWCB has conducted or sponsored intensive modeling efforts in recent years for the tidal fresh portions of the James and Appomattox rivers, as well as the Potomac embayments below Washington. Also, the EPA Chesapeake Bay Program is sponsoring a modeling program for the mainstem of the Bay, which should provide important information for us in implementing any water quality standard. Additional modeling efforts will be reserved for river basins having identified nutrient problems.

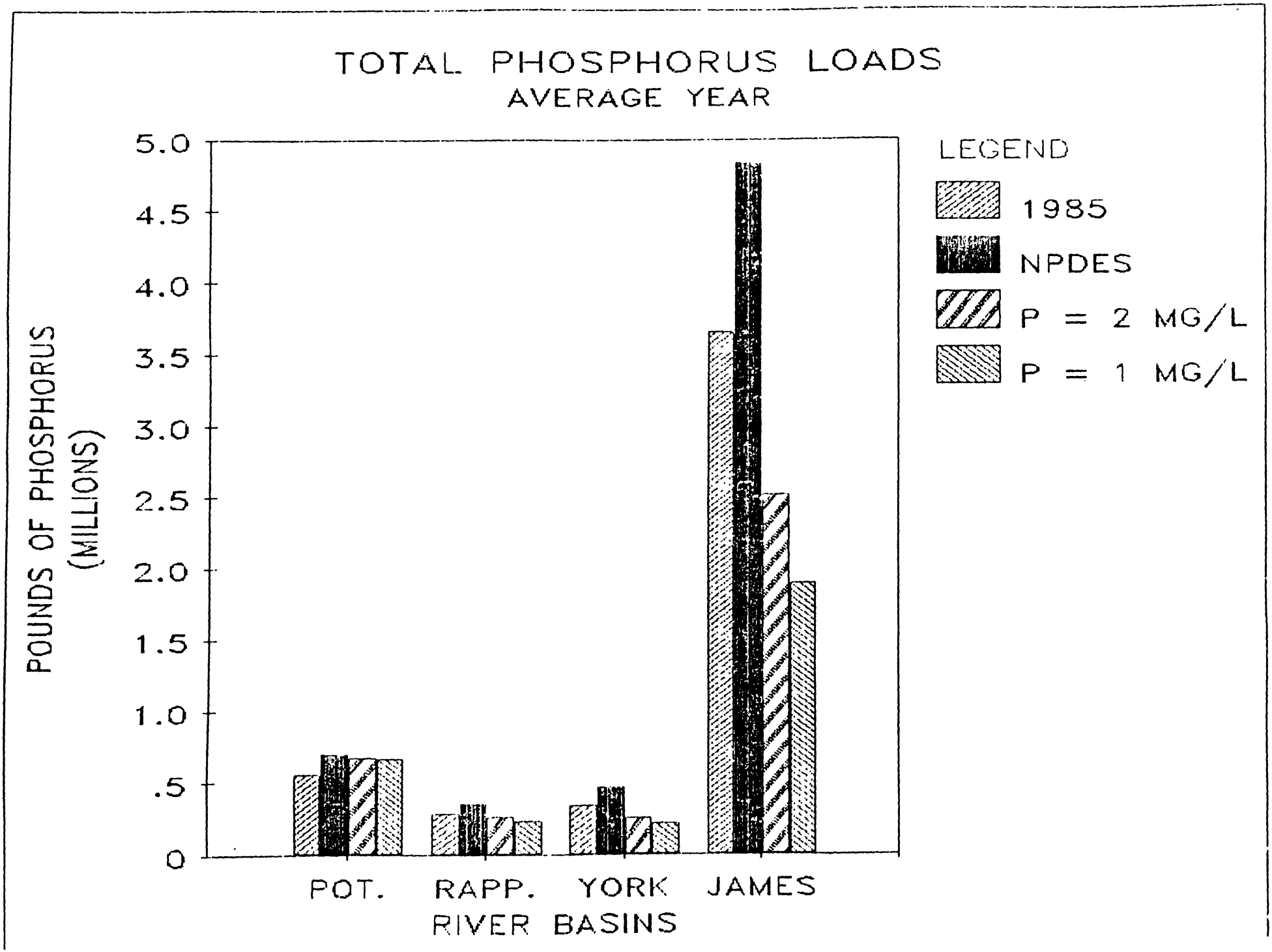
The current time table for the standard development is attached for your information (Attachment 4). You will note that the anticipated completion date for developing and adopting the nutrient standard is mid 1988.

TOTAL PHOSPHORUS LOADS (LBS./YEAR)

	RIVER BASIN	1985	NPDES	POINT SOURCE CONTROL ALTERNATIVES P = 2 MG/L	P = 1 MG/L
DRY YEAR					
	POTOMAC	490,053	644,826	596,008	584,918
	RAPPAHANNOCK	235,198	310,587	208,187	183,483
	YORK	270,637	405,210	185,230	150,490
	JAMES	3,460,838	4,654,075	2,321,632	1,692,522
	TOTAL	4,456,726	6,014,698	3,311,057	2,611,413
AVE. YEAR					
	POTOMAC	559,844	706,758	679,966	673,877
	RAPPAHANNOCK	284,578	359,967	257,567	232,863
	YORK	337,887	472,460	252,480	217,740
	JAMES	3,657,092	4,841,923	2,526,490	1,901,246
	TOTAL	4,839,401	6,381,108	3,716,503	3,025,726
WET YEAR					
	POTOMAC	1,413,017	1,561,503	1,530,306	1,523,216
	RAPPAHANNOCK	778,478	853,867	751,467	726,763
	YORK	904,987	1,039,560	819,580	784,840
	JAMES	4,816,997	6,020,742	3,667,036	3,033,094
	TOTAL	7,913,479	9,475,672	6,768,389	6,067,913

NOTE: 1. THE LOADS HAVE BEEN CALCULATED AS FOLLOWS:
1985 - USED 1985 MUNICIPAL PLANT FLOWS
NPDES - USED NPDES PERMIT MUNICIPAL PLANT FLOWS
P = 2 MG/L - USED NPDES PERMIT FLOW WITH 2 MG/L
P = 1 MG/L - USED NPDES PERMIT FLOW WITH 1 MG/L

2. IN ORDER TO PRESENT THE TOTAL LOADS FROM EACH BASIN, THE INDUSTRIAL AND NON-POINT SOURCE LOADS FROM THE 1983 EPA CHESAPEAKE BAY REPORTS WERE ADDED TO THE MUNICIPAL LOADS.

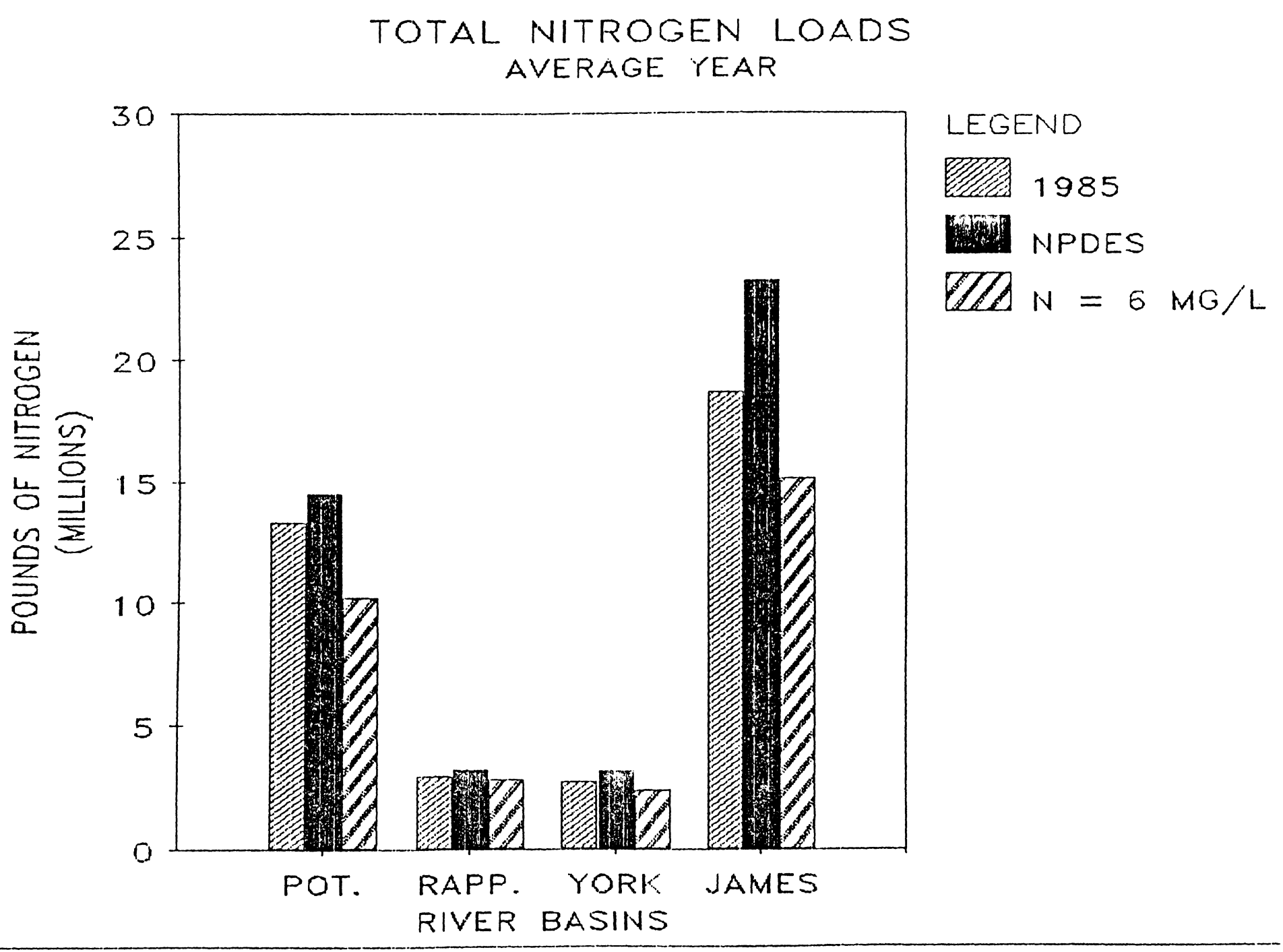

TOTAL PHOSPHORUS LOADS
AVERAGE YEAR
POUNDS OF PHOSPHORUS (MILLIONS)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
POT.
RAPP.
YORK
JAMES
RIVER BASINS
LEGEND
1985
NPDES
P = 2 MG/L
P = 1 MG/L

TOTAL NITROGEN LOADS (LBS./YEAR)

	RIVER BASIN	1985	NPDES	POINT SOURCE CONTROL ALTERNATIVE N = 6 MG/L
DRY YEAR				
	POTOMAC	11,622,883	12,822,872	8,534,729
	RAPPAHANNOCK	2,214,144	2,477,791	2,084,131
	YORK	1,791,773	2,235,619	1,470,666
	JAMES	15,831,852	20,259,832	12,314,570
	TOTAL	31,460,652	37,796,114	24,404,096
AVE. YEAR				
	POTOMAC	13,355,357	14,577,110	10,232,915
	RAPPAHANNOCK	2,995,944	3,259,591	2,865,931
	YORK	2,736,923	3,180,769	2,415,816
	JAMES	18,750,677	23,252,340	15,159,786
	TOTAL	37,838,901	44,269,810	30,674,448
WET YEAR				
	POTOMAC	23,871,314	25,239,976	20,517,431
	RAPPAHANNOCK	8,073,744	8,337,391	7,943,731
	YORK	7,855,883	8,299,729	7,534,776
	JAMES	29,104,175	33,900,573	25,218,853
	TOTAL	68,905,116	75,777,669	61,214,791

NOTE: 1. THE LOADS HAVE BEEN CALCULATED AS FOLLOWS:
1985 - USED 1985 MUNICIPAL PLANT FLOWS
NPDES - USED NPDES PERMIT MUNICIPAL PLANT FLOWS
N = 6 MG/L - USED NPDES PERMIT FLOW WITH 6 MG/L

2. IN ORDER TO PRESENT THE TOTAL LOADS FROM EACH BASIN, THE INDUSTRIAL AND NON-POINT SOURCE LOADS FROM THE 1983 EPA CHESAPEAKE BAY REPORTS WERE ADDED TO THE MUNICIPAL LOADS.


TOTAL NITROGEN LOADS
AVERAGE YEAR
POUNDS OF NITROGEN (MILLIONS)
30
25
20
15
10
5
0
POT.
RAPP.
YORK
JAMES
RIVER BASINS
LEGEND
1985
NPDES
N = 6 MG/L

ATTACHMENT 2

COMMONWEALTH of VIRGINIA

STATE WATER CONTROL BOARD
2111 Hamilton Street

Richard N. Burton
Executive Director

Post Office Box 11143
Richmond, Virginia 23230-1143
(804) 257-0056

EXCERPT FROM THE PROCEEDINGS OF THE BOARD
AT ITS MEETING OF JUNE 23, 1986

MINUTE #14 - WATER QUALITY STANDARD FOR NUTRIENT ENRICHMENT

A staff presentation was made by Jean Gregory of the Board's Office of Environmental Research and Standards on a proposed two year work plan to establish water quality standards for the protection of tributaries to the Chesapeake Bay and other State waters from nutrient enrichment.

The joint legislative subcommittee formed by Senate Joint Resolution No. 116 during the 1985 session of the General Assembly had recommended that the State Water Control Board develop these standards. The standards development and adoption process would be funded by a 1986-1988 biennium Chesapeake Bay Initiative.

The Board authorized the staff to hold public meetings on the development of nutrient standards and to proceed with the work plan.

APPROVED: A. J. ANTHONY
A. J. Anthony, Director
Office of Environmental
Research and Standards

DATE: 6/28/86

ATTACHMENT 3

COMMONWEALTH of VIRGINIA

STATE WATER CONTROL BOARD
2111 Hamilton Street

Richard N. Burton
Executive Director

Post Office Box 11143
Richmond, Virginia 23230
(804) 257-0056

Public Meetings on the Establishment of Water Quality Standards for the Protection of State Waters from Nutrient Enrichment

In accordance with Section 62.1-44.15(3) of the Code of Virginia the Virginia State Water Control Board adopts water quality standards to protect aquatic life and uses of Virginia's waters. Water quality standards affect many Agency programs, but primarily the NPDES permit program which must insure that water quality standards are met for each discharger in the State. The State Water Control Board will hold two public meetings to receive comments on the proposed development of water quality standards for the protection of State waters from the effects of nutrient enrichment.

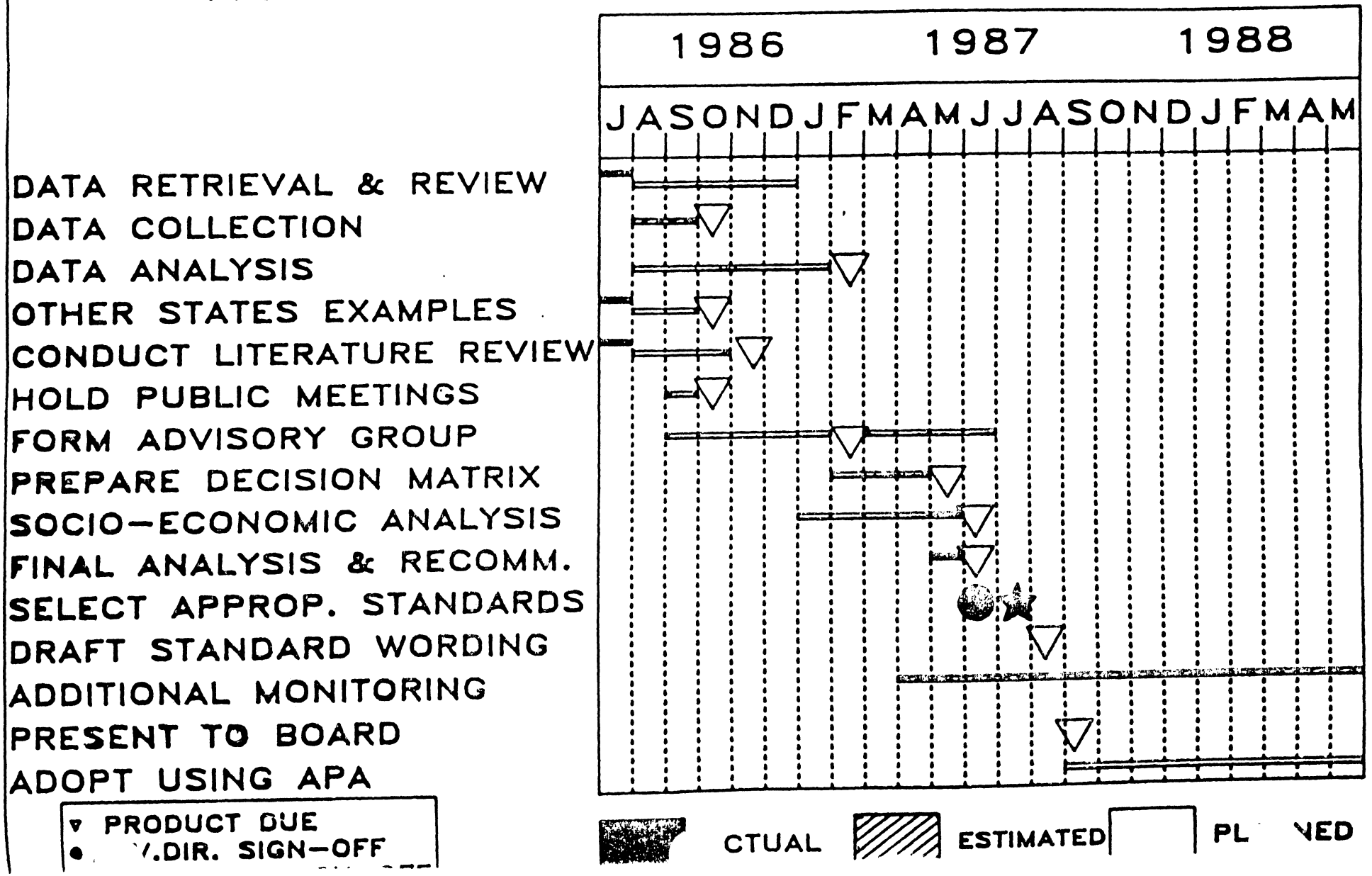
The meetings will be held in the Prince William County Board Room of the McCourt Building, 1 County Complex Court, 4850 Davis Ford Road, Prince William, Virginia 22192 on September 30, 1986 at 2 p.m. and the Norfolk City Council Chambers, 11th Floor,City Hall Building, Norfolk, Virginia 23510 on October 2, 1986 at 2 p.m.

The purpose of the meetings is to afford interested persons an opportunity to comment on the proposed establishment of water quality standards for the protection of the Chesapeake Bay, its tributaries, and other State waters, including the Chowan River, from nutrient enrichment. The Board is especially interested in receiving information on the alternative types of standards which should be considered (for example: numerical or narrative, suggested parameters, suggested concentrations).

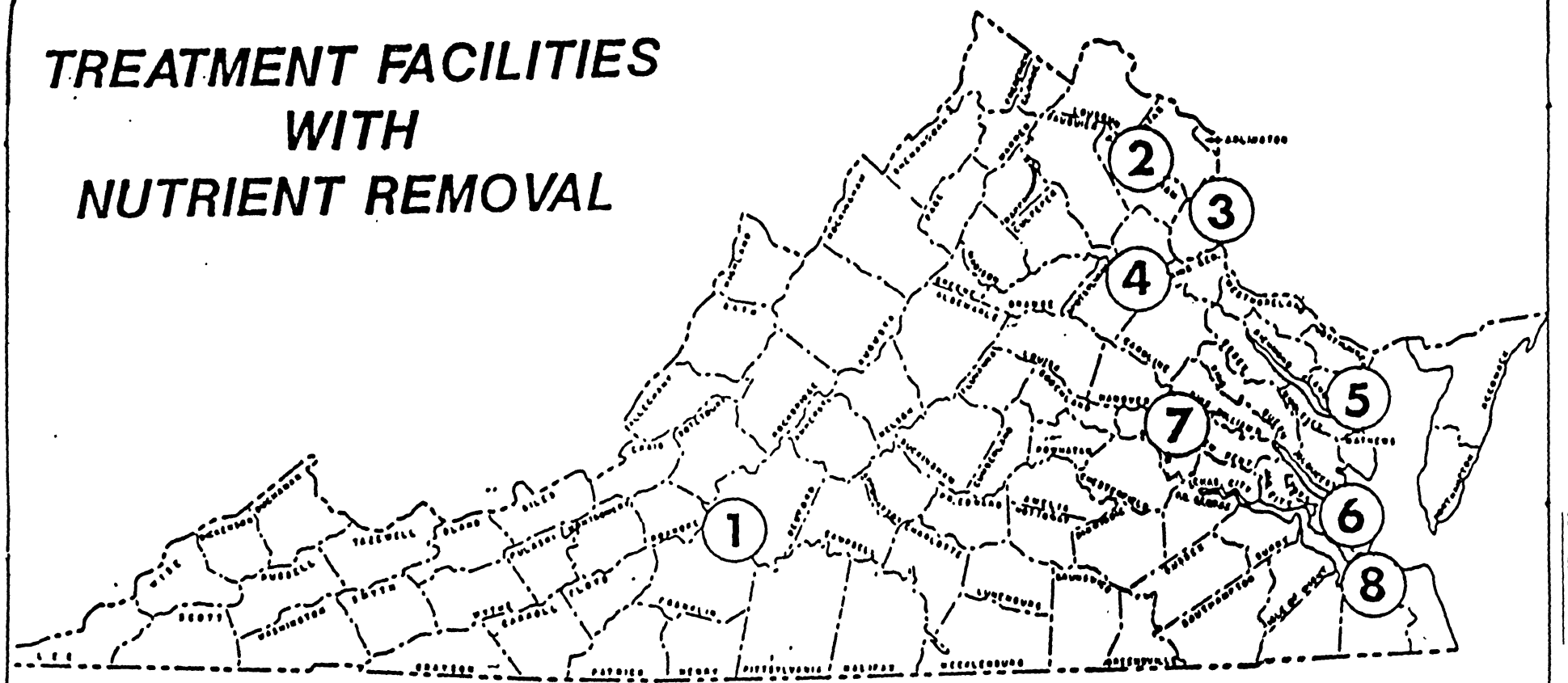
Persons wishing to speak at the meeting may do so. Anyone wishing to submit written comments should do so at any time before 5 p.m. November 7, 1986. Written comments should include the name and address of the presenter and contain a complete, concise statement of the factual basis for the comments. The comments should be addressed to Doneva Dalton, State Water Control Board, Office of Policy Analysis, P. O. Box 11143, Richmond, Virginia 23230.

More specific information including a fact sheet and the current water quality standards is available by contacting Mrs. Jean Gregory at the State Water Control Board, Office of Environmental Research and Standards, P. O. Box 11143, Richmond, Virginia 23230, phone number (804) 257-6985.

VIRGINIA WATER CONTROL BOARD
NUTRIENT STANDARDS SCHEDULE



TREATMENT FACILITIES WITH NUTRIENT REMOVAL



1. ROANOKE

2. UPPER OCCOQUAN SAN. AUTHORITY

3. ALEXANDRIA SAN. AUTH.
ARLINGTON CO.
FAIRFAX CO. (2)
PRINCE WM. CO. SER. AUTH.
DALE CITY (2)
QUANTICO MARINE BASE
STAFFORD CO.

4. FREDERICKSBURG

5. KILMARNOCK

6. HRSD-YORK RIVER

7. HOLLY FARMS

8. HRSD-VIP

VIRGINIA FACILITIES WITH NUTRIENT REMOVAL

BASIN	NAME	SIZE (MGD)	LIMIT (MG/L)
ROANOKE	CITY OF ROANOKE	35	P – 0.2
POTOMAC	U.O.S.A.	15	P – 0.1
			N – 1.0
	ALEXANDRIA	54	P – 0.18*
	ARLINGTON	30	P – 0.18*
	FAIRFAX – LOWER POTOMAC	36	P – 0.18*
	FAIRFAX – LITTLE HUNTING CR.	6.6	P – 0.18
	PR. WILLIAM – MOONEY	12	P – 0.18*
	DALE CITY #1	4	P – 0.18

* HAS N–REMOVAL CAPABILITY NOW, OR DESIGNED FOR FUTURE USE

VIRGINIA FACILITIES
WITH NUTRIENT REMOVAL

BASIN	NAME	SIZE (MGD)	LIMIT (MG/L)
POTOMAC (CONT.)	DALE CITY #8	2	P – 0.18
	QUANTICO MARINE BASE	2	P – 0.18*
	STAFFORD – AQUIA	3	P – 0.18
RAPP.	FREDERICKSBURG	3.5	DEMONSTRATION
CHES. BAY	KILMARNOCK	0.2	DEMONSTRATION
YORK	H.R.S.D.–YORK RIVER	15	DEMONSTRATION
JAMES	HOLLY FARMS	NONE SPECIFIED	P – 0.3
		AVE. – 0.6	NH3 – 2.0
	H.R.S.D – V.I.P.	40	UNDER DESIGN

* HAS N–REMOVAL CAPABILITY NOW, OR DESIGNED FOR FUTURE USE

APPENDIX C

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND HISTORIC RESOURCES
DIVISION OF SOIL AND WATER CONSERVATION
ROLAND B. GEDDES, DIVISION DIRECTOR
203 Governor Street, Suite 206
Richmond, Virginia 23219-2094
(804)786-2064

December 10, 1986

The Honorable Joseph V. Gartlan, Jr.
Member Senate of Virginia
1801 K Street, N.W., Suite 1100
Washington, D.C. 20006

Dear Senator Gartlan:

Enclosed is a revised copy of our report to your Nutrient Study Committee which was originally submitted on September 10, 1986.

The principal reason for this revision is a refinement of our phosphorus loading calculation which has resulted in a reduction of our program impact on water quality.

We have also added a figure and reformatted the report for wider distribution in response to a number of requests for this information.

If you have any questions regarding this information, please do not hesitate to call or write.

Sincerely,

Roland B. Geddes

lc

Enclosure

cc: B. C. Leynes, Jr.
R. N. Burton
Lynn Shuyler, EPA

AGRICULTURAL AND URBAN NONPOINT SOURCE NUTRIENT CONTROL

INTRODUCTION

The enclosed paper was prepared by the staff of the Virginia Division of Soil and Water Conservation (DSWC) in response to questions submitted by the Nutrient Study Committee created by the 1985 Virginia General Assembly.

This information is based on figures extracted from the Chesapeake Bay NPS Program and have not been extrapolated on a statewide basis. Answers are provided in the same order as the questions. In the case of any assumptions or estimates being developed, notes and references are provided to assist in understanding our conclusions. There are a large number of variables to be considered in any non-point source pollution analysis, and it is important to recognize the sensitivity of the answers to changes in these variables. Ultimately, there is very often no "right" answer, but only a very educated guess to be made.

The format of this paper is in response to three major questions summarized under the following headings:

1. BMP Evaluation
2. Load Reduction Potential
3. Funding

The original questions are attached for reference.

With this background then, the following is a brief evaluation of agricultural and urban best management practices used in Virginia and the extent of the implementation of each one when known:

BMP EVALUATION

Agriculture

Control of non-point source pollution from agricultural land has been traditionally tied to erosion control practices. By holding the soil in place and preventing erosion, water quality is improved by the prevention of the sediment and adsorbed pollutants (phosphorus, herbicides, insecticides, etc.) from entering the water course. The broad term of conservation practice is more accurately subdivided into structural practices or measures that provide long term control through the construction of permanent facilities or management practices that provide seasonal, annual, or longer control through the use of agronomic procedures and techniques or land use changes to reduce erosion. It should be noted that the installation of conservation practices not only address the symptom of the problem (erosion) but also deals with causes of the problem, in most cases uncontrolled excess water flow.

A large number of conservation practices are available to solve erosion or other resource use problems. The Soil Conservation Service (SCS) currently maintains standards and specifications for 147 practices. In Virginia, 97 have been evaluated as being applicable to the state's soil, topography, climate, and resource problems.

The DSWC has worked with SCS to prepare a list of 14 practices that have the highest potential for water quality improvement. These conservation practices, or Best Management Practices (BMPs) are the basic practices eligible for cost-share assistance under the Chesapeake Bay Program administered by the DSWC and local soil and water conservation districts.

The following descriptions list the practices offered as well as explain their use and the level of implementation achieved to date. It should be noted that certain BMPs are site specific and by design are only used in a limited number of situations while others, such as the agronomic practice, will exhibit a more widespread use. Certain program guidelines also affect levels of implementation for certain practices. For example, the Shenandoah sub-watershed is designated as a "target" area for animal waste management. Prior year guidelines allowed cost-share assistance only on animal waste control facilities. The 1986 program modified this slightly to allow 85 percent of the allocated funds to be spent on waste control facilities with the remaining 15 percent utilized for all other practices. The cropland target area of the Rappahannock and York basins previously restricted animal waste facilities but now provides for a maximum of 30 percent of the allocations for animal waste with 70 percent prioritized for cropland BMPs. In addition, early program guidelines were tied to or "piggy backed" a landowner's participation with the USDA Agriculture Stabilization and Conservation Service (ASCS) ACP program. Since 1985, this has no longer been required. Program modifications affecting implementation will be noted for each practice.

Animal Waste Control Facilities

This practice is one of the most effective water quality practices in the program. It combines both structural and agronomic management to utilize animal waste efficiently. Cost-share assistance is available to construct the actual manure storage facility. The DSWC has expanded its program to address major needs in this area by establishing a Nutrient Management Program (see below) to encourage the land application of manure at proper times and at proper rate to minimize water quality impacts. This practice is targeted at the Shenandoah River drainage basin and was just introduced to the Bay wide program. Acceptance by farmers has been extremely high, even given the recent economic plight of the agriculture community. Cost-share rates alone do not truly exhibit total installation cost. After installation of the cost-shared structure, participants then must purchase the necessary pumps, unloading equipment and spreading equipment to properly manage the manure application. Installation of this practice is the most costly of the BMPs available, yet is gaining popularity due to need, economic conditions, and the attractiveness of cost-share. Installations have risen from 21 structures in 1984, 27 structures in 1985, with 97 requested for consideration under the current 1986 program. Of these 97 requests, 50 were in the Shenandoah target area and can be compared with the previous years, while 47 requests came as a result of expanding the eligibility of this practice to the Baywide basin program. Many districts maintain waiting lists for this practice, should surplus funds become available.

Nutrient Management Program

Under the current Chesapeake Bay cleanup effort, the DSWC is expanding its program to address identified needs in the area of nutrient management.

The implementation plan for FY 86-88 identified these needs based on the concepts:

1. Farmers are applying more fertilizer than can be justified; and

2. Animal waste, nitrogen carry-over, legumes, etc., are not being utilized in fertilizer recommendations.

These concerns are being addressed by a pilot program in conjunction with the Virginia Cooperative Extension Service and the Soil Conservation Service.

This new initiative is directed toward operators that apply the greatest amount of fertilizer and animal waste. The fertilizer management portion will concentrate in the coastal plain region and deals with opportunities for short-run reductions in cash production costs for corn by appropriate fertilizer applications. The animal waste project will concentrate in the Shenandoah Valley area. Detailed management plans for the storage, handling, and proper land applications will be prepared for pilot farms. The plans will emphasize timely applications and proper rates on an individual field by field basis to utilize the nutrient value of the waste and reductions that can be achieved in commercially applied fertilizer.

Contour Farming

Over the past three years of cost-share assistance, there have been no requests for this practice. This is due to a great degree to an overlap of specifications with the stripcropping BMP which addresses the water quality improvement more efficiently. For these reasons, this practice has been discontinued in the 1987 program and will be replaced with a stream protection practice which will be discussed later.

Diversion

This is a site specific practice used to channel or "divert" surface flow from a site to safe outlet, or as a means to subdivide a long sloping field. Eight such structures have been constructed during the past three years, and several more used as necessary components of critical eroding area stabilization projects and are not reflected as independent BMPs.

Grass Filter Strips

Grass filter strips are vegetative buffers that are located along the banks of water courses to filter runoff, anchor soil particles, and protect banks against scour and erosion. Even the best conservation measures on a farm allow some soil movement during heavy rains. Filter strips are the stream's last line of defense against pollution. Since filter strips trap eroded soil, they help keep sediment out of streams. The strips also improve water quality by filtering out fertilizers, pesticides, and microorganisms that otherwise might reach waterways. In addition, grass filter strips along streams serve as environmental corridors. They provide valuable food, cover, and travelways for some wildlife species. As a result, they permit a great diversity of wildlife which, in turn, contributes to a more stable, aesthetically pleasing environment.

The grass filter strip was the first practice offered by the Virginia Chesapeake Bay BMP Cost-Share Program. It was the only practice offered in 1983 and served as the forerunner and model of the current program. Success that first year was evident with 464 filter areas installed. The next year dropped to 18 as the other practices were added but implementation has increased to 81 in 1985 with 106 requested for installation this year.

Grazing Land Protection

Virginia has approximately one million acres of highly erosive pastureland with inadequate vegetation to prevent erosion. Most of these poor vegetative grass stands are due to overgrazing or poor pasture management techniques. Lack of water to properly rotate grazing is the most common and widespread problem. The grazing land protection BMP is directed toward the installation of livestock watering facilities and fencing to maintain adequate cover and provide rotational grazing. Implementation of the BMP was low initially due to the program guidelines which included it with the Animal Waste Control Facility only in the Shenandoah sub-basin. Only 13 were installed during the 84-85 program years. When offered basin-wide, 102 requests were received for the current 1986 program.

No-Till Cropland

Annual practices or short term BMPs can often have dramatic results. Designed for more than short term water quality improvement, cost-share on annual practices is intended to demonstrate and educate the farmer on its benefits and costs to encourage him to continue the practice on his own after cost-share has been discontinued. Participation with this BMP has been the most popular with the farmers. The acreage planted is as significant an indicator as the number of farmers participating:

1984	29 farmers	924 acres
1985	751 farmers	32,691 acres
1986 (requested)	350 farmers	28,535 acres

Program requirements changed in 1986 to insure adequate vegetative mulch cover. Many farmers were not able to participate in 1986 due to a lack of fall planted cover crops. However, the acreage that did qualify for assistance was still quite high.

No-Till Pastureland

Most of Virginia's pastureland is located on steep, highly erosive soil types that are unsuited for crop production. Grassland plantings and other seedbed preparations on these highly erosive soils are extremely deleterious to water quality due to the high erosion rates experienced when conventional tillage methods are used. Over the life of cost-share program, 973 farmers have planted 38,942 acres of forage. The 1987 program guidelines were changed to add hayland to this BMP for the water quality benefits derived from no-till planting of crops, principally alfalfa.

Protective Vegetative Cover on Critical Area

More commonly known as critical area treatment (CAT), this is a BMP directed toward major erosion sites after these sites are bare, severely gullied, and actively eroding at excessive rates. Stabilization often requires major grading and shaping and extreme agronomic treatments to establish vegetation. Approximately 300 such sites have been stabilized through the implementation of this BMP over the last three years.

Protective Cover for Vegetable Cropland

The production of vegetable crops in Virginia often necessitates major land disturbing activities in the planting, insect and weed control, and harvesting operations. These activities increase the susceptibility to erosion and the resulting degradation of

water quality. The installation of a protective cover (cover crop) provides a soil holding and erosive prevention measure throughout the winter and early spring months. Forty-six landowners have participated in the installation of this BMP, with a majority being implemented on the Eastern Shore or in Tidewater in close proximity to the receiving waters.

Reforestation of Erodible Crop and Pastureland

An incentive to change land use to a long term less erosive usage to benefit water quality is the basic theory utilized with this BMP. A one-time incentive payment to offset the loss of economic return is paid to participants who convert highly erosive cropland and pastureland to forest. Landowner participation has been very good with 138 landowners converting over 1,200 acres into forest use. This practice is anticipated to be a major component in future work associated with USDA conservation compliance under the 1985 Food and Security Act (Farm Bill).

Sediment Retention, Erosion, or Water Control Structures

In addition to critical area treatment, the use of sediment retention, erosion, or water control structures is the main practice that is site specific in nature. Most are designed to trap sediment or to handle excessive surface water flow. To date, 47 such structures have been installed or requested.

Sod Waterway

This is a natural or constructed waterway, shaped or graded to form a swale and established in suitable vegetation to safely convey water across areas of concentrated flow. Implementation of this BMP has steadily been on the increase. Installation has risen from 28 acres in 1984, 77 acres in 1985, with 126 acres requested for 1986. All of these deal with gully erosion or other concentrated erosion areas.

Stripcropping Systems

One of the most visible and easily recognized BMPs is enjoying a renewed interest with increasing acreage being implemented each year. The success is due primarily to a modification by SCS and the encouragement of a fixed width strip (field strip) rather than the older contour strip method. Field strips are more easily worked by the new wider equipment and tend to be preferred by farmers. In addition, further water quality benefits are achieved by the installation of crop rotations and conservation tillage (no-till) on the strip widths that are cultivated. The alternating strips are then planted to grass or legume hay which reduce total erosion and filter runoff water. Implementation has risen from 9 farmers on 287 acres for the 84-85 program years to 38 farmers requesting strips on 1,745 acres during 1986. Greater implementation is anticipated due to coordination with SCS for an accelerated implementation program for stripcropping in seven counties of the northern piedmont region.

Terrace Systems

Due to the large amount of excavation and land modification involved and a reluctance by many farmers to install such an elaborate system, no terrace systems have been implemented under the Chesapeake Bay Program. The BMP was left in the program however due to the potential for implementation in the expanded statewide program. Installation of the terrace BMP is utilized more in the southside region of the state where high capital expenditures can be offset by high value crops such as tobacco.

Terraces are one of the most effective BMPs on this steep land that requires such intensive cultivation and land disturbance.

Stream Protection

This additional BMP was added to the cost-share program in 1987 not only to replace the contour farming BMP (see above), but to address a major water quality problem with sediment delivery. The purpose of this practice is to offer an incentive that will change land use, provide vegetative stabilization, or improve management techniques to more effectively control soil erosion, sedimentation, and nutrient loss from surface runoff to improve water quality. Streambank erosion can produce delivery rates as high as 100 percent directly into water courses. Implementation can take the form of planting wooded buffers along the stream, planting grass and shrub vegetation to hold the bank in place, and fencing livestock from the stream to prevent damage and bank erosion. Implementation is expected to have tremendous water quality benefits due to the massive erosion losses and high delivery rates.

Agricultural BMP Summary

To summarize the agricultural BMPs and their implementation, it should be noted that they are installed where recommended to solve a particular problem. No one BMP is best or an easy answer to all situations. Many are site specific or deal with areas so severe that a combination of BMPs are required. Implementation is increasing. The informational and educational programs, media attention, word-of-mouth between farmers, and a general understanding by farmers are all working toward a general acceptance of the program and a willingness to participate at attractive cost-share rates by the entire agricultural community.

Urban

Urban non-point source discharges are entirely different in nature from agricultural runoff. On an annual load basis, EPA's National Urban Runoff Program study suggests that nutrient loading is an order of magnitude less than loads from publicly owned treatment works (POTWs). However, "total suspended solids concentrations in urban runoff are fairly high in comparison with treatment plant discharges." Furthermore, "the nature of suspended solids in urban runoff is different from those in treatment plant discharges...the solids in urban runoff are more likely to have other contaminants, such as phosphorous, adsorbed onto them."

EPA's 1983 Chesapeake Bay Study offers a relative ranking of point and non-point source pollution source contributions to the Bay. Non-cropland non-point sources (urban, pasture, and forested) contributes about 11 to 12 percent of the phosphorous loading and 6 to 7 percent of the nitrogen loading under wet and average conditions respectively. With this in mind, the program has concentrated less of the limited resources on urban programs in order to maintain an effectively balanced program overall.

The following is a compilation of the BMPs available to control urban non-point source pollution. The Erosion and Sediment Control Program is the framework for the program and has allowed the DSWC limited control on stormwater discharges. Also, the DSWC is undertaking a study to identify ways to strengthen this program in addition to improving existing procedures to maximize effectiveness within the existing program structure and regulations.

Erosion and Sediment Controls: The range of control practices in the Virginia Erosion and Sediment (E&S) Control Handbook are considered urban BMP's, and that Handbook is actually an addendum to the State's Urban Best Management Practices Handbook published by the State Water Control Board. Because E&S Control is a regulatory program, these BMP's are applied as appropriate on development sites throughout Virginia. They control nutrients only to the extent that phosphorous is adsorbed onto sediment particles, which is quite possible during the final stablilization state of development. Structural E&S controls range from 65-70 percent effective in sediment trapping when they are first installed, if they are installed properly. This level of effectiveness can drop rapidly if regular maintenance is not performed. Vegetative stabilization with mulch generally provides about 90 percent effectiveness in preventing erosion from starting, and that effectiveness increases to between 95 and 98 percent as the grass grows and covers the ground surface. One principle and unsightly source of sediment and possibly nutrients that is not currently regulated by the E&S Control Law is the historically eroding site or abandoned site that is not adequately stabilized. Such areas are common in rural areas, as well as urban areas, but local governments currently have no authority to require the property owners to adequately stabilize the land, because no active land disturbance is involved.

Urban Fertilizer Control: Although commercial and public properties in urban areas tend to have maintenance fertilizer applied in cost-effective applications, relying on soil tests to determine application rate, many homeowners overapply fertilizer to their lawns. Due to ignorance, impatience, or laziness, homeowners seldom test their soil to determine actual fertilizer requirements. Often the homeowner attitude appears to be "if a little is good, a lot is better." Of course the excess fertilizer not used by the plants simply washes over or through the soil.

The extent of this loading source has not yet been quantified, and so far various public education schemes have been the only techniques used to change this trend.

Structural BMP's: The following BMP's are being promoted as effective in improving water quality of urban runoff, including removing nutrients, based upon results of the NURP study:

a. Infiltration Pits, Trenches and Basins: Such structures designed and constructed so that the water exits the structure by infiltrating the underlying soil profile can provide nutrient removal by adsorption to soil particles, filtering or trapping nutrients in solid form and by chemical decay within the soil profile. However, nutrient removal within the stone of the structure itself is negligible because few biological removal mechanisms are operating there. For that reason, infiltration structures designed merely as detention devices that slowly release the flow through underdrains do not provide much, if any, nutrient removal. Currently, infiltration practices are not widely accepted by developers and engineers due to the necessity of careful maintenance. However, this attitude may change with the development of improved design criteria. Most of the infiltration devices of which the DSWC is aware are located in Fairfax County.

b. Porous Pavement: Porous pavement sites monitored for the NURP study demonstrated approximate reductions of 60 percent for total phosphorous, 88 percent for total nitrogen and, surprisingly, greater than 60 percent for soluble nitrogen. The researchers attributed these reductions to the same soil-related processes responsible for reductions via infiltation structures. However, constituent reductions recorded during the first year of porous asphalt monitoring in Prince William County appear to indicate lower removals. Porous asphalt pavement is still

considered by many engineers, pavement contractors and asphalt plant operators to be a risky investment. Thus, there are few sites in Virginia other than the Chesapeake Bay Program demonstration sites. However, interest is growing.

c. Wet Ponds: Retention basins, or those having a permanent pool of water, were found by the NURP study to be effective in removing nutrients as well as many other pollutants. Removal rates averaged 28 percent for total nitrogen, 15 percent for organic nitrogen, more than 60 percent for nitrate nitrogen, 66 percent for total phosphorous and 84 percent for ortho-phosphorous. Ponds have been popular stormwater control devices thoughout Virginia where suitable land was available for their installation. They provide multiple benefits including enhancement of property values. However, several issues have clouded their popularity in the last several years. These include the inability to provide accountable long-term maintenance, particularly in residential developments; issues of safety and liability; a lack of predictability about hydrologic and hydraulic effects of smaller, on-site ponds on the lower part of the watershed; and the fact that the on-site structures are not nearly as cost-effective as larger, regional facilities.

d. Dry Extended-Detention Basins: Traditional dry basins, which empty water between storms, provide little or no nutrient removals. However, a modification of the dry-basin design, which maintains a pool of water for at least 40 hours following a storm, tends to provide nutrient removals similar to those of wet ponds. However, these dry basins are not as effective as wet ponds at removing soluble nutrients. Surveys have indicated a public preference for wet ponds over dry basins because dry basins become very unsightly if not regularly and properly maintained. They may also complicate hydrologic and hydraulic effects in the lower watershed. Nevertheless, dry basins in general have been used frequently in Fairfax County and to a lesser extent in other areas of the state.

e. Urban Marshes or Wetlands: The concept of shallow basins full of wetland or marsh vegetation has been suggested as a promising technique for improving the quality of urban runoff. The removal efficiencies and processes are not yet clearly understood, but instinct and common sense indicate that nutrients would probably be removed rather effectively by such areas. Research projects are underway in Maryland and in the planning stage in Virginia to study processes and effectiveness of such structures and to generate dependable design criteria. Previous studies indicate that such marshy areas tend to develop ecosystems and animal populations that keep insect problems in check and bring a bit of nature into the city.

f. Grass Swales: Grass swales studied under NURP got mixed reviews. Some nutrient removals were noted, but performance was inconsistent. However, research in other states, notably Florida, has indicated very good removal rates. Evaluations by the NURP projects involved concluded, however, that this was an attractive control technique whose performance could be improved substantially by application of appropriate design considerations. Additional study to develop such information was recommended. Design considerations cited included slope, vegetation type and maintenance, control of flow velocity and residence time, and enhancement of infiltration.

Effective Site Planning

Although not a BMP as such, the development of sound attitudes and site planning principles among design and development professionals can result in significa reductions in land disturbance and runoff problems in new developments.

LOAD REDUCTION POTENTIAL

In an attempt to answer the question on delivered load reductions, a number of assumptions have been made in developing phosphorus reduction estimates. The phosphorus estimates are based on the premise that a direct relationship exists between sediment loading and phosphorus loading, whereas nitrogen moves in a combination of soluble and sediment-attached forms which are not easily predictable.

The Present Phosphorus Loading table (Table 1) shows present phosphorus loading figures. The table includes figures for the maximum amount of the agricultural load that is reducible, which is labeled Potential Ag Reduction. These figures could serve as benchmarks with which to gauge program progress. Potential Ag Reductions were calculated as follows: The total load was multiplied by its agricultural percentage to arrive at agricultural loads in average and wet years as defined in the EPA study. Baseload was calculated as an estimate of background phosphorus loading under natural pristine conditions. Baseload is then subtracted from the ag loads to arrive at the potential ag reduction figures, those portions of the agricultural amounts which realistically can be reduced.

The Phosphorus Reduction Due to State Cost-Share Program table (Table 2) looks at the effect of the State Agricultural Cost-Share Program on phosphorus reductions. These estimates take into consideration current level funding for the next four years, increases in implementation effectiveness due to the targeting strategy, a carry-over benefit from no-till, and additional year benefits of past year's BMPs.

State Program Impact on Phosphorus Reduction (Table 3), compares the state cost-share program reductions with present loadings. This is also illustrated in Figure 1. The annual basin loadings are represented as reduction ranges in terms of total load, ag load, and potential ag reduction. The procedure used in calculating gross erosion is in line with SCS methodoloy and based on long-term annual averages. The result is a single reduction estimate, as opposed to a range of estimates in wet and average years, which would be more realistic. Because of this procedure, the lower end of the reduction ranges correspond to the wet years with larger loads and the higher precentages correspond to smaller average year loads.

This table shows that the BMP program is and will continue to have more pronounced effects in the cropland priority areas, the York and Rappahannock basins. One thing this scenario has not done is to take into account the law of diminishing returns with respect to additional farmer participation as there are fewer and fewer who are not in the program in a given area. Therefore, while it is presumptuous to hope to reach the 100 percent figure in the Rappahannock by 1990, the overall trends and baywide percentages are our best estimates given current level funding through 1990. These figures do not estimate effects of Federal ASCS and SCS programs or DSWC and VCES educational efforts which should further increase reductions; neither do they take into consideration increased phosphorus loading from animal waste and sludge mismanagement. These phosphorus reduction projections apply only to effects of our state cost-share program for cropland and are the best available at this time.

Regarding nitrogen, there presently is no parallel method for estimating nitrogen load reductions. Our present nitrogen strategy is principally based on participation in the Nutrient Management Program as described previously. In support of this effort, a contract with VPI&SU is being continued to develop a nitrogen transport model for surface water runoff conditions. Preliminary figures supporting our progress on nitrogen reduction should be available in another year.

TABLE 1

PRESENT PHOSPHORUS LOADING 07-Nov-86

BASIN	Total Load* AVERAGE YEAR (lbs)	Total Load* WET YEAR (lbs)	% Ag AVERAGE YEAR (lbs)	% Ag WET YEAR (lbs)	Ag Load AVERAGE YEAR (lbs)	Ag Load WET YEAR (lbs)	BASELOAD# (lbs)	Potential Ag Reduction AVERAGE YEAR (lbs)	Potential Ag Reduction WET YEAR (lbs)
POTOMAC^	1,685,208	3,027,612	0.23	0.50	387,598	1,513,806	115,621	271,976	1,398,185
RAPPAHANNOCK	417,000	1,156,500	0.39	0.71	162,630	821,115	65,181	97,449	755,934
YORK	331,300	1,183,500	0.44	0.76	145,860	899,460	67,675	78,185	831,785
JAMES	5,686,500	7,435,000	0.12	0.29	682,380	2,161,950	269,559	412,821	1,892,391
COASTAL^	114,954	292,146	0.50	0.79	57,477	230,795	32,434	25,043	198,361
TOTAL	8,235,162	13,114,758			1,435,945	5,627,126	550,470	885,475	5,076,657

* From "Chesapeake Bay: A Framework for Action", March - October loadings multiplied by 1.5 to estimate annual loadings, p.64.

^ Virginia's portion of the drainage areas: Potomac, 39.2%; Eastern Shore, 9.2%.

Baseload calculated from SCS baseload percentages times the average year ag loads.

TABLE 2

PHOSPHORUS REDUCTION DUE TO STATE COST-SHARE PROGRAM 07-Nov-86

	POTOMAC	RAPPAHANNOCK	YORK	JAMES	COASTAL	
	lbs./yr of phosphorus					
ESTIMATED 1986 REDUCTIONS						
Current Yr BMP*	48,516	33,311	23,006	35,359	12,738	
Increase in Implementation Effectiveness#				1.5		
Previous Yr BMP^	54,574	84,791	46,176	75,893	27,381	
SUBTOTAL	127,348	134,758	80,685	128,932	46,488	
Delivery Ratio**	0.087	0.095	0.090	0.085	0.119	
1986 TOTALS	11,079	12,802	7,262	10,959	5,532	47,634
ESTIMATED 1987 REDUCTIONS						
Current Yr BMP*	48,516	33,311	23,006	35,359	12,738	
Increase in Implementation Effectiveness#				1.65		
Previous Yr BMP^	94,076	109,734	64,131	102,427	37,369	
Carryover Benefit: No-Till^^	16,710	14,988	16,927	18,893	9,729	
SUBTOTAL	190,837	179,685	119,018	179,662	68,116	
Delivery Ratio**	0.087	0.095	0.090	0.085	0.119	
1987 TOTALS	16,603	17,070	10,712	15,271	8,106	67,762
ESTIMATED 1990 REDUCTIONS						
Current Yr BMP*	48,516	33,311	23,006	35,359	12,738	
Increase in Implementation Effectiveness#				1.8		
Previous Yr BMP^	190,389	151,933	99,380	154,949	55,836	
Carryover Benefit: No-Till^^	25,065	22,482	25,391	28,340	14,594	
SUBTOTAL	302,783	234,375	166,181	246,935	93,358	
Delivery Ratio**	0.087	0.095	0.090	0.085	0.119	
1990 TOTALS	26,342	22,266	14,956	20,989	11,110	95,663

* Based on 1985 distribution of funds per SWCD per BMP and average lbs of P/cost-share $, applied to the 1986 cost-share funds.

\# Increases in implementation effectiveness the first year are due to the use of the cost-effectiveness factor in prioritizing requests. Further increases will come as VIRGIS is implemented.

^ The design life of each BMP is taken into consideration in calculating its extended benefits in phosphorus reduction beyond the year in which it is installed. An assumption was made that 20 percent of the long term practices will drop out over their practice life for a variety of reasons.

** Delivery ratios are based on size of total drainage area of each basin. Targeting will result in reaching areas with greater delivery ratios.

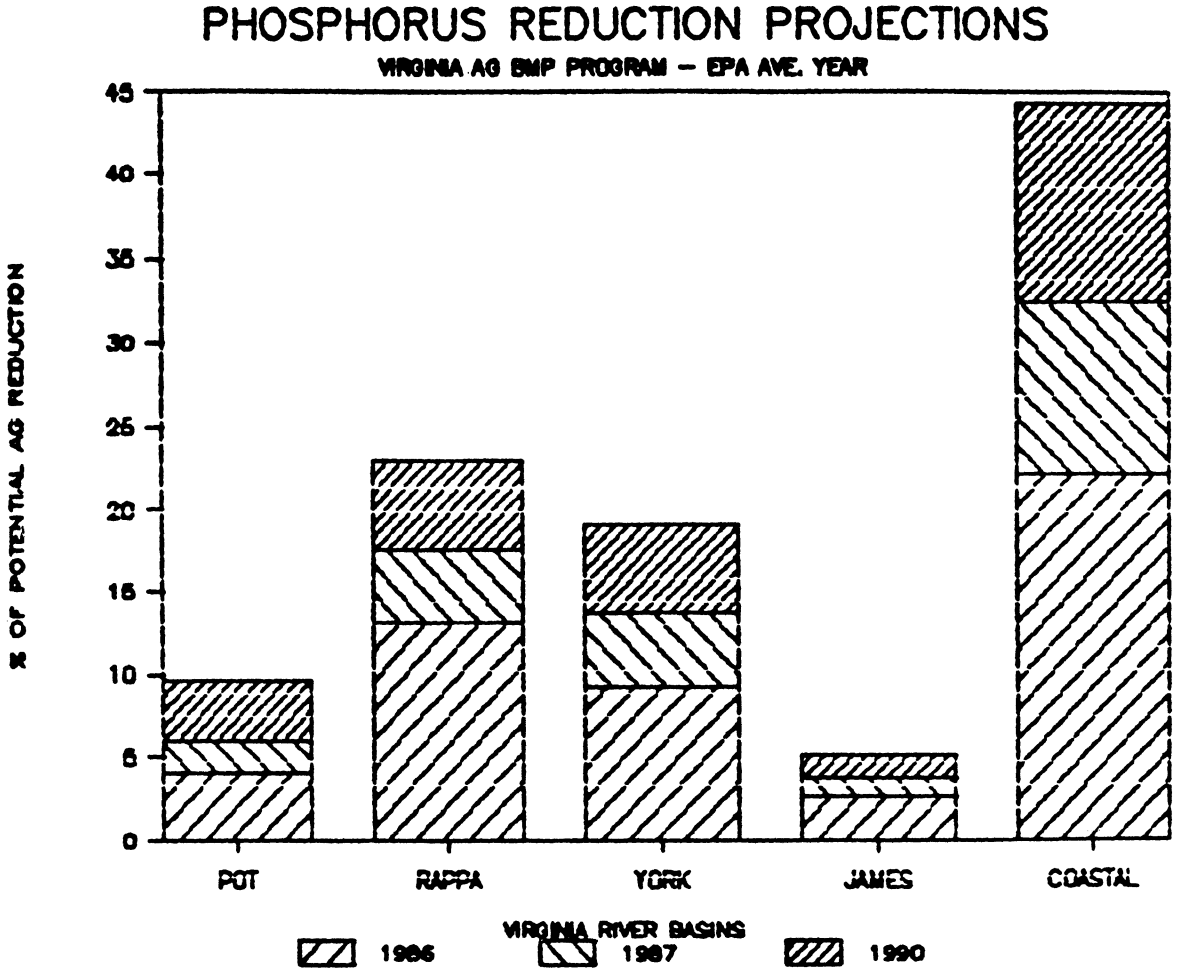
^^ Each farmer may receive cost-share for only 3 years for no-till. However, it is anticipated that a large number of farmers will continue this practice due to its other benefits to the farmer.

TABLE 3

STATE PROGRAM IMPACT ON PHOSPHORUS REDUCTION 03-Dec-86

BASIN	Estimated Ag Reductions (lbs)	REDUCTION RANGE As Percent Of Total Load		REDUCTION RANGE As Percent Of Ag Load		REDUCTION RANGE As Percent Of Potential Ag Reduct	
1986							
POTOMAC	11,079	0.4%	0.7%	0.7%	2.9%	0.8%	4.1%
RAPPAHANNOCK	12,802	1.1%	3.1%	1.6%	7.9%	1.7%	13.1%
YORK	7,262	0.6%	2.2%	0.8%	5.0%	0.9%	9.3%
JAMES	10,959	0.1%	0.2%	0.5%	1.6%	0.6%	2.7%
COASTAL	5,532	1.9%	4.8%	2.4%	9.6%	2.8%	22.1%
TOTAL	47,634	0.4%	0.6%	0.8%	3.3%	0.9%	5.4%
1987							
POTOMAC	16,603	0.5%	1.0%	1.1%	4.3%	1.2%	6.1%
RAPPAHANNOCK	17,070	1.5%	4.1%	2.1%	10.5%	2.3%	17.5%
YORK	10,712	0.9%	3.2%	1.2%	7.3%	1.3%	13.7%
JAMES	15,271	0.2%	0.3%	0.7%	2.2%	0.8%	3.7%
COASTAL	8,106	2.8%	7.1%	3.5%	14.1%	4.1%	32.4%
TOTAL	67,762	0.5%	0.8%	1.2%	4.7%	1.3%	7.7%
1990							
POTOMAC	26,342	0.9%	1.6%	1.7%	6.8%	1.9%	9.7%
RAPPAHANNOCK	22,266	1.9%	5.3%	2.7%	13.7%	2.9%	22.8%
YORK	14,956	1.3%	4.5%	1.7%	10.3%	1.8%	19.1%
JAMES	20,989	0.3%	0.4%	1.0%	3.1%	1.1%	5.1%
COASTAL	11,110	3.8%	9.7%	4.8%	19.3%	5.6%	44.4%
TOTAL	95,663	0.7%	1.2%	1.7%	6.7%	1.9%	10.8%

FIGURE 1


PHOSPHORUS REDUCTION PROJECTIONS
VIRGINIA AG BMP PROGRAM – EPA AVE. YEAR
% OF POTENTIAL AG REDUCTION
45
40
35
30
25
20
15
10
5
0
POT
RAPPA
YORK
JAMES
COASTAL
VIRGINIA RIVER BASINS
1986
1987
1990

As a final comment, the traditional use of pounds of loading in non-point source literature does not reflect the water quality effects due to concentrations as generally cited in point source references. Simply put, reductions of phosphorus and nitrogen in pounds is not directly convertible to water quality protection at a given threshold figure. Annualized figures for sediment flow may be a result of a very few torrential rainfall events and, under certain conditions, can smother life in a receiving stream for extended periods. Although nutrients lend themselves to more predictable results over a wider range of events, it is apparent that trade-offs between point and non-point inputs must be carefully evaluated beyond cost considerations.

Funding

The following is an evaluation of the extent to which both federal and state funds are expected to be available for long-term implementation of a non-point source pollution program.

Funding for this program is derived from a number of sources both State and Federal. The cooperative nature of the existing program would require continuing support and assistance from all of our partners. This method of resource enhancement also means that budget cuts can lead to magnified reductions in productivity—any one weak link will weaken the entire chain.

Specific to the question, our funding sources include the Commonwealth and the Federal government primarily including EPA, USDA (SCS, Cooperative Extension Service and ASCS). Each unit will be evaluated below.

EPA

The federal administration has made a total of $40 million available at $10 millio per year through FY 88. Of this $10 million, about $7.25 million is available to the states and about $2.75 million to EPA for program support.

Both House and Senate versions of amendments to the Clean Water Act authorize $13 million to the program, split $10 million to the State and $3 million to EPA. The time period for this authorization has not been finalized—previous record would suggest five years as an estimate.

EPA is also attempting to establish a national non-point source program based upon the model established by the Chesapeake Bay program. Legislation to accomplish this is presently under consideration within the Clean Water Act Amendments. It is envisioned that this program would be administered through the EPA Regions as needed and that the Bay program could benefit from some additional funding as a result. The actual likelihood of this program being installed and funded is speculation at this time.

Factors assuming passage of the reauthorization which could diminish funding to Virginia include Gramm-Rudman-Hollings mandatory cuts or a reevaluation of the formula presently used to distribute money among the Bay states and the District of Columbia. We anticipate answers to these questions after Congress reconvenes this fall.

The 1986 EPA grant to DCHR for non-point pollution is $2,081,475. This was reduced from $2,175,000 as a result of Gramm-Rudman-Hollings.

USDA

Many programs funded by the USDA impact the non-point source program effectiveness, especially from the perspective of technical support and education. Critical resources to this program are presently being supplied by SCS, ASCS, and the Cooperative Extension Service (CES), as detailed below:

SCS

The Conservation Operations (CO-01) portion of the SCS budget includes funds for field office operations, including salaries and administrative costs such as rents, vehicles, etc., for field staff to assist farmers and landowners with conservation planning and application.

Budget levels for the Virginia SCS operations for the last three years have been as follows:

1984 - $4.5 million
1985 - $4.7 million
1986 - $4.5 million

ASCS

ASCS administers two programs which directly impact the non-point source control program. These programs are the Agricultural Conservation Program (ACP) and the Conservation Reserve Program (CRP) as discussed below:

ACP -

In Virginia, ACP has averaged around $3 million per year to support administration and cost-sharing on BMPs as determined by county level ASCS committees.

CRP -

The CRP program provides annual rental payments of up to $40 per acre to operators who plant highly erosive cropland to grass or trees for a ten-year period. This is a new program and has a potential to make a significant impact in the near future especially in light of the conservation provisions of the Food and Security Act of 1985 (the Farm Bill) as discussed below.

CES -

The Virginia Cooperative Extension Service provides support for this program in each county over and above our contract for services. Budget cuts would ultimately result in fewer agents and thus diminish our contract benefits.

The trend in these funds is level funding to a 5 percent decrease for the next several years.

Food and Security Act of 1985

The Food and Security Act of 1985, more commonly referred to as the Farm Bill, contains the strongest language and most coordinated approach to conservation of any recent agricultural legislation. The provisions of the conservation components will have a direct and important impact on the non-point source pollution efforts in Virginia.

The three major areas outlined in the bill that will have a significant effect on Virginia's efforts are: swampbuster, sodbuster, and conservation compliance.

Swampbuster - A farmer will lose eligibility for USDA program benefits if a crop is produced on wetlands converted for production after December 23, 1985. These program benefits included USDA price and income supports, disaster payments, crop insurance, FmHA loans, Commodity Credit Corporation storage payments, farm storage facility loans, etc. ACP funds will also not be allocated for this land. Wetlands are described as hydric soils, soils that are covered with standing water or are saturated most of the year, and that support hydrophyllic (water loving) vegetation.

This program component will have an important influence on water quality in Virginia. A majority of the soils are found in the coastal plain of the state and in close proximity to water courses that lead directly into the Bay. If these soils were used for agricultural production, some method of artificial drainage would be necessary (surface ditches or subsurface drains). These practices on high water table soils have a high potential for nutrient leaching and groundwater contamination. The swampbuster provision is seen as a viable method to discourage conversion of these marginal lands. Though "clean up" efforts would be minimal, future water quality degradation will be prevented.

Sodbuster - A farmer will lose eligibility for program benefits if an agricultural commodity is produced on highly erodible land that was not cropped during the five years before the enactment of the bill and that was cultivated after December 23, 1985, unless the farmer has a conservation plan developed by the Soil Conservation Service and approved by the local conservation district. The ineligibility applies to all crops and the entire farm and is not limited to the newly converted acres.

Water quality will also be directly affected by the implementation of this program. These highly erodible soils have the highest potential for water quality degradation. Limiting cultivation (within conservation plan) or keeping these areas in grass or trees is the most effective way to reduce non-point source pollution.

Conservation Compliance - This one provision is the most far-reaching and important in terms of conservation, water quality, and non-point source pollution. Conservation compliance requires farmers who request USDA farm program benefits and who are farming on highly erodible land to develop and apply district-approved conservation plans in order to be eligible for those benefits. Farmers currently producing commodities on highly erodible lands have until January 1, 1990, to develop and begin to apply a conservation plan and until January 1, 1995, to fully implement the plan.

According to SCS estimates, approximately 1.6 million acres of Virginia's cropland are in the highly erodible category. An approved plan will reduce soil erosion to "tolerable" levels or "T" as it is commonly named. This T rate is approximately three to five tons per acre per year for the soils in Virginia.

The potential for non-point source pollution reduction and water quality improvement is great. Sediment reduction and phosphorus removal will be the major benefit of reducing erosion on 1.6 million acres. Plans are already underway within USDA agencies to encourage enrollment of the most highly erosive of these lands in the Conservation Reserve.

The magnitude of preparing conservation plans on 1.6 million acres of highly erosive land plus other land areas or individual farms will impact workload dramatically. A role is seen for the Division of Soil and Water Conservation to expand its programs to

help address these needs. The possibility of targeting cost-share funds to this highly erosive land is being examined as well as manpower needs to assist districts and SCS with the planning and BMP implementation involved.

State Funding

In addition to our individual state budget, significant interaction exists with sister agencies such as the State Water Control Board, the Department of Forestry and state universities.

The 1984 Virginia General Assembly appropriated $13,368,700 for the 1984-86 biennium for the Chesapeake Bay Plan and related items. The activities of the Bay Plan are most commonly referred to as the Chesapeake Bay Initiatives; of the $13.4 million, $10,440,000 was appropriated for this purpose. The remaining $2,928,700 was to be spent on other bay-related activities. The total 1984-85 appropriation for the Bay plan was $6,303,500; for 1985-86 it was $7,065,200.
The appropriation for 1986-87 is $10,779,521 and for 1987-88 it is $10,514,221.

The appropriation for the Department of Conservation and Historic Resources is $3,658,176 in 1986-87 and $3,706,475 in 1987-88. The agricultural cost-share program is funded at $1,200,000 for 1987 of which $550,000 is state funding and $650,000 is federal funding.

Because Virginia's budget mechanism is biennial in nature, no commitment is made to this program beyond two year budget intervals. This administration seems sympathetic to a continuing effort for this program at some level into the future.

The question of how long funding should be maintained is also important. Although significant progress is being made in the Bay Basin, our overall statewide cost-share program is only $187,500. We have requested that this be increased by $312,500 per year to make a total of $500,000 available for an agricultural non-point source pollution reduction cost-share program for water outside of the Chesapeake Bay.

Each of our programs deals with a target population which is constantly changing as landowners and operators are replaced. This fact alone justifies a continuing need to provide education, technical assistance, and cost-share incentives at some reasonable level. We are not, under these conditions, able to specify a final year when funds would no longer be needed.

APPENDIX D

THE COLLEGE OF WILLIAM AND MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

August 13, 1986

The Honorable Senator Joseph V. Gartlan, Jr.
1801 K Street, N.W., Suite 1100
Washington, D.C. 20006

Dear Senator Gartlan:

I want to thank you for the opportunity to meet with you on July 28, 1986 concerning Virginia's nutrient enrichment problems. Because we covered so much ground, it seemed appropriate that I communicate to you our perception of the problems and how we think they can best be addressed. We are in complete agreement with you that over-enrichment stresses the Bay and that remedial actions are needed. We believe that 1) establishment of a nutrient-related, in-stream water quality standard would be the most prudent action, and 2) arbitrarily set reduction targets cannot be defended on scientific grounds, but some immediate actions may be appropriate.

WATER QUALITY STANDARD: We are in agreement with the Water Control Board that the true "bottom line" is the resource - the Bay and the fisheries derived from it. Because the base of the food web is formed by the primary producers (the carbon-fixing, photosynthetic microorganisms), an in-stream chlorophyll standard relates directly to the fisheries via the food web. We believe that it is possible to derive a chlorophyll standard that is based upon both decades of fundamental research and familiarity with natural and relatively undisturbed systems. Once such a standard is enacted, then it will be possible to assess each of the Commonwealth's water bodies with respect to that standard. For those water bodies where the standard is not met, environmental engineers can develop nutrient control strategies using mathematical models and other tools. If these tools are used, then the relationship between nutrient additions (or reductions in nutrient additions) and the water quality in the receiving waters is direct and soundly based. Thus the managers can state with certainty that actions are required and they also will be able to quantify the water quality responses that will result from any proposed remedial actions.

I would note that much work has been done in recent years to gather new data and improve the models for the upper tidal James and the upper tidal Potomac, including many of Virginia's embayments. Thus, implementing a nutrient-related water quality standard in these two stressed systems will not require a lengthy period for data collection because that work has already been done.

NUTRIENT REDUCTIONS: We certainly believe that reducing the nutrient loadings to the tributaries of Chesapeake Bay is a desirable goal and that this will improve the health of the system. Difficulties arise, however, when one attempts to translate that general objective into specific actions. Should there be a strong consensus regarding the level of nutrient reduction

that is needed (and we doubt that such a consensus could be developed), one must either adopt that policy uniformly or determine how that reduction could be achieved otherwise. If the policy were applied uniformly, the result would be under protection in some water bodies and unnecessary expenditure of funds for over protection in other water bodies. Clearly, it is our opinion that this is not a prudent course of action. On the other hand, apportioning the reductions among the states, among the tributaries, and among the dischargers to any particular water body requires some specific objective upon which the allocations can be based.

Numerical goals, such as a 20% reduction from 1980 levels or a 1,500 pounds per day reduction, cannot be defended from a scientific or engineering perspective unless they are related to in-stream water quality. Although there will be some delay for the development and adoption of a nutrient-related water quality standard, Virginia will be in a position to move forward forcefully once such a standard is adopted.

Until that standard has been adopted, I believe that it would be unwise to try to achieve specific nutrient reductions unless the costs to achieve those reductions are small. If the localities must spend large sums to achieve an arbitrary nitrogen or phosphorus reduction, we will not be able to defend those plans without an in-stream standard. Additionally, plans developed now would undoubtedly employ methodologies such as phosphorus precipitation, methods which have large capital and operation and maintenance costs. If the biological nutrient removal processes work as well as we hope they do, this treatment technology would greatly reduce costs. Thus, one could argue that it would be unwise to proceed now with conventional phosphorus or nitrogen removal approaches given that the results are not yet available with respect to the biological approach. Again, it is worth noting that this work is underway. Lengthy delays will not be required. Preliminary results should be available within a few months and more complete results on hand in a year or so.

NEAR TERM MEASURES: In the meantime, what can Virginia do to reduce nutrient loadings? A phosphate detergent ban would improve conditions in the nontidal and tidal freshwater regions. Preliminary results of VIMS studies as well as at the University of Maryland suggest that it would have no effect on phytoplankton growth in the brackish portions (i.e. above ca. 10% salinity) of our estuaries. The advantages of the ban are that it results in limited additional costs to individual citizens, it can be implemented easily and quickly (and as easily undone), and no capital outlays are required. All of these are good points that were highlighted in the study commission's report*. Thus the ban appears to have great appeal for the nontidal and tidal freshwater areas. An additional benefit would be the opportunity for the individual to do his or her share towards the cleanup program for the Chesapeake Bay drainage basin, even though the benefits would probably be felt only in the freshwater and low salinity areas. Our ongoing research should provide much information to support or refute this assertion. The possible exception to the assertion relates to the migratory organisms such as striped bass, which spend part of their life cycles in tidal freshwater and low salinity regimes. Improved water quality there could impact those populations.

* "A report on the Costs and Benefits of a Phosphate Detergent Ban," Senate Document No. 9, 1985.

Voluntary implementation of BMP's by farmers, municipalities, industries, and homeowners could also accomplish much, as could educational programs which do much to see that our citizens are aware of the ways that their actions affect the Bay. A number of the Chesapeake Bay Initiatives address water quality problems. All of these are worthwhile and should be continued.

Although I, too, would like to see progress in the very near future, I believe that much more significant and long-lasting benefits will be achieved by waiting until a nutrient related, in-stream water quality standard has been adopted. Such a standard provides a firm foundation for future actions. Actions based on arbitary percent or pound reductions, however, have a very weak foundation that VIMS would have great difficulty in defending.

I hope that my comments are helpful. I look forward to the time when our efforts bear fruition and the Bay is in better shape. Meanwhile, I welcome the opportunity to work with you, as are the other members of the Institute's staff.

Yours truly,

Frank

Frank O. Perkins
Dean/Director

cc: Richard Burton

APPENDIX E

COMMONWEALTH OF VIRGINIA

JOSEPH V. GARTLAN, JR
36TH SENATORIAL DISTRICT
SOUTHERN PART OF
FAIRFAX COUNTY
1801 K STREET N.W.
WASHINGTON, D.C. 20006

SENATE

COMMITTEE ASSIGNMENTS
PRIVILEGES AND ELECTIONS CHAIRMAN
COURTS OF JUSTICE
FINANCE
REHABILITATION AND SOCIAL SERVICES
RULES

August 1, 1986

Mr. Keith J. Buttleman, Director
Council on the Environment
903 Ninth Street Office Bldg.
Richmond, VA 23219

Dear Keith:

As I am sure you are aware, the Nutrient Study Committee which I charied during 1985 was continued by the General Assembly pursuant to SJR 65 adopted in the 1986 session.

In preparing the schedule for the committee's work, there is some information I would appreciate receiving from your agency: A description of how the recently created River Basin Committees will be involved in developing nutrient standards and strategies for the tributaries.

I am anxious that the committee be enabled to complete its work as soon as possible and would appreciate your furnishing us this information as promptly as you can.

With kind personal regards and best wishes,
I am,

Very truly yours,

Joseph V. Gartlan, Jr.

JVG:nmn

COMMONWEALTH of VIRGINIA

Council on the Environment

KEITH J. BUTTLEMAN
ADMINISTRATOR

903 NINTH STREET OFFICE BUILDING
RICHMOND 23219
804-786-4500

August 14, 1986

The Honorable Joseph V. Gartlan, Jr.
36th Senatorial District
1801 K. Street, N.W.
Washington, D.C. 20006

Dear Joe:

The chairmen and vice-chairmen of the river basin committees were just recently appointed by the Governor and will have their first meeting with Secretary John Daniel on September 3. Although the committees have not met individually yet, an initial collective meeting was held in December 1985 to orient members to the Bay programs and issues and exchange ideas and information. At that meeting the committees expressed an interest in the issues related to nutrient enrichment.

The committees have been given the following charges:

- To identify present and future Bay-related problems of each river basin.
- To formulate goals and objectives for Bay-related issues in each river basin.
- To review Virginia's Chesapeake Bay initiatives in light of basin goals and objectives.
- To suggest funding mechanisms to implement basin objectives. These suggestions will be reviewed by a "blue-ribbon commission" to be appointed by the Governor.
- To recommend changes to state plans and programs designed to benefit the Bay for the 1988-90 biennium based upon the following considerations:
  A. Significance of impact on Bay and tributaries
  B. Cost-effectiveness
- To review certain of these state programs again as additional information becomes available or as new projects are implemented.

I expect that the development of strategies to curtail nutrient enrichment will be a high priority objective of these committees. In accordance with the requirements of the Administrative Process Act, the State Water Control Board's development of nutrient standards will provide several opportunities for the committees' review and comment. Any comments and suggestions made by the committees will be considered by the Board and adopted, if appropriate.

I would be very interested in reviewing your report and recommendations as soon as they are available. If I can be of any help please let me know.

Sincerely,

Keith J. Buttleman

cc: Mr. Richard N. Burton

1987 SESSION

LD5767118

SENATE JOINT RESOLUTION NO. 165

Offered January 27, 1987

Requesting the State Water Control Board and the Department of Conservation and Historic Resources' Division of Soil and Water Conservation to develop a coordinated point and nonpoint nutrient control strategy for the Chesapeake Bay and its tributaries.

Patron—Gartlan

Referred to the Committee on Rules

WHEREAS, the Chesapeake Bay is a valuable natural resource which provides a variety of recreational and economic opportunities as well as serving as a habitat for fish and waterfowl; and

WHEREAS, studies undertaken by the Commonwealth, EPA, and others have shown that the living resources of the Bay and its tributaries have declined in recent years; and

WHEREAS, these studies have shown that one of the factors causing this decline is a deterioration of the quality of water entering the Bay and its tributaries; and

WHEREAS, this deterioration has resulted in part from the point source discharges of wastewater treatment plants and the nonpoint runoff from agricultural, forestal, and urban areas; and

WHEREAS, these sources have generated excessive amounts of such nutrients as phosphorus and nitrogen which may stimulate excessive algae growth, which increases water turbidity and reduces the amount of dissolved oxygen essential for the survival of fish and other living organisms; and

WHEREAS, control strategies are necessary to reduce and otherwise limit the input of these nutrients; and

WHEREAS, a sound enforceable strategy involves the establishment of a water quality based nutrient standard or standards; and

WHEREAS, the subcommittee established by Senate Joint Resolution No. 116 (1985) recommended that the State Water Control Board establish nutrient standards for the waters of the Commonwealth by 1988; and

WHEREAS, the subcommittee continuing its study under Senate Joint Resolution No. 65 (1986) has encouraged the State Water Control Board to adopt nutrient control strategies and regulations for point sources discharges; and

WHEREAS, this same subcommittee believes management control strategies are also needed by the Department of Conservation and Historic Resources' Division of Soil and Water Conservation to address nonpoint source nutrient runoff; and

WHEREAS, the Division of Soil and Water Conservation provides education, technical assistance, and financial incentives to effectively implement a nonpoint runoff control program on a voluntary basis with farm and forest operators; and

WHEREAS, the United States Food Security Act of 1985 (also known as the 1985 Farm Bill) requires farmers to conserve highly erodible land and associated nutrients through the use of approved soil management practices to retain their eligibility in most United States Department of Agriculture programs; now, therefore, be it

RESOLVED by the Senate, the House of Delegates concurring, That the State Water Control Board and the Department of Conservation and Historic Resources' Division of Soil and Water Conservation are requested to cooperatively develop and implement a comprehensive nutrient limitation strategy by July 1, 1988; and, be it

RESOLVED FURTHER, That the strategy shall include:

(1) a nutrient standard or standards for the waters of the Commonwealth including the watershed of the Chesapeake Bay;

(2) suggested target loads for the main Bay stem and each of its tributaries from point and nonpoint sources resulting from application of the water quality standard;

(3) suggested regulations, quidelines, and budget projections as appropriate or necessary to implement nutrient management strategy; and

(4) recommendations for short-term and long-term data gathering, analysis, and research needed to fine tune the nutrient limitation strategy in future years to provide the most effective, equitable and cost-effective approach to controlling nutrient enrichment in the Bay and its tributaries; and, be it

RESOLVED FURTHER, That the Secretaries of Natural Resources and of Health and Human Services are requested to work with representatives of the jurisdictions participating in the Chesapeake Executive Council to ensure that Virginia's strategies and those of the other jurisdictions are consistent with a baywide nutrient control strategy and incorporated into the Chesapeake Bay Restoration and Protection Plan by July 1, 1989; and, be it

RESOLVED FINALLY, That the State Water Control Board and the Department of Conservation and Historic Resources are requested to report to the 1988 Session of the General Assembly on the status of the strategy, recommendations for its implementation, and any impediments to its implementation.

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Agreed to By The Senate	**Agreed to By The House of Delegates**
without amendment ☐	without amendment ☐
with amendment ☐	with amendment ☐
substitute ☐	substitute ☐
substitute w/amdt ☐	substitute w/amdt ☐
Date: _____	Date: _____
Clerk of the Senate	Clerk of the House of Delegates