4. Cost-Sharing grants may be viewed as second in effectiveness to educational efforts to promote BMP's.

5. Because of the high cost of implementation of BMP's and the fact that some take land out of production, thus adversely affecting farm income, cost-share is an important program. The farm economy is not strong enough to carry out the full program alone.

Voluntary programs are working, but we must stop and reflect, are they really that voluntary? With the 1985 Farm Bill, with the Sodbuster and the Swampbuster provisions; the 404 Clean Water Act, Critical Area law and now new wetlands guidelines and enforcement, what is so voluntary? If there is a complaint of a water quality problem, MDE or DNR Water Resources is quick to investigate. The Corps of Engineers has increased their jurisdiction and are engaging in more investigations.

In our local District, our staff watch for problems and work with landowners to get them corrected. We work with the Corps, MDE, and DNR to resolve problems they identify. We strive to get the landowners in compliance without fines or court costs if at all possible. We are usually successful.

How will the new efforts of LISA, Low Input Sustainable Agriculture, fit into the voluntary framework? LISA is not an entirely different type of agriculture, but an introduction of new concepts. I and other farmers have been using some of the concepts of LISA for years, and use more as technology develops. The economics of agriculture dictates that we must use the lowest input possible to produce a profitable crop. Some concepts already in use are:

1. Soil testing with nutrient and lime used according to the recommendations by the University or commercial companies.

2. Integrated Pest Management, using pesticides as required or dictated by identifying economic thresholds.

3. Use of conservation tillage or no till (at the NACD convention no till was called the way of the 1990's).

4. Use of cover crops to lock up residual nitrogen and prevent erosion of soil.

At the NACD meeting, Dr. Neill Schaller, who is Program Director of LISA Research and Education, USDA stated:

1. It is too soon to define LISA yet.

2. LISA is a way of thinking; it is a revolution in thinking, not technology.

3. LISA could open the door to the ethics of land conservation.

Maryland is moving ahead on reducing non-point source problems. We have a long way to go, but we need to give present programs time to work. More will be accomplished by keeping the voluntary approach. Going to more of a regulatory basis will cost more money and time and be less effective. We currently have the laws in place that are sufficient, when enforced, to assure reducing nonpoint source pollution and achieve the goals set forth. The awareness of and implementation of Best Management Practices has drastically increased. If we are observant, we can already see many improvements. The quality of the Bay is improving.

WORKSHOP #7: MODELING AS A MANAGEMENT TOOL

Lynn Shuyler, Moderator, EPA Chesapeake Bay Liaison Office

Speaker #1:

THE CHESAPEAKE BAY WATERSHED MODEL

Lewis C. Linker
U.S. EPA Chesapeake Bay Liaison Office
and
Anthony S. Donigian, Jr.
AQUA TERRA Consultants

The Chesapeake Bay Program has developed a comprehensive modeling system of two models, each with a specific role. These two models are the Watershed Model and the Time Variable Bay Model. The Watershed Model is a computer model of water quality providing estimates of basin loads to the tidal Chesapeake Bay. Load estimates may be output in hours, weeks, or years depending on the analysis required. Runoff, groundwater flow, river flow, and the associated nonpoint source and point source pollution loads of the entire Bay basin are simulated by the Watershed Model. Output from the Watershed Model is used as input to the Time Variable Model of the tidal estuary. The Time Variable Model is a continuous hydrodynamic and water quality model of the tidal estuary. These two models will be used in combination to provide information to guide the restoration program.

The Watershed Model is being developed in two phases. Phase I was initiated in October, 1988 with the following two goals:

- provide data needed for the 3-D Model calibration, and
- provide an initial analysis of Basin nutrient loads delivered to the Bay.

These goals were achieved by updating the model input and calibration, which were based on an earlier simulation of 1974-78, to the years 1984-85. Phase I also included refinements of the model's simulation of hydrology and water quality. Phase I was completed in March, 1990.

Phase II was initiated in March, 1989. Its two goals are:

- provide detailed scenario input data to the 3-D Model for the 1991 reevaluation of the nutrient reduction strategy, and
- provide information for large scale planning and tracking of NPS controls.

Phase II will upgrade the model by including sediment transport and sediment/nutrient interactions in the river/reservoir submodel. Simulation of detailed agricultural practices will be incorporated in the nonpoint source submodel. Development of interactive processors to facilitate model operation, data input, and results analysis is also included in the Phase II project. Phase II will be completed in November, 1990.

The Watershed Model consists of three submodels, a hydrologic submodel, a nonpoint source submodel, and a river/reservoir submodel. To calculate the stream flow, nonpoint pollution loads, and sediment loads in the Bay's 64,000 square miles drainage area, the Watershed Model uses extensive input and output data files including everything from meterological records to discharges from point sources. Transport and decay of nonpoint source and point source loads are modeled to the head of tide in the Chesapeake.

The model continuously updates the hydrology, including rainfall, runoff and subsurface flow, for the years 1984-85. The hydrologic submodel uses time series of rainfall, evaporation, and meterological data. From this, the soil moisture is calculated, and the rainfall input is converted into runoff, subsurface recharge to stream channels, soil moisture, evaporation and evapotransporation. The runoff and ground water discharge ultimately drive the model.

The model is divided into basins, such as the Potomac and Susquehanna, and the basins are further divided into model segments. There are 64 model segments in all, with segmentation generally becoming finer in model segments closest to the Bay. Finally, each segment is divided into seven land uses: conventional cropland, conservation cropland, pasture, manure production areas, forest, urban, and water surfaces.

The nonpoint source submodel uses rainfall intensity records as well as surface and subsurface output from the hydrologic submodel to simulate the degree of soil erosion and the surface and subsurface pollutant loads. This input is used to calculate nutrient and sediment loading to river channels. Pollutant and sediment loads from the land are loaded to the river/reservoir submodel on an hourly time step. Below the fall line, these loads are considered to be delivered directly to the tidal Bay.

The river/reservoir submodel routes stream flow and associated loads through the river, lake, and reservoir system of the Chesapeake drainage basin. Major physical, chemical, and biological processes of pollution decay and transformation are included. Input to this submodel includes point source loads, major water supply diversions, nonpoint source loads from the NPs submodel, atmospheric deposition loads, and flow from the hydrologic submodel. Since localized water quality conditions are not the focus of the model, rivers are modeled in one dimension, and relatively large model segments (mean size of 1,000 square miles) are used.

Coupled to the Watershed model, the Time-Variable Model now in development is the second generation in the Bay modeling program. Included in the Time-Variable Model are detailed simulations of sediment, plankton, and other water quality processes. Scheduled for completion in March 1991 (not coincidentally, the year the 40 percent nutrient reduction goal is to be re-evaluated), the model can profile an entire year, virtually day by day, providing a tool more flexible and more accurate than the previously used steady-state version. It also will be capable of a detailed evaluation of the reductions needed in phosphorus and nitrogen in specific tributaries and in areas of special concern. The new model will be able to answer questions such as these:

- What nutrient reductions are necessary to protect living resources in specific sensitive areas.
- Given the reservoir of nutrients in sediments, once controls are in place, how long will it be before measurable improvement occurs in the Bay?

Valuable as they are, the coupled Watershed Model and Time-Variable Model are incapable of providing absolute predictions of what will happen in the Bay. Models are not perfect, particularly in dealing with complex systems like the Chesapeake Bay. Modeling can't precisely predict how the adoption of better manure management practices on farms in Pennsylvania will benefit a particular oyster bed halfway down the Bay. But models and, and do, chart the directions that should be followed, and the mid-course corrections that may be needed, to achieve the restoration of the Bay. Models also improve our understanding as they challenge our knowledge and ability to simulate a tiny portion of the interchange of ties, currents, and life that we call the Chesapeake Bay.

Donigian, A.S., B.R. Bicknell and J.L. Kittle, Jr. 1986. Conversion of the Chesapeake Bay Basin Model to HSPF Operation. Prepared by AQUA TERRA Consultants for Computer Sciences Corporation, Annapolis, MD, and U.S. EPA Chesapeake Bay Program, Annapolis, MD.

Donigian, A.S., B.R. Bicknell, L.C. Linker, J. Hannawald, C.H. Chang, and R. Reynolds. 1990. Watershed Model Application to Calculate Bay Nutrient Loadings: Preliminary Phase I Findings and Recommendations. Report Prepared for U.S. EPA Chesapeake Bay Program, Annapolis, MD.

Northern Virginia Planning District Commission. 1983. Chesapeake Bay Basin Model. Final Report Prepared for U.S. EPA Chesapeake Bay Program, Annapolis, MD.

HydroQual, Inc. 1987. A Steady-State Coupled Hydrodynamic/Water Quality Model of the Eutrophication and Anoxia Processes in Chesapeake Bay. Report Prepared for U.S. EPA Chesapeake Bay Program, Annapolis, MD.

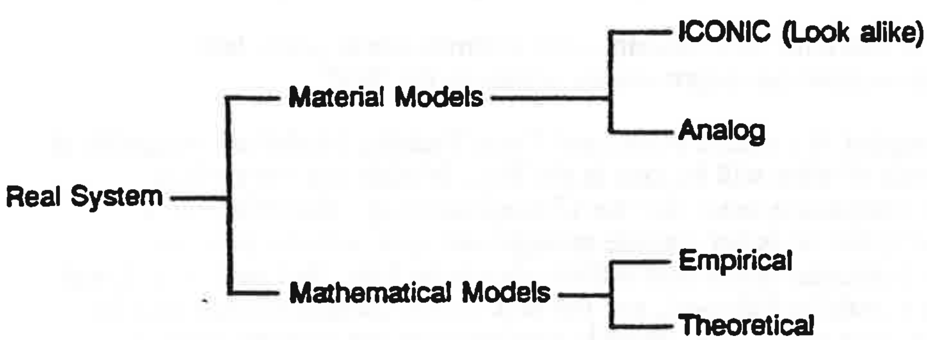
Speaker #2:

Adel Shirmohammadi
Agricultural Engineering Department
University of Maryland, College Park

To address the question, "Are models management tools?" one may need to have a proper understanding about the term "model" and the philosophy behind the model development. The term "model" may have different interpretations based on its discipline of use. In hydrologic, water quality and engineering sense models are used to explain the natural phenomena and under some conditions make predictions in a deterministic or probabilistic sense. Hempel (1963), in a book titled "Philosophy of Science," states that "we understand an event or a regularity if we can give a scientific explanation of it." The essence of Hempel's philosophy may be expressed as:

$$E = f(L1, L2, ..., Ln) + g(C1, C2, ..., Cn)$$

Where, E is a statement describing an event, L1....Ln are general laws or theoretical principles, and C1, ...Cn are statements of empirical circumstances. Therefore, a modeler tries to use the established laws or circumstantial evidences in order to represent the real life scenario. In doing so real system may be modelled using different approaches as classified by Woolhiser (1982) in the following form:



Although each of the above forms of models try to represent the real system but they have their own strengths and weaknesses depending upon the application conditions and scale of application. For example, an empirical model is derived from a set of measured data for specific site conditions and therefore its application to the other sites may create a real problem. Unfortunately, problems in misuse of nonpoint source pollution (NPS) models exist. Some users stretch the model use beyond model's capability or misinterpret the model output out of the intended scope.

Nonpoint source pollution (NPS) models are either empirical, theoretical, and/or a combination of the two. Their scale and level of application may also differ depending upon the capability of each model. Available transport models are either: 1) porous media oriented and lack the consideration of BMP impacts; or 2) they are solely BMP evaluation models and lack the comprehensive vadose zone transport component. Models reflecting the first category have been developed for environmental screening of pesticides through soil profile. Examples of such models are 2, 4-D diffusion model (Lindstrom et al., 1968), CMIS (Nofziger and Hornsby, 1984), LEACHM (Wagenet and Hutson, 1986). Models in the second category include ANSWERS (Beasley et al., 1983), CREAMS (Knisel, 1980), HSPH (Leonard et al., 1987). Each of the aforementioned models have their own degree of application limitations and the user must pay close attention for selecting an appropriate model for their intended use.

CREAMS (Knisel, 1980) is a well tested and widely used BMP evaluation model and has three components of hydrology, erosion and chemistry. It is a field scale model and may be used to provide relative comparisons between different BMP's. One should note the caution that CREAMS does not produce absolute values. This model has been and is being used by researchers, regulatory agencies, service agencies, and educators as a management tool. Shirmohammadi and Shoemaker (1988) used CREAMS model to evaluate the relative impacts of ten different BMP's on surface losses of nutrients and nitrate leachate below the root zone in three sub-basins in the Susquehanna River basin for 30-years of recording period. Their simulations resulted in different rankings of BMP's regarding their impact on surface losses of N and percolation losses of N03(Table 1). Authors believe that similar simulations may be conducted on different sub-basins of Chesapeake Bay Basin and results may provide overall guidelines regarding the selection of environmentally sound BMP's. For example, data on table 1 indicate that conventional till-terrace - with nutrient management plan (CT-TR-NMP) and CT-strip cropping-NMP (CT-ST-NMP) may be selected as the best practices regarding the reduction of N losses to surface runoff, respectively. However, consideration of the cost of terraces may dictate the selection of notill-contour-nutrient management plan (NT-CN-NMP) as the best practice for all sites. Close examination of the rankings based on the N03 leachate loss and economic considerations may prove that N-CN-NMP may be selected as the best alternative regarding both surface losses of N and percolation losses of N03. This example indeed proves that models may be used as management tools if their limitations are properly recognized.

Table 1. Ranking BMP's based on surface losses of N and percolation losses of N03 (Simulation period: 1949-1 978).

Simulation results of CREAMS may be used as loading parameter values in the Chesapeake Bay Watershed model. Impact of climate and crop rotation may also be determined using CREAMS results.

Field	Management Practices	Surface N Loss	Percolation NO_3 Loss A	C	E
A & C	*CT	1	5	5	4
	*CT-NMP	2	10	10	10
	*NT	3	3	2	2
	*NT-NMP	4	8	7	8
	*CT-CN	5	4	4	3
	*CT-CN-NMP	6	9	9	9
	*NT-CN	7	1	1	1
	*NT-CN-NMP	8	6	6	7
	CT-TR	9	2	3	-
	CT-TR-NMP	10	7	8	-
E	CT-ST	9(E)			5
	CT-ST-NMP	10(E)			6

A: Lower Susquehanna (Piedmont - Chester, Leck Kill, Penn Series)
E: North Branch Susquehanna (Appalachian - Volusia)
C: Western Lower Susquehanna (Blue Ridge Mountain - Berks Series)

FUTURE RESEARCH NEEDS

1. Field experiments must be conducted for proper understanding of hydrologic, chemical, and biological processes.
2. Inclusion of such understandings in item 1 into the transport models may enhance their use.
3. Consideration and addition of such aspects as spatial and temporal variability of hydrologic, chemical, and biological factors into the models should be on the priority list.
4. Handling the scale-concept of watershed system with multi land use or aspect should be devised in the models.
5. Multi-management aspects such as WTM and above-ground BMP's and their interactive impact on surface and ground water quality must be considered.
6. Clear guidelines on model selection criteria should be provided for the users. Dandy & Lichty (1968) have suggested 4 criteria:
   a. Accuracy of prediction
   b. Simplicity of the model
   c. Consistency of parameter estimates
   d. Sensitivity of results to changes in parameter values.
7. Research needs to be multi-disciplinary if proper outcome is desired.

Speaker #3:

VIRGINIA'S NONPOINT SOURCE (NPS) APPROACH

J. Michael Flagg
Virginia Department of Conservation and Recreation
Division of Soil and Water Conservation

The Department of Conservation and Recreation, Division of Soil and Water Conservation (DCR-DSWC) uses the technology of mathematical modeling to support three main objectives in Virginia's NPS control program. These objectives are to identify areas of high NPS pollution, to prioritize and target, and to assess and evaluate NPS control alternatives. Modeling provides the framework for accomplishing each of these objectives by integrating land based resource information such as soils, topography, and land use with pollution abatement information provided in NPS control program tracking. Monitoring data is also used in this process to provide control and assure accurate and correct assumptions are made in the modeling processes.

Modeling provides NPS managers with a unique tool for evaluating the effects of land management practices on water quantity and quality. This is particularly important since, it is not possible to obtain experimental data for all combinations of management practices and hydrologic conditions. By approximating real environmental systems with mathematical abstractions under varied conditions, modelers can produce management alternatives that integrate many social as well as physical processes.

There are some difficulties that hinder a manager's ability to utilize modeling tools effectively. These difficulties can generally be identified under the component headings of NPS program progress tracking, basic data availability (monitoring and resource data) and, Model Applicability and Complexity. The factors that hinder modeling efforts are usually inter-related and involve more than one of the component headings. The combined contribution of these interfering factors is the delay or lack of responsiveness of modeled output to managers deadlines and needs. The DCR-DSWC is addressing these difficulties by utilizing or implementing programs in water quality monitoring, geographic information system (GIS) application, best management practice (BMP) and nutrient management tracking, and mathematical water quality model development and utilization. These programs serve independent functions for Virginia's NPS control effort; however, coordination and focusing of these efforts through the use of modeling broadens the capabilities of the program managers. This synopsis will focus on DCR-DSWC's model development and utilization efforts, two separate, more detailed, synopses of the other program efforts, prepared by Karl Huber and S. Mostaghimi, appear elsewhere in this conference summary.

NPS pollution problem identification, prioritization, targeting, assessment, and alternative evaluation are a continuous process involving interrelationships at various levels of the decision tree. DCR-DSWC has organized the state managers decision requirements into three distinctly different groups. The first group would include information required to make decisions at the interstate or Chesapeake Bay basin level. Second would be that information necessary to evaluate a total state perspective and thirdly information required to make decisions at the field and subwatershed level.

At the interstate or Chesapeake Bay basin level, DCR-DSWC is relying on the HSPF "Watershed" model as the interface and comparable reporting system for the Bay effort. At this level DCR-DSWC in acquiring the Virginia portions of the "watershed modeling effort" and working to interface their capabilities with that framework.

At the state level DCR-DSWC has been working over the past two years and developed a cooperative agreement with the Soil Conservation Service (SCS) to develop a subwatershed boundary system for Virginia. This system is being incorporated into the Virginia Geographic Information System (VirGIS) and merged with other resource information to provide better management capabilities at a subwatershed level. During 1990, this effort will result in a set of state subwatershed maps that are compatible with the USGS watershed system, as well as, a data base system capable of organizing information for management decisions in a timely and workable manner.

In addition to the broader efforts the DSWC has been working since 1985 to build a NPS control and natural resource geographic information system called VirGIS under contract to the Information Support Systems Lab (ISSL), Department of Agricultural Engineering, Virginia Tech. This system currently contains resource information for soils, land use, streams, elevation and many more layers for more than 10 million acres of Virginia's Chesapeake Bay-drainage. This information is at 1:24000 scale and represents units of .27 acres for most of the data layers. The VirGIS effort has also resulted in improved detailed modeling algorithms and model interfaces for water quality models such as AGNPS, FESHM, USLE, and other in house procedures. The VirGIS data base is very significant because it supplies much of the basic resource information such as soils, topography, land use, etc. at a detailed level, with spatial reference and in an automated computerized framework. This is significant because all of the present NPS water quality models rely heavily on this data as input. This type of data is usually the most laborious and expensive to collect and process for model runs. The VirGIS data base provides considerable coordination of information and greatly enhances DCR-DSWC's ability to make more detailed and timely model runs for management decisions.

By building the interfaces between GIS technology, conservation tracking systems, monitored data, and mathematical models, the DCR-DSWC has and will continue to develop, with the assistance of many organizations and groups, the capability to manage many significant sources of NPS pollution. New efforts are underway to broaden the scope of present capabilities and include more NPS categories of pollution in the data bases as well as establish workable evaluation tools and models.

EMERGING ISSUES
(Concurrent Workshops)

WORKSHOP #1: WETLANDS AS MANGEMENT TOOLS

Louise Lawrence, Moderator, MD Department of Agriculture

Speaker #1:

THE DRAGON RUN STORY

Blaine K. Delaney
District Conservationist
Soil Conservation Service

My presentation will focus on a very unique wetlands found in Tidewater, Virginia and the effort by a diverse group of citizens, county governments, private organizations and state and federal agencies to put together a comprehensive management plan to protect it. During the second half of this presentation I will explain my involvement and how I was able to utilize existing federal conservation programs to add an additional layer of resource protection beyond their initial work.

Dragon Run is a beautiful stream that splits Virginia's Middle Peninsula as it flows to the Piankatank River on the Chesapeake Bay. The Dragon wilderness is a unique ecosystem which has been ranked second in ecological significance among 232 areas investigated in a

Smithsonian Institution study which covered the entire Chesapeake Bay watershed. Along its 35 mile length it is flanked by the counties of Essex, King & Queen, Middlesex and Gloucester which lie in the Coastal Plain.

A group of local landowners, farmers and public officials formed the Dragon Run Steering Committee during the early 1980s and were reactivated in 1987 when a proposed subdivision threatened the tranquility of this pristine waterway. The Chesapeake Bay Foundation provided technical support by assigning Jerry Stokes to help guide this committee to develop some form of management plan to provide a first layer of resource protection for Dragon Run.

Their collective effort was successful and the Dragon Run Conservation District (DRCD) was created. Three of the four counties which control 90% of its watershed adopted it into their county ordinances.

Agricultural Best Management Practices (BMPs) were to be employed on all cropland that fell within the DRCD which created a 100 to 150 foot buffer inland of the outer edge of the hydric soils.

I decided to utilize existing federal conservation programs and to add a second layer of protection to the upper part of the Dragon's watershed that comes under the jurisdiction of the Three Rivers Soil and Water Conservation District (Essex and King & Queen counties). Through this approach we could deal with all of the cropland in this portion of the Dragon's watershed not just those acres that fell in the narrow corridor of the DRCD.

Two key conservation provisions of the Food Security Act of 1985 were invaluable for our work--Conservation Reserve Program (CRP) and Conservation Compliance.

RESULTS:

--over 500 acres of highly erodible land were enrolled in CRP
--about 30% of this acreage was planted to trees
--most of the remaining highly erodible acreage was adequately addressed by the conservation compliance plans

SUMMARY:

(1) A first layer of resource protection was provided to the Dragon Run through the adoption of the DRCD by three of the four counties.

(2) This unique coalition of individuals who represented a broad spectrum of interests was masterfully led by Jerry Stokes of the Chesapeake Bay Foundation (CBF). This is a role that I hope CBF continues to use into the future by providing the glue to bring various groups and agencies together for one common purpose.

(3) Once a coalition sets their sights on some goal such as protecting Dragon Run it is easy for others like myself with the Soil Conservation Service to target staff resources to help address NPS pollution through existing federal and state programs.

Speaker #2:

THE REGULATORY APPROACH

JoAnn Watson
MD Department of the Environment

I. Applicable laws and regulations

A. Clean Water Act, Section 401: Requires States to certify that no violation of State water quality standards will occur as a result of federally permitted activities which might result in discharges to State waters (usually section 404 activities).

B. Environment Article of Maryland: Basis for water quality protection goals and standards.

C. Federal regulations

1. 33 CFR 320 through 330, U. S. Army Corps of Engineers: Give States' requirements for denial and conditioning of water quality certifications.
2. 40 CFR 230, U. S. Environmental Protection Agency (404 B 1 guidelines): Gives states guidelines on the appropriateness of water quality certification issuance.

D. State regulations: COMAR 26.08.01 and .02, Water Quality Standards: Presents the "yardsticks" against which all projects requiring water quality must be measured.

1. Numerical criteria
2. Narrative criteria
3. Anti-degradation policy

II. Applied Science

A. Functions and values of wetlands

B. Environmental assessment: Systematic approach

III. Know your limitations

A. Legal, regulatory

B. Political, economic

C. Science

WORKSHOP #2: PESTICIDE MANAGEMENT IN THE NINETIES

Walt Peechatka, Moderator, PA Department of Agriculture

Speaker #1:

BEST MANAGEMENT PRACTICES FOR ENVIRONMENTAL PROTECTION

Orlo Ehart
CIBA-GEIGY Corporation
Greensboro, NC

There are many emerging issues that will affect pesticide uses and policies in the nineties. Some of them are existing issues where there are honest differences of opinion on the best course of action; some are issues as a result of new research which may have identified previously unknown results; and some are policy questions which are as equally affected by public opinions as they are by facts and science. The major areas of debate currently appear to fit within the areas of pesticide regulation and enforcement, water resources protection, sustainable agriculture, food safety, integrated pest and farm management, and the state's role in pesticide policy setting. All of those areas, and some others which I may not have mentioned, are important issues of concern that will be debated and remain important issues in the nineties.

Since this is a nonpoint source pollution conference, I will focus my attention on water resources management concerns and leave other areas to the question and answer period. I will discuss several best management practices that the industry supports. Most of the examples come from experiences that CIBA-GEIGY Corp., my employer, has been involved in. They all fit with in the concept of integrated farm management, and, I believe, are consistent with the broad view of sustainable agricultural practices.

One thing that we may need to be reminded of is that what is done on land can and does affect water quality. Since it is not possible to see what is happening below the surface of the soil, the significance of some activities and the effects they can have on groundwater quality are not always obvious. The application of agricultural chemicals generally can be done safely with the right soil and ground or surface water conditions. However, since these activities can directly affect water quality, land use practices must be carefully managed and water resources protected. Since clean-up can be costly in groundwater circumstances, and land lost forever as well as water potentially contaminated when erosion control is not practiced in surface water situations, prevention of problems is an important part of good pesticide management and environmental protection.

Best management practices and principles can help to assure water resource protection. When growers follow these recommendations, environmental risks are minimized, and ground and surface waters should be protected. The future of modern agriculture and a safe, healthy environment depend on cooperation between product manufacturers, researchers, dealers, users and policy makers. Water contamination problems can occur through improper application, handling, and disposal practices of agrichemicals. Problems have also been identified from proper applications of some chemicals.

Best management practices might include:

Cultural controls of pests
Comply with state and federal pesticide laws
Read and follow label directions
Become a certified applicator
Determine the susceptibility of groundwater
Minimize pesticide runoff

Match application rates to field characteristics
Select proper pesticides
Assess timing of planting and applying
Store pesticides in a safe place
Do not mix and load near water sources
Avoid backsiphoning
Properly calibrate application equipment
Follow proper and timely irrigation techniques
Do not apply pesticides near wells or sinkholes
Avoid overspray and drift
Properly dispose of pesticide containers
Keep accurate records
Develop plans

The management of each parcel of land where pesticides are used and each site where pesticides are stored or mixed will become more complicated in the future. The responsibility for proper and sophisticated management will rest with the pesticide user. The manufacturers and researchers will help to identify the best management practices in the form of changes in label directions and future recommended practices, including alternate methods of control. However, those landowners who recognize that the future use of their land will be regulated because of the potential for water contamination caused by current use practices, will benefit by using their creativity to develop practical solutions to reducing and hopefully eliminating the potential of water contamination by their agricultural operations. It is in everyone's best interest to do that. The willingness to modify current actions will impact future water quality and determine the extent of governmental regulations necessary to balance the right to do as one wishes on his/her land versus the need to assure a clean water supply for all Americans. The industry will continue to take an active role in assuring product stewardship and developing more environmentally compatible products and packaging to help reach the goal of a clean environment free from unreasonable risks.

WORKSHOP #3: PROTECTING GROUNDWATER

Bill Woodfin, Moderator, VA State Water Control Board

Speaker #1:

BAY LESSONS FROM DC GROUNDWATER REGIME

James V. O'Connor
Department of Environmental Science
University oF D.C.

Recommendation 4 from the Chesapeake Bay Nonpoint Source Programs Implementation Committee (Jan, 1988) is too limited in scope for urban groundwater contributions to the quality and health of the surface water system of the bay. The major urban settings (Baltimore, Richmond, and Washington) for the Bay system are Fall Zone cities. There is the drastic difference in the general geology and hydrology on either side of the Fall Zone. The variation in rock history and paleo-environmental settings yields unique quality and quantity stories. The urbiscape covering the natural setting is another component impacting on the groundwater behavior.

Gemeral Geological Factors:

The natural terrain carries its own groundwater characteristics and behavior. Piedmont bedrock itself has low groundwater yields but is highly fractured. Fractured zones will yield much higher values but at shallow to medium depths (300' or less). Groundwater decays this bedrock along the fracture zones creating saprolite deposits which are good water bearers. Numerous springs occur on hillsides at the boundary between the saprolite and its bedrock. In DC these springs are the headwaters for many tributaries to Rock Creek. While all three cities have Piedmont bedrock, it is not the same rock type. Baltimore marble and Richmond granite equivalents do not occur in DC. Coastal Plain sedimentary geology controls groundwater flow regimes. The ancient sedimentary environments left us perched water tables, old channel seeps and springs, and one true confined aquifer (Potomac Group). The old deltaic sediments of the Potomac Group control interstate transfer of groundwater, plus landslide and swelling hazards. This parent material yields a highly erodible soil in all three cities. The geology has a high iron content with high sulfur in the paleoswamp deposits noted for their coal and petrified logs. These naturally acidic waters react adversely with many underground structures today but were a positive economic source for the health spa industries in the last century.

Urban Groundwater--Special Research Needs:

1. Large city cemeteries are located on well drained local topographic highs. They serve both as recharge areas and as spring sources for city streams.

2. In select city neighborhoods, domestic roof drains provide about 20% of the overland recharge on permeable ground or are directly injected into the soil. This injection process is a bad idea in the landslide prone areas.

3. Construction dewatering generally lowers the water table below the foundation bed. Pumps are utilized until the work is complete. Deeper roots for high rise development, partly generated by offstreet parking regulations, create larger drawdowns. This highrise evolution means a larger stress to the urban groundwater system. Dewatering is an urban inverse analog to the rural/suburban perc tests.

4. Extracted groundwater in DC is pumped directly to the Potomac through the city storm sewers. Sediment laden construction water is filtered through tandem 55 gallon drums or baffled dumpsters. Barrels and dumpsters are our temporary sediment control ponds where there is no downtown projects per year during the 80's; conservative calculations indicate that approximately 1/2 million gallons were dewatered downtown daily. There is another 1/2 million gallons sump pumped from the federal enclave into the same sewers on a daily basis. Recent field checks indicate that some city blocks are not recovering from dewatering while the law says it must.

5. The laws and regulations concerning groundwater use and abuse have changed at all political levels. Underground storage tanks will have monitoring systems. Historic springs and recharge areas are now being protected. EPA laws govern monitoring and remediation of past spills. Groundwater basin maps and quality classification systems are coming online. The role of the interstate and intercounty groundwater migration has altered individual rights to states rights for the common good. In DC our one true federal endangered species is an isopod related to the quality of groundwater and springs. FIFRA laws and groundwater in the city involves rat poison

in subway waters, spraying street trees, plus chemical care of golf course and garden pests and weeds. Much of the recreational land for golf and gardens in DC is under the NPS which does not allow use of these substances. Lawn fertilization and spraying by companies is currently under scrutiny for controls by the city.

6. Buried landscapes in a 200 year evolution of the urban environment also haunt us through the groundwater regime. Buried stream valleys, sewered or not, become slow conduit of migration especially for contamination. The chemistry of estuarine dredge spoil and sludge create a new infiltration medium for groundwater interaction. The history of each neighborhoods land use changes may leave problems behind especially where heavy industry was replaced by other uses. Filled-in and built on tidal marshes and bogs still contribute to the deterioration of groundwater because these sites were not labeled or recognized as point sources or point repositories. The history of the development of the urban environment is an important link in the study of groundwater geomorphology.

7. Urbiscape development in our modern city has recreated a whole new host of scientific processes for groundwater management. Among the most interesting in DC are: underground ponding from tunnels and highrise basements; bathtub effect in tree planting; controlled freezing with liquid nitrogen; city water irrigation or sprinkling systems;redirected flow from construction site pumping or from trenching utility lines; overpumping; addwatering; inter aquifer leakage from drilling; broken water and sewer pipes; dewatering subsidence; quicksand or quickclay conditions; flow rate chemical changes; underground piping (erosion); water table rise and fall chemical changes; the porosity/permeability of back fill material related to the site material; and change of contaminent chemistry with the time of travel and reactions to underground conditions.

Summary

The subsurface environment is a dynamic local system. Each groundwater basin associated with a local stream should be a protected resource. The unsaturated zone must be investigated equally with each groundwater study. The recharge area, drilling punctures and overpumping of confined aquifers must be carefully monitored and managed especially as a water supply for an unknown emergency. The public, the legislators and the science educators must join forces to understand and properly utilize urban groundwater systems for a healthier bay region. The economies of all three cities were once based on the groundwater resource, but now urban groundwater is perceived as non-potable and a nuisance by many in DC. While the quality of our groundwater reflects the our stewardship, it also reminds us to appreciate and monitor the natural resources in the "land of pleasant living". The status of our urban groundwater ecology is a signal. Our commitment to life in the 21st Century revolves around the Bay's stressed hidden resource: its groundwater.

Speaker #2:

GROUND WATER IN PENNSYLVANIA

Mary Jo Brown
Pennsylvania Department of Environmental Resources

Even though ground water provides over 90 percent of the fresh water in Pennsylvania, groundwater protection and management has not been emphasized as much as surface water. On a state-wide basis, ground water contributes approximately 70 percent of all stream flow under average conditions. Approximately one third of the state's population relies on ground water for domestic use. Almost all private supplies and two thirds of the public water systems depend on ground water as their water source.

Documented groundwater problems in the state include elevated levels of iron, sulfate, dissolved solids, hardness, and acidity in the coal mining regions of western and eastern Pennsylvania. Elevated nitrate-nitrogen problems have been found in the southcentral and southeastern sections of the state while leaking underground storage tanks have been responsible for local groundwater problems statewide.

Since the 1960's the commonwealth has been becoming more aggressively involved in groundwater protection. Some of this involvement has been the result of federal expansion into areas such as solid waste, hazardous waste, leaking underground storage tanks and mining regulation and some has been the result of state program initiatives.

Monitoring is an essential part of Pennsylvania's ground water strategy. Monitoring generally consists of two types; ambient monitoring and source monitoring. Ambient monitoring involves the collection of data from an area for the purpose of characterizing the water quality in that area. In contrast, source monitoring involves gathering data from an area to determine the impacts of specific activities on water quality.

In the early 1980's Pennsylvania started work on developing a systematic statewide ground water ambient monitoring program. The first phase of this program involved delineating and prioritizing the ground water basins. Fixed station sampling networks were established in higher priority basins with actual data collection beginning in 1985. It is anticipated that this program will provide information on the overall groundwater quality in Pennsylvania and will indicate areas in the state that have or may develop water quality problems.

Source monitoring has been the traditional type of groundwater monitoring conducted in Pennsylvania. In this type of monitoring a problem is identified and monitoring is conducted to determine the extent and severity of the problem.

One groundwater source monitoring program in Pennsylvania is part of the Conestoga Headwater Rural Clean Water Program (RCWP) project. This federal program provided money to farmers for the installation of Best Management Practices (BMPs) in the upper Conestoga River basin. Additional funding was provided to evaluate the effects of the BMPs on water quality. Ground water was monitored in the entire 188 square-mile area and on two farm field sites. The monitoring conducted in the entire project area showed that high nitrate-nitrogen and detectable pesticide concentrations were associated with agricultural land use and carbonate geology. The field site monitoring has shown that there can be wide variations in nitrate concentrations in the ground water within a very small area. For example, from 1984 through 1989 at a 48-acre site, nitrate concentrations ranged from 130 to 7 mg/l at the 8 groundwater sampling locations.

WORKSHOP #4: ERODING SHORELINES

Jack Frye, Moderator, VA Division of Soil and Water Conservation

Speaker #1:

VIRGINIA'S SHORELINE PROGRAMS: MISSION AND NONPOINT SOURCE POLLUTION RESEARCH

Carlton Lee Hill
Virginia Department of Conservation and Recreation
Division of Soil and Water Conservation
Shoreline Programs Bureau

The Commonwealth of Virginia is blessed with over 5,000 miles of tidal shoreline. Programs provided through the Department of Conservation and Recreation, Division of Soil and Water Conservation's Shoreline Programs Bureau enable local governments and private property owners on tidal waters to receive technical assistance and advice concerning Coastal Zone Management, as it relates to shoreline erosion and public beaches. Additionally, shoreline resource information archived at the Virginia Institute of Marine Science (VIMS) is provided to targeted user groups and the general public.

All property owners along tidal shoreline can request and receive assistance from the Shoreline Erosion Advisory Service, better known as SEAS. SEAS's engineers provide on-site inspection and technical analysis of shoreline erosion followed by written recommendations covering environmentally acceptable erosion control measures. Other services include contract review and construction inspection for properties previously assessed. Technical information is also provided to localities developing and administering coastal zone management programs. SEAS can provide guidance in establishing setbacks, minimum construction standards for erosion control structures and determining shorelines where non-structural measures are adequate for protection of private property.

To maintain and improve recreational beach access on tidal waters, a 50/50 matching grant fund for localities is administered by the Board on Conservation and Development of Public Beaches. Approximately 24 miles of public beach, as defined by the Board, exists within the Commonwealth. The Shoreline Programs Bureau provides administrative services and technical assistance to the Board. Localities are provided technical and financial assistance in planning and implementing beach projects.

A final aspect of the Bureau's activities provides direction and coordination of generic and applied shoreline erosion control research among other state agencies, universities and the federal government. Efforts include development and evaluation of innovative erosion control structures and marsh grass plantings for erosion control. Through annual contracts with VIMS, information is collected and databased on beach quality sand resources, public beach monitoring, wave data collection and native sand inventories. A hydrodynamic computer model has been developed to predict shoreline change as a result of wave and current interaction. Information from these databases are disseminated by the Bureau to local governments, engineering/design consultants, environmental interest groups and the general public.

Sediment and Nutrient Contributions of Eroding Banks

In the 1987 Chesapeake Bay Agreement, the participants targeted nitrogen and phosphorus contributions to the mainstem of the Chesapeake Bay for a 40% reduction by the year 2000. To meet this goal, all possible sources of point and nonpoint source nutrient inputs need to be examined. Although research has been or is being conducted on agricultural, atmospheric and groundwater contributions of nonpoint source pollution, the role of sediment and nutrients from tidal shoreline erosion has not been addressed.

To examine the role of sediment and nutrients from tidal shoreline erosion, 14 eroding banks were selected on the Chesapeake Bay, Potomac, Rappahannock, York and James Rivers. Site selection was based on historical erosion rates of greater than 2.0 feet per year and erosion volumes of greater than 1.0 cubic yard per foot per year. Most sites were also located within 1400 feet of living marine resources. Soil samples were collected and analyzed for grain size, total nitrogen, total phosphorus and inorganic phosphorus.

Results of grain size analysis indicated a large difference between shore sediments and fastland sediments which can be attributed to the transport of fine grained fractions away from the foreshore. Fastland nitrogen and phosphorus concentrations were not found to differ significantly among the sites. Nitrogen concentrations at the sites showed a more consistent relationship with grain size and bank height than phosphorus concentrations. Nutrient loading rates differed among the sites due to the influence of bank height and erosion rate on the calculated volume rates.

A quantitative comparison of upland erosion with shoreline erosion indicates that the large volumes of material lost by shoreline erosion processes result in large nutrient inputs directly into receiving waters. An estimated 1.37 million pounds per year of nitrogen is entering the Bay ecosystem through shoreline erosion. This quantity of nitrogen is equivalent to 5.2% of the controllable nonpoint source nitrogen load. Additionally, an estimated 0.94 million pounds per year of phosphorus, equivalent to 23.6% of the controllable nonpoint source phosphorus load, is entering the Bay ecosystem. Further research is needed to better determine the total magnitude of nutrient inputs from shoreline erosion and to determine the influence of the shoreline erosion contribution on the 40% nutrient reduction goal.

Speaker #2:

MARYLAND'S SHORE EROSION PROGRAM

Chris Zabawa
MD Department of Natural Resources
Capital Programs Administration
Shore Erosion Control Program

Introduction

In the overall context of any Chesapeake Bay pollution control strategy, an important contribution towards reducing sediment and nutrients comes from the stabilization of eroding shorelines in the State of Maryland. This section of the conference proceedings presents a short overview of the problem of shore erosion in the State of Maryland, and a brief description of the State of Maryland's shore erosion control policy and programs.

Overview of the Problem

The shores of the Chesapeake Bay, tributary rivers, and streams in Maryland have a total length of more than 4,360 miles. Comparison of US Coast and Geodetic Survey charts dating back as far as 1841 with the latest available charts shows 1,221 miles (or 28%) of shoreline on the Bay in Maryland is eroding at rates which can be measured over the last few decades. The breakdown is as follows:

885 miles (20%) - eroding at 1-2 feet per year
206 miles (5%) - eroding at 2-4 feet per year
72 miles (2%) - eroding at 4-8 feet per year
57 miles (1%) - eroding at greater than 8 feet per year.

Impacts

Nearly 25,000 acres of shorefront land in Maryland were eroded away between the mid-1800s and 1947, and the continuing loss of land due to shore erosion is estimated at 325 acres per year. Other impacts include the loss of natural resources (beaches, timberlands, and agricultural lands); the loss of standing structures (houses, and other structures of historical significance); and the release of sediments, with resulting degradation of water quality and aquatic habitat.

Maryland's Shore Erosion Control Program

The Maryland Shore Erosion Control (SEC) Law legislates a program of financial assistance which includes interest-free loans for the design and construction of engineering structures, including groins, bulkheads, and revetments. The loans are repaid over 25 years. As part of the Chesapeake Bay Initiatives Legislation, the SEC Law was expanded to provide for a program of matching grants for vegetative erosion control projects. The law also provides for free technical services to be provided to shorefront property owners who request assistance in identifying erosion problems and seeking solutions for erosion control.

Annual funding for the design and construction of projects for which loans are issued generally consists of $2 million in general revenue funds and $800,000 in loan repayments. (The SEC Law provides for a "revolving loan fund" where loan repayments from property owners are reused to issue additional loans to qualified persons on the waiting list.) For work on State lands, the Capital Budget also provides an average of $1.5 million per year. A separate appropriation provides the funds for the Ocean City Beach Replenishment and Hurricane Protection Project.

During the past-20 years, the Maryland SEC Program has received appropriations in the amount of $22 million for loan projects. In addition, $6.5 million in loan repayments has been "recirculated" through the Revolving Loan Fund to provide for additional financial assistance. Another $8 million in Capital Funds has been expended for work on State lands. The projects for which loans have been issued have protected better than 35 miles of shoreline on the Chesapeake Bay and its tributary rivers in Maryland.

Since 1985, funds have also been appropriated by the Maryland General Assembly for the program of matching grants for vegetative projects. A total of $1.5 million in State General Funds have been made available, and have been supplemented by grants from the EPA Chesapeake Bay Program totalling $1.9 million. These funds have been used to encourage the revegetation of more than 10 miles of Maryland shoreline with wetlands species since 1985, either by providing grants to individual private property owners, or by undertaking "Demonstration Projects" in different geographic areas of Maryland.

The States of Maryland and Virginia also participate with the Norfolk and Baltimore Districts of the US Army Corps of Engineers in the Chesapeake Bay Shoreline Protection Study. The program has produced Reconnaissance Reports and detailed project reports which will be used to seek funds from the Federal Government for the design and construction of projects to protect critically eroding areas of the Bay. Demonstration Projects have also been undertaken to restore wetlands along the shoreline, in conjunction with offshore breakwaters, and sills.

Besides providing locations where the public can inspect wetlands restoration projects, the Demonstration Projects also provide valuable laboratories for monitoring the effectiveness of installations, and are yielding a wealth of valuable data which will improve the design of vegetative projects.

LUNCHEON
Tuesday, February 27

NUTRIENT MANAGEMENT SPEECH

Speaker:

Hon. Jeffrey Coy
PA General Assembly

On behalf of the Pennsylvania delegation to the Chesapeake Bay Commission, I have introduced legislation which would establish a "Nutrient Management Act" in Pennsylvania.

The legislation has triggered a significant amount of interest, to say the least. I'd be lying to you if I denied that its generated some controversy as well. But those of us that advance new policy initiatives are used to that.

The new policy in the legislation which has generated all the attention is one that makes nutrient management planning on the farm a mandatory obligation. We have a voluntary program in Pennsylvania that has worked quite well by all indications and has been well received by the agricultural community throughout our portion of the basin.

Given the success, some have legitimately raised the question of why we need to go to a mandatory approach. We think we have good reason for it.

As I am sure most of you are well aware, the Susquehanna not only provides 50% of the Bay's fresh water, it also brings along 3 million pounds of phosphorus and 121 million pounds of nitrogen each year to the Bay. Our best data reveals that 82% of the controllable nitrogen load and 63% of the controllable phosphorus load comes from agricultural nonpoint sources. It also reveals that more than half of that total load comes from animal manure.

We re knee deep in it, to say it mildly. As a comparison, you should know that Pennsylvanians generated 12 million tons of solid waste every year. But as significant as that number is, you should also know that for each ton of trash we humans wheel out to the curb, the animals we raise generate two tons of manure, or 25 million metric tons per year. That's why Pennsylvania's program has focused so sharply on the manure issue thus far.

We have all made a commitment to reduce controllable nutrients by 40% by the year 2000. Pennsylvania's share translates to a 1.3 million pound reduction for phosphorus and a 24 million pound reduction for nitrogen. Furthermore, in addition to reducing our 1985 levels by these amounts, we must also limit by 100% all new sources; be they agricultural, suburban or whatever, so that there's no new growth in the total load.

This is a courageous goal, to say the least. We have tried to address the phosphorus portion with better soil management practices and the invitation of P-ban legislation (which I sponsored), but the greater problem of nitrogen still eludes us. In fact, under our voluntary program we have spent close to $9 million to date and we estimate a resulting annual nitrogen reduction of 761,000 pounds. That's less than a million in 5 years. We've got another 23 million to go and only 10 short years to get there if we want to hit our target. And as others have alluded to at this conference, we may also have to do more with phosphorus because some of our original assumptions are off.

That's why we want to go beyond the voluntary and institute a prudent mandatory approach. Voluntary is good, but it is not enough.

The legislation will require our state conservation commission to develop criteria for use in writing nutrient management plans. The framework for that criteria has actually been developed under our voluntary program, where nutrient management planning is required for participation in the cost-share-program.

Within two years thereafter, anyone conducting commercial livestock or poultry operations, or any person conducting agricultural operations on whose land manure is applied, will be required to develop a nutrient management plan and fully implement that plan with 5 years thereafter. This should give farmers sufficient time to implement new practices without unduly burdening them.

For high density livestock and poultry operations, those plans must be reviewed by local conservation districts for approval. And if these operations are located in high priority watersheds, they must implement their plans within three years rather than five.

Besides imposing planning requirements on agriculture, the legislation will also force the appropriate state agencies to assess the impact of other more insidious nonpoint sources of nutrient pollution and come forward to the general assembly with some concrete recommendations. This would include things like malfunctioning septic tanks, urban runoff, residential application of fertilizers, improper water well constructions, and the like.

We think its a bold initiative, but we by no means think its the answer to all our prayers. We think it's a prudent first step beyond a voluntary program. If nothing else, planning to keep our nutrients on the farm and out of the bay would be tremendous accomplishment.

When a farmer is forced to look at how much nutrient is in the soil, how much needs to be applied, as well as the best way to keep it there for crop use, then I submit we'll have the problem half licked. And we think the time has come when its appropriate to say to the farmer: "YOU MUST PLAN."

Thank You Very Much.

WORKSHOP #5: RIPARIAN BUFFERS: DO THEY WORK?

Bruce James, Ph.D., Moderator, University of Maryland

Speaker #1:

LITERATURE SUMMARY AND ANALYSIS OF THE ROLE OF FOREST BUFFER STRIPS IN REGULATING NONPOINT SOURCE NUTRIENT LOADS

Joseph F. Tassone
Natural Resources Planner
Maryland Department of the Environment

Introduction

Forest strips along stream channels affect nutrient and sediment loads, and therefore water quality, in two principal capacities. First, their presence adjacent to streams results in lower direct nutrient yields to streams than would occur if the land were in other uses, due to their inherently lower export rates. Second, when discharge waters from upslope land uses pass through a buffer area in groundwater, in streams with natural hydraulic regimes and channels, and as diffuse overland flow, nutrients and sediment from those upland sources are retained, often at very high rates, within the buffer area. Stated another way, less nutrients are contributed to the stream from the buffer strip acreage itself in all cases; and in many cases, the buffer strip actually reduces the load delivered to a stream from other land uses within the watershed upslope of the buffer strip.

The ability of forested buffer strips to reduce delivery of nutrient loads from more intense land uses may be roughly estimated from existing data. The term "roughly" is used because the effectiveness of buffer strips in this capacity will vary considerably with conditions in the landscape. However, the hydrogeologic and biological parameters which determine the capability of buffer areas to regulate nutrient export can be clearly inferred from existing work, and effectiveness can be predicted in association with these parameters. The following synopsis of buffer strip effectiveness was developed from work by Peterjohn and Correll, 1984 (Ecology 65:1466-1475); Lowrance et al., 1983 (Agriculture, Ecosystems and Environment 10:371-384); Cooper et al., 1986, Fail et al., 1986 and Schnabel, 1986 (all from Watershed Research Perspectives, Smithsonian Institution Press); and Patrick and Smith, 1975 (USDA For. Serv. Res. Paper NE-324).

In those studies which calculated watershed nutrient budget parameters (Cooper et al. 1986, Peterjohn and Correll 1984, and Lowrence et al. 1983), 86, 87, and 67% of the nitrogen loads and 50, 79, and 25 % of the phosphorus loads released from upland land uses were estimated to be retained within buffer strips on an annual or longer basis. Cooper et al. estimated that 88% of the sediments and over 50% of the phosphorus from upland sources were retained within riparian buffer areas over a 20 year period in one watershed studied. And Schnabel (1986) observed 50% reductions in nitrate concentrations in shallow subsurface flow through a riparian area between agricultural fields and a receiving stream. Other data reported for these studies identify the mechanisms involved in these reductions, and indicate the conditions under which similar results can be expected.

In summary, forested buffer strips can be expected to significantly reduce nutrient transport whenever there is extensive contact between upland discharge waters and forest soils and vegetation. Appreciable contact and nutrient reductions occur under several common hydrogeologic conditions, described below. These include shallow lateral groundwater flow, flow in natural stream channels, and overland flow.

Groundwater Flow

Buffer strips are very effective in retaining nutrients, particularly nitrogen, where shallow groundwater movement occurs near streams. This function may be appropriately considered one of filtering. In each of the studies cited which report appropriate data, it is, from a quantitative standpoint, the most important mechanism through which forest buffers act to prevent excessive enrichment of aquatic systems. It occurs on both small and large streams in the Coastal Plain, where permeable soils are underlain by shallow, unconfined aquifers; in areas where permeable surface soils are underlain by slowly or impermeable subsurface layers; in the Ridge and Valley Province, where slopes are steep and layered soils result in shallow groundwater flow (interflow); in many headwater areas and on low order streams throughout the Piedmont and Coastal Plain, where significant proportions of streamflow originate from shallow groundwater flows; and, in general, wherever enriched groundwater approaches the soil surface near stream channels such as at the heads of some ephemeral (spring-fed) streams, around the perimeter of non-tidal wetlands, and in some cases where groundwater flows emerge within stream channels.

All of these areas function to filter nutrients from upland discharges moving primarily in groundwater. In order to be most effective, the intensity of agricultural and development activity in the contributing land area must be limited so that the discharge pattern within the area is not dominated by channelized surface flow. This requires that a significant proportion of the infiltration capacity of the upland area remain intact; that subsurface flows will intersect forested soils in the course of moving down-gradient from the source area; and that the degree to which runoff is concentrated in surface channels is limited. These complementary approaches must be used in conjunction with buffer strips in both agricultural and development applications for maximum effectiveness, because the ability of the forested strips to filter groundwater is essentially bypassed when upland discharge crosses the buffer as channelized flow.

For this reason, the establishment of buffers in headwater reaches is essential to their use as a means of reducing nutrient loads in watersheds with deforested streams. The objective in such areas should be to maximize the percentage of streamflow in a watershed which enters surface channels through forested soils. Deforested upstream channels represent essentially unfiltered inputs, so it is important to extend buffer establishment to headwaters. Priority locations should be those where the greatest volumes of groundwater discharge and shallow groundwater flow occur. In many watersheds, this will in fact be in headwater areas.

Flow in Surface Channels and Overland Flow

One study examining surface flow through a buffer strip in a natural Coastal Plain channel (Peterjohn and Correll, 1984) reported reductions of 15.7 kg-N/ha of buffer strip (an 87% reduction of channel inputs) and 2.97 kgP/ha (also an 87% reduction). Based on concentration data, the majority of nitrogen retained was in the forms of particulate organic-N and nitrate; phosphorus was retained primarily in particulate material, although some reduction in orthophosphate was observed.

Cooper et al. (1986) and Jacobs and Gilliam (1983, Nitrate Loss from Agricultural Drainage Waters, Water Res. Inst., U.N.C.) report on nutrient retention and removal of nitrogen, phosphorus and sediment in a group of watersheds in North Carolina's Lower and Middle Coastal Plain. Sediment and phosphorus movement was examined in a Middle Coastal Plain watershed with slopes 2 to 7% and slope lengths which result in some erosion potential. Here, the authors estimate that nearly 90% of the sediment and over 50% of the

phosphorus moving from the uplands over the past 20 years has been retained in riparian areas
(on headwaters and low order streams) and flood plains (on larger streams), with the former accounting for the majority of sediment deposition and phosphorus retention.

Area and Width Requirements for Effectiveness

The literature previously cited provides useful guidelines regarding the relative areas and widths of buffer strips required for sizable reductions in nutrient loads exported from upslope areas in hydraulically similar conditions. Two studies reporting relevant data showed retention of 11 kg of nitrogen and .54 kg of phosphorus for each hectare of contributing agricultural upland by a buffer area comprising 30% of the total watershed area (Lowrance et al. 1983); and 34 kg-N and 1.6 kg-P per hectare by a buffer area comprising 36% of the watershed (Peterjohn and Correll 1984). These per-unit-area retention rates represent from 67 to 87% of the total N loads and from 25 to 79%of the total phosphorus loads received by the buffer zones in both surface and subsurface discharge.

Based on these data, a reasonable initial expectation is that such removal rates are achievable, under appropriate conditions, with approximately 1/3 of a watershed in forest cover, distributed predominantly along stream channels. However, based on the three studies reporting concentration data as a function of distance through the buffer, much of the nutrient removal was accomplished within 19 m (Peterjohn and Correll, 1984), 16 m (Cooper et al., 1986), and 15 m (Schnabel, 1986) of buffer strip. Hence, buffer strips of 50 to 65 ft. or greater in width, on each side of surface channels, can be expected to effectively reduce loads from contributing areas under appropriate hydrogeologic conditions. Where soils are less permeable and/or less subsurface water moves through short, shallow flowpaths than observed in these studies, wider buffer strips and a higher ratio of permeable to impermeable surface area in the contributing area would be needed to effect similar retention of nutrient export from uplands.

Mechanisms of Removal

A variety of mechanisms through which retention and removal of nutrients take place in buffer strips are reported in the literature cited. The following is a synthesis of these findings, integrated with some basic concepts on nutrient cycling and transport, which attempts to summarize the principal mechanisms at work.

Effectiveness on a given buffer strip site will be a function of rates of denitrification (for N), vegetative uptake (for both N and P), deposition, and adsorption (for P). These rates are in turn dependent upon both physical site characteristics (i.e. soils, topography, and site hydrology), and the attributes of the particular forest habitat. The physical site characteristics determine the relative proportions of discharge which traverse the buffer strip as deep groundwater, shallow groundwater, overland flow, and channelized flow. They will also influence the flow rates through each of these components, which in turn affects contact time between the nutrient load transported in the water and the soil, microorganisms, vegetation and bottom sediments which carry out the removal of nutrients. The specific forest attributes which appear critical include dense and diverse vegetation, (particularly decidous trees) which stabilizes soil, slows flow, and contributes organic material; high rates of both uptake and evapotranspiration of water; very rapid recycling of nutrients, which prevents mineralized forms from leaving the buffer; facultative increases in nutrient uptake in response to increased nutrient inputs; the presence of high organic content in the soil/litter, facilitating denitrification; and biological activity in the soil profile, which maintains permeability and texture, increases soil-water contact time, and probably maintains the availability of cation exchange sites within the soil.

Conclusion

Forest buffer strips will be extremely effective in controlling nutrient loads from upslope intensive land uses throughout much of Maryland when discharge patterns from these areas are properly managed. The extent and distribution of cover types, and the pathways through which rainfall leaves the site, are the major management elements of interest. The presence of forest buffers will reduce delivered loads under any circumstances by generating lower direct nutrient yields than alternative uses adjacent to a stream, and by minimizing lateral inputs to the stream. Ideal deployment of buffer strips would involve their use from headwaters to estuaries, but significant reductions in existing loads can be realized from judicious implementation in parts of a watershed. For the purpose of reducing existing loads, focus should be on headwaters, floodplains, and other areas where groundwater discharges and shallow subsurface flow occur. Protection of remaining buffer areas, on both perennial and ephemeral streams in Maryland's Bay watershed, appears to be essential if load increases from new development and other land use changes are to be adequately controlled for the purpose of achieving the State's nutrient reduction commitment.

Speaker #2:

EFFECTS OF VEGETATIVE FILTER STRIPS AND RIPARIAN BUFFERS ON SURFACE WATER QUALITY

Theo A. Dillaha, Associate Professor
Agricultural Engineering Department
Virginia Polytechnic Institute and State University

Riparian buffers and vegetative filter strips (VFSs) are bands of planted or indigenous vegetation that are situated between pollutant source areas and receiving waters to remove sediment and other pollutants from surface and subsurface flow. Riparian buffers are usually composed of indigenous vegetation while VFSs are usually composed of grasses and are specifically designed to remove pollutants from surface runoff. Both of these practices are being heavily promoted by state nonpoint source (NPS) pollution control programs in Virginia and Maryland, but little reliable data is available concerning their effectiveness. Currently, there are no standards or accepted methods for VFS design and many VFSs are installed in areas where they are ineffective for pollutant reduction or their effectiveness is grossly over-estimated (Dillaha et al., 1989a). This presentation deals primarily with the role of grass VFSs in removing pollutants from urban and agricultural runoff, but the same principles are also applicable to riparian buffers.

The major pollutant removal mechanisms associated with VFSs involve changes in flow hydraulics which enhance infiltration, deposition, filtration, adsorption, and absorption of pollutants. Essentially this means that if the VFS vegetation can slow surface runoff down, then there will be more opportunity for sediment and sediment-bound pollutants to settle out and more opportunity for surface runoff and soluble pollutants to infiltrate into the soil. Numerous researchers have found that under experimental conditions, grass VFSs are effective for sediment removal as long as flow is shallow and the VFS are not inundated with sediment. However, sediment trapping efficiency decreases dramatically at higher runoff rates which inundate the media (Dillaha et al., 1989b; Hayes et al., 1979). Flow conditions of this type would be expected under field conditions where runoff concentrates in internal field drainageways before reaching field boundaries. Several other short-term experimental studies reported on the effectiveness of VFS in reducing nutrient, bacteria, and organics concentrations in agricultural runoff (Dillaha et al., 1989; Doyle et al., 1977; Magette et al., 1989; Norman et al., 1978; Young et al., 1980). These studies reported that with shallow flow in-experimental plots, VFSs had sediment and sediment-bound pollutant trapping efficiencies exceeding 50%. Dissolved pollutants such as nitrate and orthophosphorus, however, were not removed as effectively and several studies reported that runoff from VFS often had higher concentrations of dissolved nutrients than the runoff entering the VFSs (Dillaha et al., 1989b; Magette et al., 1989). This was attributed to the conversion of previously trapped sediment-bound nutrients to soluble forms that were subsequently released to surface runoff. VFS plots with concentrated flow, similar to that expected under Geld conditions, were reported to be 20 to 50% less effective than shallow flow plots for pollutant removal (Dillaha et al., 1989b).

VFS performance in the field was evaluated by observing VFS on 18 farms in Virginia (Dillaha et al., 1989a). Filter strip performance was reported to fall into two categories depending upon site topography. In hilly regions, VFSs were judged to be ineffective for pollutant removal because most surface runoff concentrated in natural drainageways within the fields before reaching the VFSs at the field boundaries. Flow across these VFSs during larger runoff producing storms, the most significant in terms of water quality, was primarily concentrated and the VFS were locally inundated and ineffective for pollutant removal. This assessment was confirmed by the fact that very little sediment accumulated in the majority or the VFSs observed in hilly regions.

In flatter regions, such as the Virginia Coastal Plain, VFS appeared to be more effective. Slopes were more uniform, and larger portions of stormwater runoff entered the VFSs as shallow flow. This observation was supported by significant sediment accumulations in many of the Coastal plain VFSs. Several one to three year old VFSs were observed that had trapped so much sediment that they were higher than the fields they were protecting. In these cases, runoff flowed parallel to the VFS until a low point was reached where it crossed the VFS as concentrated flow. These VFSs needed maintenance to regain their sediment trapping ability, but landowners had no economic incentive to perform the maintenance.

Recently, researchers have begun investigating the effectiveness of riparian buffers in removing pollutants from cropland runoff. Riparian buffers in North Carolina have been reported to trap 84 to 90% of the sediment (Cooper et al., 1987) and 50% of the phosphorus (Cooper and Gilliam, 1987) in surface runoff leaving cultivated fields. Riparian zone effectiveness for pollutant removal would be expected to be a function of the degree of concentrated flow entering the riparian zone. Like VFSs, riparian buffers will be most effective for pollutant removal when flow into the riparian zone is shallow and distributed throughout the riparian zone.

Several models have been developed or used for VFS design and evaluation, but these models simulate only single storms and cannot quantify the long-term effectiveness of VFSs. No riparian zone models currently exist. Consequently, most VFSs are installed based upon local customs or regulations which do not consider long-term effectiveness and site specific conditions such as the occurrence of internal field drainageways. Until reliable design methods and models are developed, the effectiveness of riparian buffers and VFS for pollutant removal will continue to be over-estimated and water quality goals will not be achieved. Sites in which most of the runoff crosses the VFS as concentrated flow are probably not suitable for VFS.

Lastly, it should be remembered that riparian buffers and VFSs are a last defense against pollution. They are much less desirable and effective than in-field best management practices (BMPs) such as conservation tillage, contouring, terracing, strip cropping, and nutrient and pest management which reduce pollutant generation and keep sediment and chemicals in the field where they are beneficial. VFSs cannot replace these practices, but they can "polish-up" surface runoff when used in conjunction with BMPs. It should also be remembered, that even though VFSs and riparian buffers may be ineffective for pollutant removal in many areas, they are still beneficial because they provide valuable wildlife habitat, localized erosion protection along streambanks where erosion is often most critical, and prohibit land disturbing activities immediately adjacent to water bodies.

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SPEAKER #3:

"RIPARIAN BUFFERS - MARYLAND'S APPROACH"

Jeffrey L. Horan
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MD Department of Natural Resources
Forest Park and Wildlife Service

Forests are known to be the most protective land use surrounding the Chesapeake Bay. Because of this, many of Maryland's programs target the retention or restoration of forested buffers, also known as riparian buffers, adjacent to streams and waterways throughout the State.

It is important to understand why forests and, therefore, forested buffers are so effective at protecting water quality.

Rain has a very destructive nature with regard to unprotected soil. As rain falls from the clouds, it is constantly accelerating at a rate of 32 feet/second. This is easily enough energy to dislodge soil particles when there is no vegetation protecting the soil. As the water begins to move on the ground from a sheet flow condition to concentrated run-off, it is able to carry more soil with it, creating rills and gullies as it goes. This runoff often carries nitrogen in its nitrate form, and phosphorus bond to the dislodged soil particles.

In a forested situation, you have an upper canopy that can intercept the rainfall and reduce the destructive energy of the raindrop. In many forests a multi-teared structure exists where there are numerous canopy levels that will further defuse the rains energy. These many layers of canopy also provide habitat for a plethora of forest dwelling creatures. Different varieties of these creatures may live at different levels of this vertical habitat.

Finally the raindrops energy is completely dissipated when it reaches the herbaceous cover and the forest floor itself.

The forest floor is the key to the tremendous infiltration capacity of the temperate forest. The forest floor blankets the soil with three fairly distinct protective layers or horizons. The first or Oi horizon is made up of undecomposed organic matter such as leaves, twigs, bark and wood. The Oe is made up of partially decomposed organic matter. Very fine tree roots as thin as fishing line are also part of the structure of the Oe horizon. The Oa is the guey, very well decomposed organic matter that is now completely unrecognizable. In Maryland, it is not unusual for these three layers combined to be 6 inches or more in depth. Because of its incredible infiltration capacity the forest floor is often called "nature's sponge".

This infiltration process in which water passes through the surface layer of the forest soil has been carefully studied: using ring infiltrometers and percolation measurements, infiltration rates over 5O-inches per hour have been measured in deciduous forest stands (Horbeck and Reinhart, 1964). Rain greater than 6 inches, over a 24-hour period, is 1/4 inch per hour and would not begin to approach the infiltration capacity of most forest soils. Infiltration capacities of forest not only exceed rainfall, they can absorb overland flow from adjacent agricultural land (Curtis, 1966).

Studies by Gillian, Lawrence and Correll have shown that wooded riparian areas as narrow as 50 feet in width, can completely remove excess nitrogen as it moves from the farm field through the riparian area to the adjacent stream (Meckley, Wrabel, et al). New research by James has also shown that the type of vegetation present on the site is a major factor in the ability of a riparian buffer to remove nitrogen from ground water. This same research shows nitrogen removal on red oak and black cherry dominated sites throughout the winter months. Results also indicate nitrogen removal by leguminous species like black locust has not been nearly as effective as the oak and cherry buffers (James). Nutrient retention by forests adjacent to agricultural land was estimated at 80% for phosphorus and 89% for nitrogen in the Rhode River watershed (Correll, 1983). Similar studies in North Carolina showed a reduction of 80% of the nitrogen leaving agricultural land as it passed through a forested buffer adjacent to a water course (Gillian, Skagg, 1983).

Retentior of forests became a major focus of Maryland's Chesapeake Bay Critical Area Protection Program hecause of the forests ahilitv to absorb water and filter out damaging nutrients and other pollutants from runoff and groundwater.

A "no net loss of forest land" approach was taken in the 1,000 foot strip of land adjacent to the Chesapeake Bay and its major tributaries called the Critical Area. The first 100 feet of vegetation next to the Bay and its tributaries became almost inviolate. Where development was allowed to occur in the Critical Area, only 20% of the forest vegetation could be removed, with replacement required on an acre for acre basis. Nonforested sites were required to be brought up to a minimum of 15% forest cover.

When development occurs in Maryland, the project plans are reviewed by foresters, wildlife biologists and natural heritage ecologists to assure that natural resources and sensitive areas are protected wherever possible.

In Maryland it is very clear that the days of engineering the site to meet our particular needs are over. We now are more likely to analyze the site for sensitive areas and species and then determine what development or use would be appropriate.

Some well known scientists, when discussing the needs of the Chesapeake Bay, have taken a slide of the Bay and turned it upside down. The result was an image that looked much like a tree, with the many tributaries feeding the main stem of the Bay being analagous to the tree roots. When the roots die, so follows the whole organism. Recognizing this, Maryland began developing programs aimed at the farthest reaches of the Bay's tributaries, hundreds of miles from the Bay's main stem.

Maryland's Green Shores forest buffer incentive program is an example of a program that applies techniques begun in Maryland's Critical Area to all the tributaries that feed the Bay. The Green Shores Program has two broad goals:

1. To plant forested buffers adjacent to streams to reduce nonpoint source pollution such as nitrogen, phosphorus and sediment, therefore, protecting the water quality of the Chesapeake Bay and its tributaries statewide. Maryland's Nutrient Reduction Strategy relies heavily on the planting of forested buffers to help us meet the goal of 40% reduction of non-point source nitrogen and phosphorus by the year 2000.

2. To educate the public about the value of trees and forests in watershed and overall environmental protection.

To accomplish these goals we have targeted 1,000 acres on public land and another 1,000 acres on private land directly adjacent to streams. State and local agencies as well as citizen groups such as Save-Our-Streams help locate sites in need of reforestation. If these sites are on public land Green Shores supplies the planting materials, usually seedlings, but occasionally larger balled and burlapped or containerized trees and shrubs. Technical assistance is also available to assure the proper species mixture for a particular site. In many cases, the actual planting is accomplished with the help of volunteers recruited through the Governor's Chesapeake Bay Clean-up Campaign. Last year, in the first year of the program, we involved 1,500 volunteers on nearly 70 sites, planting trees and learning the value of conservation first hand. This year, Maryland's DNR announced the Green Shores Private Land Buffer Incentive Program (B.I.P.). This new program pays eligible landowners (within 300 feet of a Bay tributary) $200 per acre to plant forested buffers, according to a planting plan written by a DNR forester. The program is designed to piggyback on top of existing programs such as the Federal Conservation Reserve Program to provide an attractive incentive to plant forest buffers next to streams.

To make sure programs like these are effective, it is important to educate the citizenry in general about conservation and management of our watersheds. Most people do not realize for instance, that a stream covered by a tree canopy can be 15 degrees (fahrenheit) cooler than one that is not, making a non-buffered stream uninhabitable for fish like trout that require a cool water temperature. Working with the local school systems, we have helped develop curriculum and outreach projects to help students understand the environment around them. Arming our youngest generation with this information should pay large dividends for our future. Working together. . . we can continue to enjoy the many joys of the Chesapeake Bay region.

WORKSHOP #6: HOMEOWNERS AND LAWN CARE

Nancy Ragsdale, Moderator, MD Cooperative Extension Service

Speaker #1:

NUTRIENT LOSSES FROM TURFGRASS

J. Scott Angle
Associate Professor of Agronomy
University of Maryland

Turfgrass is currently the mid-Atlantic region's most valuable agricultural crop. In addition, it ranks second in acreage, behind only corn. Further, as the rate of urbanization increases, a concurrent increase in acreage planted to turfgrass will occur. It is predicted that within the next few years turfgrass will become the predominate cultivated crop throughout the region. The extensive acreage of turfgrass in the Chesapeake region, coupled with the intensive use of fertilizers and pesticides, makes these areas very important as related to quality of the Chesapeake Bay. Unfortunately, very little research has been conducted to investigate pesticide and nutrient losses from turfgrass and subsequent movement into the Chesapeake Bay.

The focus of the current paper will be to discuss the work we have conducted at the University of Maryland and to examine the limited data available elsewhere. Our investigations at the University of Maryland have examined nutrient losses from turfgrass both via leaching and runoff. Leaching of nitrates out of the root zone of turfgrass was found to be extremely low, with losses much less than that observed from properly fertilized corn or soybeans. The metered application of fertilizer to the turfgrass coupled with the rapid growth potential ensured that excessive pools of nitrates were never available for leaching. We also examined runoff losses of fertilizer nutrients (phosphorus and nitrogen) from turfgrass. Losses were initially estimated from natural rainfall events. We found however, that runoff losses from turfgrass were so small that they were often difficult to quantify. The dense, thatchy nature of turf prevents the generation of runoff from all but the heaviest of rainfall events. We subsequently examined runoff losses from turfgrass when the runoff was generated with the use of a rainfall simulator. It was observed that turfgrass dramatically reduced runoff losses when compared to barren soil. Even a poor quality stand of turfgrass significantly reduced runoff losses.

Several other studies have reported similar results. In all studies, runoff and leaching losses of nutrients from turfgrass have been found to be minimal. The lack of observed losses from turfgrass raises the question as to the fate of the applied nutrients. The most likely theory is that the thatch layer is immobilizing most of the nutrients which are applied to the turfgrass. From the time of turf establishment to approximately 25 years after establishment, the thatch layer is increasing in thickness and density. Thus, it is possible that the nutrients are being incorporated into the thatch.

A question arises as to the fate of the immobilized or newly added fertilizer nutrients after the thatch layer reaches establishment equilibrium (ie. the thatch layer is decomposing as fast as it if forming). To date, no research has examined the fate of fertilizer nutrients on well-established turfgrass. It is postulated, however, that because established turfgrass does not have the capability to immobilize added fertilizer nutrients, fertilizer applications could potentially result in significant losses of nutrients to the environment.

Only a very limited number of studies have examined pesticide losses from turfgrass. The studies have tended to be somewhat incomplete and thus not fully representative of actual potential losses. With this in mind, it should be noted that losses of pesticides from turfgrass appear to follow a similar pattern as losses reported for nutrients. Extremely small quantities of pesticides are found in both runoff and leachate from turfgrass. It is generally believed that minimal pesticide losses are related again to binding within the thatch layer. Therefore, while losses from recently established turfgrass are generally low, we know nothing about potential losses from established turfgrass.

In conclusion, the preponderance of evidence suggests that nutrient losses from newly established turfgrass is minimal. Further, pesticide losses, while not as strongly supported, also appear to be very low from turfgrass. The problem of pesticide and nutrient losses from turfgrass remains unresolved due to the lack of information regarding losses from well-established turfgrass. Since more that one-half of all turfgrass is at least 25 years old, we are not currently in a position to determine whether turfgrass is a significant source of nutrients and pesticides entering the Chesapeake Bay. Additional research is required to answer this very important question.

ACKNOWLEDGEMENT: Portions of the research described above were supported by a grant from the Maryland Department of Agriculture.

Speaker #2:

LAWN CARE AND THE CHESAPEAKE BAY

Marjorie J. Smigel
Springfield Garden Club of Montgomery County, MD

Urban/suburban contribution to deterioration of the Chesapeake Bay has been largely overlooked. Pesticides, developed from research on chemical warfare during World War II, spawned a new service -- the lawn-care industry. Advertising of lawn-care products by the chemical industry has also influenced the homeowner who cares for his own landscape. But most homeowners are unaware they are part of the Chesapeake Bay problem. The pesticide and fertilizer runoff from their properties carries toxic materials that feed into streams and ultimately to the Chesapeake Bay.

A 1980 report of the National Academy of Sciences, Urban Pest Management, raised serious questions concerning excessive use of toxic chemicals for nonagricultural or cosmetic purposes. Specific findings included the following: (l) Suburban lawns and gardens receive heavier pesticide applications than most other land areas in the United States, yet there is no particular federal agency or specific policy to report on poisonings and illness that result, or to monitor problems, as is the case in agricultural application; (2) The public is at risk of exposure that can produce acute or chronic health effects (cancer, sterility, neurological and renal disease, teratogenic effects, behavioral disorders, etc.); (3) Damage to the environment includes toxicity to wildlife and domestic pets, deleterious effect on soil structure, decrease of bird populations, drift, runoff and damage to aquatic environment and fish; (4) Private market process creates incentives to overuse toxic chemicals and without external intervention, private pest control firms and individuals will not take into account impact of their actions on the welfare of others; (5) There is need for public education and for ordinances at state and local levels that emphasize Integrated Pest Management (IPM).

LACK OF REGULATIONS The state and federal laws governing landscape application are weak and poorly enforced. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) does not protect our health nor does it protect the environment. A report of the U. S. General Accounting Office, GAO/RCED-86-97, Nonagricultural Pesticides--Risks and Regulation, estimated that in 1984, 65 million pounds of pesticides were applied around homes and gardens. The findings were that (1) The public is poorly informed about pesticide risks and not aware that they are exposed involuntarily in numerous public places; (2) Professional applicators make deceptive claims that lawn products are safe, harmless or EPA-approved that may lead consumers to believe pesticides are safe although chronic health and environmental risks have not been assessed in accord with current standards; (3) The U. S. Environmental Protection Agency (EPA) has taken limited action against false and deceptive claims.

NEED FOR PUBLIC EDUCATION Homeowners use pesticides and fertilizers unnecessarily and with little understanding of the consequences. The EPA Consumer's Guide to Safer Pesticide Use finds that 9 out of 10 American households use pesticides; that less than 50% read pesticide labels for information; only 9% use pesticide products with caution. Customers may not even realize that "weed and insect controls" or "lawn-care products" are toxic pesticides, or that the EPA risk/ benefit registration formula weighs the benefit (increased crop yields) against the "societal costs" (human deaths, acute and chronic illness, environmental damage).

ENVIRONMENTAL DEGRADATION AND HUMAN HEALTH EFFECTS We are confronted daily with new evidence of the hazards of over-zealous pesticide and fertilizer application, groundwater contamination; diminished and diseased finfish or shellfish population; vanishing songbirds, butterflies and honeybee pollinators; toxic fog containing high concentrations of pesticides. Runoff from urban/suburban areas contribute to the pollution that kills vegetation and aquatic life in rivers. A fourth of our waterways are unsuitable for recreation, according to the EPA.

Human long-term or chronic health effects of pesticide exposure may include lower male fertility, miscarriage, birth defects, chemical sensitivity, liver and kidney dysfunction, heart disturbances, cancer, neurological and immune system disorders, etc. A study reported in the July 1987 Journal of the National Cancer Institute found a nearly seven-fold increase in leukemia for children from homes where pesticides were used indoors and in the garden at least once a month. Unfortunately, physicians may not associate an illness with pesticide exposure.

HOPEFUL SIGNS In response to concerned citizens, Maryland has enacted legislation that requires commercial landscape firms to post a standardized caution sign on property treated with pesticides in order to prevent involuntary exposure of the public. The law requires that such companies give customers appropriate health, safety and environmental hazard information for the product applied. It also provides for prior notification to contiguous or adjacent property owners who are chemically sensitive or have a diagnosed condition or ailment that requires protection from pesticide exposure.

Reports in the media have helped to alert the public to the hazards of lawn-care products. The trend is away from high-maintenance manicured lawns. The new "wildlife" garden reduces grassy areas and features ground covers, native plants and shrubs, wildflowers, trees, rocks, foliage and water. This kind of landscape requires little fertilizer or pesticides and absorbs up to fourteen times more rainfall than mowed grass; thus it reduces runoff and helps prevent stream pollution. Homeowners are planting organic gardens because of their concerns over pesticides in market produce, and real estate agents report that many customers now want to know what pesticides have been applied to properties they are considering.

Lawn-care firms are beginning to respond to customer concerns, and some now offer IPM or non-toxic programs. Regulations need to be drafted to define IPM and ensure that such procedure is actually followed.

Churches are speaking out on the moral and ethical aspects of the ecological crisis. Rachel Carson Council held a symposium last November on "The Ethics of Pesticides." Schools are making environmental education part of the curriculum.

On January 30, 1990, the Montgomery County Executive and Council adopted a county government IPM policy through joint resolution. This was the result of a two-year review of pest management practices in county agencies. The county public school system has already adopted IPM.

The Alliance for the Chesapeake Bay Conference on Nonpoint Pollution is a landmark event and is evidence of the concern and serious commitment of those gathered here to meet the challenge of the nonpoint pollution problem.

WORKSHOP #7: IMPROVING SEDIMENT AND STORMWATER MANAGEMENT

Jessica Landman, Moderator, Natural Resources Defense Council

IMPROVING SEDIMENT AND STORMWATER MANAGEMENT

I. Introduction

A. In ASIWPCA's 1985 study, "America's Clean Water":

38 states reported urban runoff as a major cause of use impairment;

21 states reported construction site runoff as a major cause of use impairment.

B. NURP found that:

Suspended solids in separate storm sewers that drain residential/commercial/light industry are at least an order of magnitude greater than secondarily-treated sewage effluent.

COD loadings from stormwater sewers are comparable to secondarily treated POTW effluent.

77 priority pollutants were detected in stormwater samples taken in NURP. Eleven metals were detected in more than 10% of samples.

C. Important sources of urban stormwater contamination:

1. Construction runoff, industrial site runoff and road runoff.

2. Illegal dumping and illicit connection.

II. Here in the Chesapeake Bay, both conventional and toxic pollutants in urban stormwater play an important role in causing pollution problems.

A. NRDC has made some effort to calculate the quantities of pollutants reaching our waters from urban stormwater runoff.

We used a method developed by the Council of Governments (Tom Schueler). To simplify: we multiplied the amount of runoff in a given time period (i.e., precipitation) by the concentration of a given pollutant in the runoff (based on NURP data) and the land area of the particular urban area. We utilized land use data to break the cities down into a number of land use categories, and made separate calculations for each category.

The results were predictable based on what we know, but they were still startling.

1. Some examples in Baltimore (we compared January October 1989 rainfall to 1988 Toxics Release inventory data):

a. Six times as much zinc was discharged to the Harbor by poison runoff as by industries.

b. Nearly as much copper came from urban runoff as came from industrial discharges.

c. Lead from runoff, 5800 pounds, was more than one-half the total factory discharges.

d. For BOD, the results are even more stark. From January-October 1989, in Baltimore City, we estimate that 3.25 million pounds of BOD were discharged in urban runoff. This dwarfs the estimated factory loadings of BOD to the Harbor, of about 730,000 pounds, about one fourth, in all of 1988.

e. Urban runoff contributed half again as much phosphorous, and one-fifth again as much nitrogen, to the city's waters, as the factories did.

2. Some examples in the D.C. metro area:

a. Three times as much zinc, and almost as much copper and lead, reached the Potomac from poison runoff as was discharged by all Virginia's and Maryland's factories in 1987;

b. Nine times as much phosphorous, eighteen times as much BOD and two-thirds as much nitrogen was contained in Washington area runoff in the first 10 months of 1989, as was discharged in all of 1987 by the Blue Plains sewage treatment plant.

Summary: there is a significant problem and the time is ripe for BOLD solutions.

III. Current State of Federal Stormwater Control Regulations

A. Current law and regulations-to-be are defined by 1987 Water Quality Act.

1. Stormwater has been the orphan stepchild of water quality protection, neither welcomed in point source nor fully admitted in nonpoint source control regime (or lack thereof).

2. EPA had postponed actual regulation of most stormwater sources for over a decade. Litigation by NRDC dates back as far as 1975, when NRDC challenged EPA's effort to exempt stormwater discharges from the NPDES program.

3. Several attempts at deciding on a regulatory approach were stalled and were very controversial.

4. When Congress reauthorized and revamped the Clean Water Act in 1987, with adoption of the water Quality Act, it enacted a specific scheme for stormwater regulation through the NPDES program. New section 402(p) sets out which types of stormwater dischargers are required to have NPDES permits before October 1, 1992:

a. a discharge that already was subject to a permit

b. a discharge associated with industrial activity

c. a discharge from a municipal separate storm sewer system serving 250,000 or more

d. a discharge from a municipal separate sewer serving populations of 100,000 to 250,000; and

e. a discharge that the Administrator or the State determines causes or contributes to a violation of water quality standards, or is a significant contributor of pollutants to waters of the U.S.

5. For discharges in municipalities of less than 100,000, the 1987 amendments provide that no permit can be required until October 1, 1992.

6. Federal rules requirements: the Water Quality Act mandated that EPA promulgate regulations for stormwater associated with industrial activities and for municipal systems of 250,000 or more by February 5, 1989, and for medium-sized cities by February 4, 1991.

7. Applications are required for:

a. large systems and industrial stormwaters -- applications due by February 4, 1990;

b. medium municipal systems -- applications due no later than February 4, 1992.

8. Types of permits:

a. permits can be issued on a system-wide or jurisdiction-wide basis

b. permits must include a requirement to prohibit non-stormwater discharges into storm sewers; and

c. permits must require controls to reduce pollutants to the "maximum extent practicable."

9. Exemptions for:

a. stormwater runoff from mining operations or oil and gas exploration, production, processing or treatment operations if stormwater does not come into contact with or become contaminated with any overburden, raw material, intermediate product, finished product, waste product, etc.

b. agricultural stormwater also is excluded from definition of point source, and therefore is not covered by NPDES program.

10. Current status of rules:

a. EPA was required to promulgate first round of regulations by February 2, 1989. EPA has not yet done so. Proposed regulations were published on December 7, 1988. They have not yet been finalized. EPA has said that it anticipates publication of final rule in August of 1990.

b. The law's requirements call for large municipalities to submit permit applications by no later than February 4, 1990. Even in the absence of Federal permit application regulations that deadline still stands in the law.

IV. Summary of key provisions of the proposal: (NRDC thinks the proposed approach is inadequate in a number of key respects.)

A. The proposed rule consists of proposed permit application rules -- not specifics of actual pollution control. (NRDC's viewpoint: it is like a "write-your-own-permit" program; not what Congress envisioned. A few of the major deficiencies:

1. The proposed rule does not require industrial stormwater discharges into a municipal stormwater system to be permitted; instead it allows the permit of the municipality to be the only one issued. No requirements for flow rates, or stormwater treatment or resultant water quality, or programmatic requirements like financial resources, personnel, etc.

2. EPA's preferred option for defining the systems subject to the initial round of rules is as narrow as possible; EPA proposes to limit the more-than 250,000 population cutoff to incorporated cities or towns. In effect, if EPA adopted this approach, Washington, D.C. would be covered, but Montgomery and Prince George's Counties, Maryland would not be. (60 incorporated places in the U.S. with population of more than 250,000; 122 incorporated places with population of 100,000-250,000-)

3. Applications and requirements for municipal separate storm sewers:

   a. The proposal does require procedures for detecting and eliminating illicit discharges. Two permit application requirements:

      (i) a screening analysis to set priorities
      (ii) a management plan to detect and remove illicit discharges.

   b. Permit applications can be made on a systemwide or jurisdiction-wide basis. Ultimately, EPA may allow system-wide permits.

B. Two part permit applications, submitted in 2 phases:

1. Part 1: (identify known sources and characterize pollutants)

   a. general information re applicant and legal authority in hand.

   b. information re source identification.

   c. information characterizing discharges, including any quantitative data and field screening data to detect illicit discharges.

   d. description of existing structural/nonstructural controls.

2. Part 2:

   a. adequate legal authority demonstrated.

   b. supplemental source identifying information, focusing on "major outfalls".

   c. results of screening and establishment of pollutant loadings and concentration, via use of models rather than individual sampling at each outfall.

   d. proposed management program to provide maximum-extent-practicable controls.

   e. cost estimates.

   f. description of roles of co-applicants.

   g. its own proposed controls (no national requirements or minimum criteria)

3. Application requirements for construction activities: (permits for construction industry are important because localized impacts can be severe. Sediment runoff rates are typically 10-20 times that of agricultural lands (and as high as 100 times), and 1000-2000 times that of forest lands)

   a. Construction activity sites would have to provide descriptions of:
      (1) nature of construction activities;
      (2) total area of the site to be excavated;

(3) measures include BMP's to control stormwater discharges during construction, including erosion/sediment controls;
(4) measures to control pollutants in stormwater after construction is completed;
(5) increase in impervious area, and the runoff coefficient (fraction of rainfall that will appear as runoff);
(6) name of receiving water.

b. Exempt construction activities:

(1) less than one acre total land area and not part of larger common development site plan
(2) single family residential projects, less than five acres.

4. Deadlines for filing:

a. For discharges associated with industrial activities, EPA proposes to make application due one year after final rule (August 1991).

b. For large municipalities, EPA proposed that Part 1 be due within one year of final rule (August 1991). EPA would approve or disapprove within 90 days. Part 2 would be due two years after final rule (August 1992).

V. Summary: NRDC hopes final rules are significantly better and significantly simpler than proposed rule. EPA delay in and of itself is a problem, holding up state action.

Speaker #1:

MD's SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAMS - PAST AND FUTURE

Ron Gardner
Maryland Department of the Environment
Sediment and Stormwater Administration

In 1961, Maryland's Attorney General declared that sediment was a pollutant and that it is unlawful to discharge pollutants into the waters of the State. This declaration was significant because, for the first time, the importance of sediment pollution was recognized. Almost a decade later in 1970, the Maryland legislature passed the Sediment Control Law which mandated the establishment of the Statewide Sediment Control Program.

The concept of managing stormwater runoff has been evolving for many decades, beginning in the 1930's with the requirement of a permit for anyone who proposed "in any manner to change or diminish the course, current, or cross section of a stream". The next evolutionary step in stormwater management was actually flood management. People were beginning to realize that uncontrolled stormwater runoff was contributing to flooding problems. Finally, in 1982 the Maryland Legislature established the Stormwater Management Program. This program was primarily concerned with maintaining "after development, as nearly as possible, the predevelopment runoff characteristics, and to reduce stream channel erosion, pollution, siltation and sedimentation, and local flooding". As water quality issues have become more pronounced, the State has continued to improve practices designed to ameliorate stormwater pollution as well as providing quantity controls.

The original sediment control program was established as a division of the Water Resources Administration, Department of Natural Resources. When the Stormwater Management program was established, it was also made a division within Water Resources. The Sediment Control Program was targeted at stormwater runoff that occurs during construction, while the Stormwater Management Program was designed to control stormwater runoff that occurs after construction is complete. Therefore, both of these programs are treating the same problem, i.e., controlling stormwater runoff. The process for controlling runoff evolved again when the sediment and stormwater management programs were joined in the Sediment and Stormwater Division of the Water Resources Administration.

The next step in this developing process occurred in 1987 when the Maryland Department of the Environment was formed. The Sediment and Stormwater Division was transferred from the Water Resources Administration to the Department of the Environment. At the same time this division and part of the enforcement unit of the Water Resources Administration were joined to form the Sediment and Stormwater Administration. By elevating this program to the level of an Administration, Maryland was clearly stating its support for and underscoring the importance of controlling the runoff that occurred as a result of development.

When the Sediment Control and Stormwater Management Programs were first brought together, discussions were held to determine how to maximize the effectiveness of these efforts. One thing that became clear as these discussions continued was that an overall strategy needed to be developed to control pollution contained in stormwater runoff from all sources, not just from construction activities and development. The program that started as sediment control and had evolved to include stormwater management was now expanding to include the concept of nonpoint source pollution control.

Soon after the Sediment and Stormwater Administration was formed, the State's Nonpoint Source Pollution Control Program was transferred to the Administration. In addition, the State's Agricultural Nonpoint Source Inspection and Enforcement Program was also transferred to the Administration. This consolidated most of the nonpoint source inspection and enforcement programs into one Administration.

The question now becomes, what will be the next step of this continuing process in the development of a more holistic approach to controlling pollution. Part of the next step will be to implement Maryland's Nonpoint Source Pollution Management Program. The primary goal of this program is the reduction, by 40%, of the nutrient loading of the Chesapeake Bay by the year 2000. The strategy for the implementation of this plan is currently being developed by the Office of Planning. In accordance with the Nonpoint Source Management Program, the Sediment and Stormwater Administration will be developing strategies to meet the 40% nutrient reduction goal in our Sediment Control and Stormwater Management Programs.

In the Sediment Control Program, the State Law and Regulations will be reviewed with the intention of the clarifying and strengthening the Sediment Control Inspection and Enforcement Program. The sediment control manual is being updated with major changes to the sediment trapping devices that will substantially increase the efficiency for sediment removal. All of the other practices in the manual are being improved as the results of research projects are factored in the specification. These improved practices coupled with a renewed effort to ensure continued soil stabilization will markedly increase our ability to meet the 40% goal.

The stormwater management law and regulations will be reviewed and revised consistent with the 40% nutrient reduction goal. These revisions will include updating the priority listing of stormwater practices, including a section on maintenance of these practices and making the changes necessary to provide for the establishment of a stormwater management utility to help pay for the program.

The Best Management Practices (BMP's) currently being used to manage stormwater runoff are not adequate to meet the 40% nutrient reduction goal. Consequently, the Administration is developing a water quality strategy that will require pretreatment of stormwater runoff to remove pollutants contained in the runoff for quantity control.

Pre-treatment will involve processing the first one-half inch of runoff, which contains most of the pollutants. Pretreatment practices will include: vegetative buffers, the use of forebays to collect sediments and other pollutants, shallow marshes, wet pools in conjunction with extended detention times, and infiltration of the first one-half inch of runoff on site. By treating the first one-half inch of stormwater runoff, the Administration hopes to meet the 40% nutrient reduction goal.

Another aspect of Stormwater Management that will be addressed in the near future will be the development of an assessment and monitoring effort. This effort will include; watershed planning, inventories of existing facilities, developing models to help target BMP's and a monitoring program to measure the effectiveness of each program.

Assessment of the Sediment Control and Stormwater Management Programs is essential to the continued development of the process for controlling runoff. Assessment of nonpoint source pollution control activities in general is critical to achieving the 40% nutrient reduction goal. Currently, there are discussions concerning using the point source permitting process (NPDES permits) as a primary management tool for nonpoint source pollution control. Assessment of nonpoint source activities would then be conducted using point source techniques. When trying to control a pollution that is pervasive, it is essential to analyze the source of that pollution. That means that traditional methodologies used for point source assessment may not be effective, and that edge of field assessment capabilities must be expanded.

Maryland's Sediment Control and Stormwater Management Programs are moving rapidly to assimilate nonpoint source pollution control concepts and will continue to develop objectives for achieving the 40% nutrient reduction goal. In addition, these programs will continue to work toward our ultimate goal which is to provide needed facilities while protecting and enhancing the natural environment.

Speaker #2:

EPA'S STORMWATER MANAGEMENT CONTROL PROGRAM

Lawrence R. Liebesman, Partner
Weinberg and Green, Maryland

I. Statutory Background - 1987 Water Quality Act

A. Water Quality Act of 1987 - Congress established program to control runoff from municipal separate storm sewers and industrial sites. (Studies showed up to 63 toxic pollutants in municipal separate storm sewers.)

B. Section 405 amends Section 402 of CWA by establishing priorities, deadlines and requirements for stormwater permit sources. As a general rule, no permit will be required prior to October 1, 1992 for stormwater discharges except in four instances:

1. A discharge already subject to a permit issued before date of enactment

2. A discharge associated with industrial activity

3. A discharge from a municipal separate storm sewer system serving populations of 100,000 or more

4. A discharge that contributes to a violation of a water quality standard or is a significant contributer of pollutants to a water of the U.S.

C. A permit for a municipal separate storm sewer may be issued in a systemwide or jurisdictionwide basis

D. Exemptions

1. Stormwater runoff diverted around oil and gas mining and extraction that does not come into contact with raw materials or process waters

2. Stormwater that is not contaminated by contact with industrial or other process contaminants

3. Agricultural stormwater discharge

II. Proposed Stormwater Regulations - Proposed In Federal Register December 7, 1982 (Vol. 53 Fed. Reg. 49416) - Impacts On The Construction Industry

A. Proposal - specifies permit application rather than actual permit requirements. EPA intends to require Best Management Practices (BMPs) as conditions to permits. Many BMPs already required by local jurisdiction (e.g., straw bales, detention and retention ponds, sediment traps, etc.)

B. All stormwater runoff from industrial plants and residential subdivisions are regulated with exception of projects disturbing less than 1 acre of land area and single family residential disturbing less than 5 acres of land area

C. Indirect discharges into separate municipal stormwater systems - no permit required - municipality to get permit

D. Direct discharges - requires applicant to include:

1. Nature of construction activity

2. Total site and area expected to undergo excavation

3. Proposed pollution control measures, including BMPs, both before and after construction

4. Estimate of the site's runoff coefficient and the increase in impervious area after completion of construction

5. Name of receiving waters

E. Owners of construction activity generally do not have to submit sampling and analysis data with application

F. Indirect discharge application requirements

1. Municipalities operating separate storm-sewer systems will not need the traditional end-of-the pipe treatment technology

2. Instead, municipalities will need to develop comprehensive stormwater quality management programs covering new development and post-completion runoff

3. Programs may be implemented on individual outfall or systemwide, watershed or jurisdictional basis (BMPs)

4. Application requirements in two parts

   a. Part One - identification of source and character of discharge and existing current municipal management practice

   b. Part Two - proposed management control program including structural and nonstructural BMPs for construction sites. These include site planning procedures, procedures for identifying priorities, inspecting sites and enforcement and appropriate education and training measures

5. Data Submission by municipalities

   a. Must provide estimate of the reduction in loadings of pollutants expected as a result of program

   b. fiscal analysis of capital, operating and maintenance expenditures

   c. first flush pollutant concentration data from samples taken during first 20 minutes of discharge

   d. flow weighted average concentrations - to estimate pollutant loads and evaluate certain concentration based WQ impacts

6. Builder who discharges into a municipal separate storm sewer must notify the municipality of intent to discharge. The municipality then must insure that the builder's discharge will meet the permit requirements

G. Deadlines for Filing

1. For direct discharges associated with industrial activity, the applicant must submit an application 12 months after the final rule takes effect

2. For discharges from large municipal separate storm sewers (municipal separate storm sewer systems serving a population of 250,000 or more), the applicant must submit part one 12 months after the final rule takes effect, with the EPA approving or denying a sampling plan within 90 days of receipt; the applicant must submit part two 24 months after the final rule takes effect

3. For discharges from medium-sized municipal systems (municipal separate storm sewer systems serving a populations of 100,000 but less than 250,000), the

applicant must submit part one by November 4, 1990, with the EPA approving or denying within 90 days of receipt: the applicant must submit part two by February 4, 1992. A permit application shall be submitted to the agency within 60 days of notice

4. Small municipal separate storm systems are exempt until at least 1992

H. Final rule expected to be issued -- Summer, 1990

III. CWA SECTION 401 WATER OUALITY CERTIFICATIONS

A. Used by Maryland Department of Environment to address water quality impacts of stormwater discharge

B. Maryland Department of Environment issued stormwater management assessment guidelines on June 24, 1988 - addresses wetlands and stormwater issues

Speaker #3:

OUR EROSION AND SEDIMENT (E&S) CONTROL AND STORMWATER MANAGEMENT (SWM) PROGRAM

D. R. Vaughan
VA Division of Soil & Water Conservation

Erosion & Sediment

The E&S program consists of 171 local programs and state sponsored projects (about 15 state agencies have major capital improvement projects).

We monitor the effectiveness of local programs by reviewing their ordinance, plan review and approval techniques and inspection and enforcement procedures. We review and approve all state agency plans (or at their option approve their standards and specifications) prior to the initiation of land-disturbing activities. State project sites are inspected at a minimum of every two weeks by our staff.

The impacts from the 1988 legislation provided:

Civil penalties (up to $2000 for each violation) in addition to criminal penalties.

Erosion Impact areas that are defined as an area.

Stop Work Orders were added to provide an effective means of dealing with land-disturbing activities that have a significant negative impact on the environment.

As of today we have added new personnel in our central office and 8 regional offices. We had 5 staff people in 1984 that has now been expanded to a present total of 17 people. We can now:

Provide detailed reviews of local programs as mandated by the 1988 legislation. We review a minimum of 36 local programs every three years.

Develop a certification program for E&S inspection after mandated by the 1988 legislation.

Provide a complaint response for E&S violation.

Provide one-on-one assistance to local governments. This means at the local governments request we have a staff member visit the locality on a regular basis spending up to 2 days per week providing technical assistance in plan review and inspections.

We are processing revised regulations for promulgation by July 1, 1990. The significance here is moving from the "General Criteria" in our E&S Handbook which are implied to be regulatory to legal regulations.

An E&S tracking system is being planned. We selected 11 localities that have volunteered to feed input into our VirGIS (Virginia Geographical Information System) system for nutrient reductions.

Stormwater Management

The original GC-7 criteria (part of the General Criteria in State E&S Handbook) provided authorization to control "flow quantity" primarily focused on stream channel erosion. The authority for the criteria is from the State Erosion & Sediment Control Law.

The Stormwater Management Law created by the 1989 General Assembly addresses:

Water "quality control based on first one-half" of runoff for treatment.

Watershed planning.

Annual pollutant reduction reporting system.

Local administrative cost allowed.

Develop criteria for Keystone Pollutants. Regulations have been developed and are being processed for promulgation by July 1, 1989. The regulation will be voluntary for local governments, but is mandatory by all state agencies having land-disturbing activities greater than one acre after January 1, 1991.

New personnel to administer program consists of:

1 stormwater manager
4 field stormwater management engineers located in our Richmond, Suffolk, Staunton and Tappahannock Regional offices.

Summary

Progress is increasing with:

Pollutant reduction initiatives to help answer Chesapeake Bay issues on water quality.

The future of our program looks very good. We have received much support from the General Assembly, other regulatory agencies, and the general public.

WORKSHOP #8: HIGHWAY CONSTRUCTION

Charles Spooner, Moderator, EPA CBLO Director

Speaker #1:

C. Theodore Fridirici
Pennsylvania Department of Transportation
Bureau of Design

In the design, construction and maintenance of Pennsylvania's 27,000 bridges and 43,000 miles of highway, the Department of Transportation strives to reduce the impact that its activities have on the environment. Through cooperation between and coordination with resource agencies and the implementation of innovative and well conceived designs, PennDOT has taken great strides toward our overall goal of providing a safe and efficient transportation system while preserving the environment.

Following is one example each from the maintenance, design and construction process of how PennDOT has sought to reduce nonpoint pollution.

Maintenance

More than any transportation activity, maintenance has the potential to adversely impact aquatic resources. From shoulder cutting and ditch cleaning to the application of salt or anti-skid to the Commonwealth's roads, PennDOT seeks to reduce nonpoint pollution.

At the Pike County salt storage site in Milford Township, a pollution control plan has been formulated by PennDOT and the state Department of Environmental Resources to prevent pollution incidents. It reflects PennDOT's current policy of using Domar buildings for salt storage sites. These 116-foot diameter buildings allow enough room for delivery, storage and loading of salt and anti-skid while virtually eliminating the potential for the stored salt to contaminate the local environment, particularly groundwater.

Design features incorpoated in this development included sealing the entire floor with asphault cement; installing a "salt trap" across the entrance doorway to catch salt falling from vehicles leaving the building; extending the entrance doorway 12 feet and sloping the the entrance pavement into the building to reduce salt "tracking" outside the building; installing a slotted drain pipe across the site driveway to divert surface runoff away from the building entrance; and grading the gravel parking lot to divert surface runoff away from the entrance.

In addition to those design features, PennDOT will initiate a groundwater monitoring building at three nearby wells, sampling the water twice a year, in April and October.

Several operational procedures are incorporated in the plan, including a requirement that all salt and anti-skid mixtures are made and stored in the building; all trucks will be loaded in the building; all salt or anti-skid materials which spill on the sides of the trucks will be broomed or cleaned off before the truck leaves the building; all trucks returning with unused material will dump it in the building; all pothole patching material will be stored in the building; no bulk oil or asphault will be stored at the site; and any sodium or calcium chloride accidentally spilled outside of the building will be thoroughly cleaned up immediately.

Should an accident occur where either gasoline, fuel oil, anti-freeze or other materials are spilled, the spill will be contained immediately and DER notified. A sufficient quantity of absorbent material will be kept at the site at all times for immediate containment and to facilitate cleanup.

It is PennDOT's hope that these design features and operations plan will serve as a model for salt storage sites throughout the state.

Design

Several special features were designed into I-78 in the Allentown area to protect ground and surface waters from fuel and chemical spills. The design incorporates five spill containment facilities which collect highway surface runoff, and isolate potentially hazardous spill substances from highway runoff for proper treatment and removal before reaching water.

The containment system involves a network of surface drains which collect runoff from the highway surface and shoulder areas and channels it through pipes into one of the five concrete containment boxes located along the highway embankment. The boxes have an impervious membrane and each is designed to hold 30,000 gallons of spill material with a 38,900 gallon capacity. Baffles in the boxes reduce flow velocity allowing hazardous spill materials to separate from runoff. Water exits through a perforated, sand-filled PVC pipe into the containment basin associated with the box from which it is discharged through an outflow pipe. The spill material can be treated and pumped from the box once it has separated from the water.

In the event that contaminants flow out of the box into the basin, a concrete valve box equipped with a shear gate has been located at the basin's outflow which can be closed. The containment basin is also lined with an impervious membrane-to hold the spill.

The containment box must be cleaned out to remove typical roadway runoff and sediments which will accumulate.

Construction

During construction of the Blue Route expressway in suburban Philadelphia, an environmental monitor was directly involved with the design and maintenance of erosion and sediment control measures. The monitor's responsibility included serving as a liaison between the public and PennDOT; to act as an independent source of environmental expertese; to review and report on design and construction activities to ensure compliance with environmental requirements; and to search for further means of reducing project impacts and enhancing the environment.

Stormwater goals for the project were met by installing grassed channels and swales typically 200-400 feet long between inlets; installing detention basins to receive runoff; using detention basins as a cleanup point for spills from tanker accidents; having water from the basins be released into adjacent wetlands when possible; and installing these measures in sequence -- so they will be cumulative in their benefits -- rather than using them as alternates to each other.

The resultant effluent quality of stormwater runoff from I-476 reflects an overall average of 75 percent removal of total suspended solids.

WORKSHOP #9: NPS - WHO PAYS?

Richard Christiansen, Moderator, MD Soil Conservation Service

Speaker #1:

Timothy J. Kari Kari
Housing and Environmental Regulation Administration
Department of Consumer and Regulatory Affairs, Soil Resources Branch

The District of Columbia's stormwater management regulations (D.C. Law 5-188, Sections 509-518) state unambiguously that for all new construction, where it is determined by the Department of Consumer and Regulatory Affairs (the lead agency for D.C.'s nonpoint source program) that nonpoint source control measures are required, the developer is responsible for ensuring that such measures are incorporated in their development projects.

Similarly, through the District's "Erosion and Sediment Control Act of 1977", (D.C. Law 2-23), the developer is responsible for ensuring that all appropriate erosion and sediment control measures are installed for any land disturbing activity.

In both situations of curtailing nonpoint source pollution, the developer bears the construction cost.

Therefore in the District of Columbia, the issue of who pays for nonpoint source pollution is perceived by the Soil Resources Branch (the agency responsible for operating the District's erosion control and stormwater management programs) as a purely maintenance problem.

Recent statistics from our engineers and field inspectors show that of the 39 stormwater management facilities (BMPs) documented, 11 have been completed, while construction is still in progress for the remaining 28. Ninety eight percent of the BMPs are located on private property.

The records also indicate that some of the completed facilities are already facing maintenance problems; either poor maintenance or total lack of maintenance, although the law states that proper maintenance at all times is the property owner's responsibility.

Clearly, in such a situation, the responsibility of paying for nonpoint source control falls on the property owner.

However, when a property owner refuses to abate such violations, the District can invoke D.C. Law 5-513 which gives it the legal authority to correct the violations and assess the cost against the property owner or place a lien on the property.

Other scenarios are encountered with respect to erosion and sedimentation where the erosion process is so severe that it can create an eminent danger or cause destruction of adjacent properties and siltation in nearby streams.

On a number of occasions, the District has used its authority under D.C. Code 5-513 to correct the problems. However, because of the budget crises, the District will find it increasingly difficult to come up with the financial resources to continue to address these problems.

We forsee construction of more BMPs not only on private property, but on both District and Federally owned lands. The question we are constantly asked is, "Who will maintain these structures once the developer is gone ?"

To ensure that facilities that are built to control nonpoint sources of pollution are maintained properly and consistently, the Soil Resources Branch is considering the following initiatives:

1) Amend the District's Stormwater Management Regulations to include a provision whereby developers would be charged a fee-in lieu of doing stormwater management where it is determined that site conditions make the construction of stormwater management facilities impracticable. The fees would be used for District-wide environmental improvements related solely to nonpoint source pollution;

2) Amend the Erosion Control and Stormwater regulations to charge a fee for plan review, technical assistance and site inspections; and

3) Charge fees for technical manuals and other nonpoint source publications which are presently distributed free charge.

Based on the above discussions, we will like to conclude that on private land, the property owner should pay for nonpoint source controls. However, if a facility is developed by either a federal, state or local agency on public land, the particular agency or agencies should pay for the maintenance of the facility.

Speaker #2:

LONGEVITY OF BMP's

Donald R. Urban
VA Soil Conservation Service

There is relatively little information about the performance of -agricultural practices that control nonpoint source runoff after they have been installed for several years. This study considers BMP longevity, focusing on five practices: terraces, animal waste storage, vegetative strips, waterways, and conservation tillage. Expert judgements on the subject were elicited from 300 conservation district and local SCS personnel across the nation. In addition 123 practices in North Carolina, Pennsylvania and Ohio, with ages ranging from five to fifty years, were assessed in the field.

In general, there is a striking disparity between potential BMP longevity and the actual lifespan of practices. This highlights the significance of O&M activities in maximizing returns on investment in NPS controls. Study results suggest that existing Soil Conservation Service life expectancies may be too conservative and that many practices can last indefinitely if properly maintained. In particular, vegetative strips typically remain effective far beyond the five year SCS estimated life spans. Similarly, even though it is often classified as an annual practice, the vast majority of local experts did not put an upper bound on the potential longevity of conservation tillage. Despite the substantially higher price, no meaningful difference in the long term effectiveness of concrete, as opposed to earthen animal waste lagoons was detected. Both appear to effectively store wastes for periods upward of twenty years. Grassed waterways may be an exception to this pattern, as site-visits and respondents revealed longevity to be somewhat lower than the 15 year SCS life-span.

The O&M activities required by different BMP's varies among practices. For vegetative practices, particularly waterways, the most important ones are passive "precautionary measures" (i.e., caution with farm equipment and herbicides) which do not require additional spending. Similarly, both human and environmental factors affect different BMP's longevity. In some cases operators' education and environmental attitudes are viewed as having the greatest influence on a BMP's lifespan. These can be affected by through educational initiatives. In other instances, especially for structural BMPs, economic prosperity may be the most important factor, requiring a different policy response. In general, BMP longevity should play a key role in the decisions of both regulatory and nonregulatory nonpoint source policy makers prior to promotion of a particular control strategy. Operation and maintenance activities hold the key to long term water quality improvement and should increasingly become central objectives of nonpoint programs.

Speaker #3

PAYING FOR POISON RUNOFF MONITORING PROGRAMS

Diane M. Cameron
Natural Resources Defense Council
Clean Water Program

Many cities are beginning to survey stormwater outfalls, as EPA readies its final rules for urban runoff control under section 402 (p) of the Clean Water Act 1. Unfortunately, these surveys often stop short of obtaining a full picture of the pollutants, especially toxics, present in urban runoff. While public works officials understand the necessary link between stormwater characterization, and choice and design of control and treatment devices, local elected officials are often unwilling to appropriate funds for characterization monitoring. The 1978-83 Nationwide Urban Runoff Program (NURP) provided the primary data base for stormwater quality information, and demonstrated the importance of the urban runoff problem 2. NRDC researchers have used NURP data to demonstrate that loadings of pollutants in the runoff from Baltimore City and the Washington, D.C. metropolitan region rival the pollutant output of factories and sewage plants in Maryland and Virginia 3.

Although the NURP study remains useful, and is highly respected among urban hydrologists and planners, a second generation of stormwater quality data is now required. Conducting up-to-date baseline monitoring studies of urban runoff can verify the validity and representativeness of the NURP data. Such studies can also improve the siting, choice, and design of detention and control devices, source reduction programs, and to water-quality-based planning and zoning programs 4. Despite these obvious benefits, few urban stormwater monitoring projects are now underway in the Chesapeake Bay Region. Urban water quality officials cite financial restrictions as the primary reason for the lack of current monitoring programs. This study compares the funding strategies of urban runoff monitoring programs in three Chesapeake Bay cities: Baltimore; the District of Columbia; and Hampton, Virginia; with the funding strategies of three other cities that have undertaken innovative monitoring programs: Bellevue, Washington; San Francisco, California; and Grand Rapids, Michigan. Officials in these six urban areas were interviewed by telephone in late 1989 and early 1990.

In his 1988 survey of 20 urban stormwater utilities, Greg Lindsey of the Maryland Sediment and Stormwater Administration found that water quality monitoring, and other water quality programs, played second fiddle to other priorities such as construction of flood control devices. Out of 19 utilities responding to the survey, only 6 (less than a third) reported expenditures for water quality management programs (including runoff quality monitoring). According to Lindsey, "Twenty percent [of the total stormwater utility budget] seems to be a maximum that any utlity spends on water quality programs." 5

Stormwater policy analysts, including Lindsey, predict that this trend will change, and that in the near future water quality will be the driving motive behind the establishment of new stormwater utlities (and new components of existing utilities). The role that water quality considerations will play in urban runoff management will depend to a large extent on the final stormwater regulations that are expected soon from U.S. EPA. Regardless of the direction of the new EPA regulations, however, progressive urban water quality managers are now finding ways to fund stormwater quality monitoring and control, and these innovations can be applied to Chesapeake Bay cities.

SUMMARY OF THE SIX-CITY TELEPHONE SURVEY

Chesapeake Bay Cities

Current or Planned Monitoring Programs	Cost	Who Pays?
Washington, D.C.		
No significant mon. since NURP; a 2-site, multi-year project is planned. Purpose is to study the effect of diff. land uses on loadings.[6]	Not Avlble.	District of Colum.
Baltimore, Maryland		
Conducted a monitorng. project for nutrients at 5 stormwater detention basins; 2 were compre-hensively monitored (inflows & outflows) for nutrients.[7]	$175,000	State, City, and Federal govts. all kicked in money.
Hampton, Virginia		
No stormwater quality monitoring at present. Industrial sites incl. shipyards will begin to implement BMPs; Virginia Beach is requiring BMPs for new developmnts., but not requiring monitrng. Virginia lacks enabling legisl. for stmwtr. utilts.[8]	Not Applicable	N/A

Current or Planned Monitoring Programs	Cost	Who Pays?
San Francisco		
Santa Clara And Alameda Counties undertook stormwater monitoring programs between 1987 and 1990. About 8 homogeneous L.U. stations, and 4 stream stations in each county were sampled and monitored for PPs, bact.,conven.,nutrients [9].	Santa Clara: $1.2 million Alameda: $1.4 million	Flood Control District: 1/3; 2/3 from local general revenues
Bellevue, Washington		
Proposal to conduct a 5-station stormwater monitoring program in 1990. Conventionals, 6 heavy metals, O & G will be analysed. Purpose is to develop a prototype NPDES stormwater permit application [10].	$199,989	State and City each kick in 50%. (City $ is gen. rev.)
Michigan (Grand Rapids & Ann Arbor)		
Storm drain sampling for industrial toxics & illicit connections (pilot project). (Grand Rapids)	Not Available	County Drain Commissnr provides funds.
Permanent program in-place to sample storm drains, dye-test and find illicit connections.[11] (Ann Arbor)	Not Available	County Drain Commissnr

Conclusions

Creativity is needed to devise a funding plan for stormwater monitoring projects, especially since stormwater monitoring is often an "orphan" project, often viewed as superfluous by the local elected officials who control the purse strings. Given this attitude, the paucity of general revenue sources for funding urban stormwater monitoring projects must be countered with an innovative funding approach that taps a variety of sources. All but one of the urban projects in the survey were funded by multiple sources and government entities. The following is a list of our preliminary conclusions:

* Urban Stormwater quality and quantity monitoring will likely be required by EPA for major cities as part of the permit application for NPDES stormwater permits.

* Even without the EPA monitoring requirement, stormwater monitoring has several benefits; among them is the ability to efficiently target runoff control resources.

* Stormwater utilities are an underutilized funding source for stormwater quality monitoring projects. Where they already exist, they should be tapped for monitoring funds. Where they do not yet exist, officials should explore the possibility of establishing such a utility.

* County-level Flood Districts or Drainage Districts are more common than are special stormwater utilities. These flood districts can and should be tapped for funds to support stormwater monitoring, especially where statutory authority for establishment of stormwater utlities is lacking.

* Experience with monitoring techniques and equipment maintenance gained during the baseline study can be applied to later work of monitoring the reductions achieved by control devices.

* Most local policymakers are taking a reactive rather than a pro-active stance toward urban runoff monitoring and control; they are waiting for the EPA regulations to take effect before they are willing to embark on a baseline monitoring project. In contrast, a few aggressive local policymakers, such as those in the San Francisco area, are not waiting for the EPA regulations to force their hand; they are acting now to characterize their stormwater runoff and to design targetted control strategies.

INTO THE NINETIES: ISSUES AND STRATEGIES

Roland Geddes, Moderator, VA Division of Soil & Water Conservation

Speaker #1:

NONPOINT SOURCE POLLUTION INTO THE NINETIES: ISSUES AND STRATEGIES

Ernest C. Shea, Executive Vice President
National Association of Conservation Districts

Nonpoint pollution is not a new problem. In fact, it is a problem that has existed since the beginning of time and will be with us until the end of time.

What is new, however, is the growing awareness and recognition of what it is and, more specifically, how land use activities contribute to the problem. At the heart of nonpoint pollution is human activity and, as such, NPS pollution is primarily a "people" problem. It is also deceptive in nature due to the fact that the cumulative effect of seemingly small, insignificant, individual human activities results in significant impairment of water quality, degradation of aquatic resources, and loss of ecosystem diversity and integrity.

No segment of society escapes responsibility for contributing to nonpoint pollution. It is not a problem where responsibility can clearly be placed on any one group of individuals or activities. Farmers, developers, homeowners, boaters and backyard gardeners all contribute to the problem. As a result, any successful NPS strategy must involve all segments of our society.

Although considerable progress has been achieved in elevating public awareness of this problem, efforts to implement comprehensive abatement programs have only recently been initiated.

Water quality experts agree that there are a number of forces which are impairing or blocking widespread adoption of NPS abatement efforts. Efforts to overcome these impediments represent a priority agenda item for the 1990's.

The first and primary impediment is the public's lack of understanding and awareness of the nature of nonpoint pollution, its causes, its impact on society, and the consequences of not addressing ongoing problems. Until this basic impediment is overcome, little progress can be expected in developing and implementing effective NPS control programs. Closely related to this point is the widespread belief among many policy makers that the problem is too big to tackle. Although NPS pollution is pervasive, we must demonstrate that individual actions do make a difference.

A third major impediment is the "quick fix." piecemeal approach that is often a characteristic of poorly designed NPS control programs. Successful NPS programs are holistic in nature and are based on an integrated watershed approach. Failure to develop this type of approach can result in simply transferring pollution to other mediums and expending limited resources without seeing significant improvements in water quality. Lack of cooperation and coordination on the part of the numerous federal, state and local government agencies with nonpoint responsibilities represents a fourth serious impediment that must be overcome. Turf battles coupled with poor communication and coordination of efforts at the local level contribute to the lack of progress in addressing NPS pollution. Incomplete science and gaps in technology are also major impediments which impede further progress. Despite our best efforts to implement best management practices, there are still many unknowns which complicate control efforts. For example, the movement of many pesticides through soil is still not fully understood, nor is the synergistic effect of chemicals which combine or interact in the soil profile.

A sixth fundamental impediment is conflicting public policy and laws which exist at all levels of government. This can perhaps best be exemplified by federal farm policies which, in the past, have encouraged the production of agricultural commodities on fragile, environmentally sensitive land areas. Last but not least is the lack of resources which have been made available to combat this problem. Despite the fact that NPS has now been clearly identified as the last major barrier to meeting the goals and objectives of the Clean Water Act, federal appropriations for NPS abatement have been almost nonexistent. Not until the public and private sectors commit the resources that are needed to address this problem will any real progress be achieved.

It will take more than overcoming these seven impediments if we hope to control NPS pollution in the 1990's. It will also require the development and execution of a comprehensive abatement strategy. This strategy, at a minimum, must incorporate the following key ingredients.

First and foremost, education must be the cornerstone of our future NPS control efforts. Our goal should be to get people to accept personal ownership and responsibility for solving NPS problems. If we succeed in getting the public to understand and recognize the problem, it will be much easier to convince citizens to take actions to correct the problem. Without cooperation and support from the public at large, NPS pollution will continue with serious consequences to the resource base.

Second, we must continue to develop comprehensive NPS abatement programs that place primary emphasis on pollution prevention. These plans must deal with the problem holistically on a hydrologic unit basis.

Third, we must continue to improve communication among all management agencies with NPS responsibilities. No one unit or level of government has the expertise, resources or ability to solve the problem on its own. Therefore, it is critical that we develop goals, objectives and action steps that are understood and supported by all parties participating in prevention or cleanup efforts.

Fourth, we must do a better job of targeting our resources. Given the fact that we most likely will never have all of the resources we need, we must continually monitor our efforts to insure that our resources are used as effectively as possible. It is also critical, particularly in the early stages of new NPS programs, that we find projects and programs where it can be clearly demonstrated that the abatement efforts make a difference.

Speaker #2:

AGRICULTURAL POLLUTION CONTROL: AN AGENDA FOR THE 1990's

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Introduction

Good Morning. Before I jump into the substance of my remarks, this morning, I would like to thank Fran Flanigan and her very capable staff for making this conference possible, and I would like to extend my appreciation to the Nonpoint Source subcommittee as well for sponsoring the event in the first place. I think it has been a productive conference, and a necessary one. We all know that cooperation and communication are essential to making progress towards the goals we have set for ourselves in the nonpoint source area in order to "save the Bay."

The charge to this panel, as you know, is to look ahead to the upcoming decade and to identify issues that we must face and satisfactorily resolve in order to clean up the Bay, or more specifically, to meet the 40 percent nutrient reduction goals. One such issue that I believe is essential to address is the question of the direction that our agricultural pollution reduction programs should take. By that I mean to bring into the open the debate about whether largely voluntary agricultural programs will suffice or whether more regulatory programs are necessary to meet our water quality goals.

Now, for those of you who are saying to yourself, "here it comes, CBF is finally going to reveal its true self and demand a badge and a gun and a court order in order to literally force farmers to adopt conservation measures." Of course, I'm not going to say that, because I do not believe that that is the direction we ought to be taking. Indeed, I think that the current debate, which seems to admit only two options-- pure voluntarism or heavy-handed regulation--needs a fresh perspective. You see, I think that the basic premise of the current debate, that voluntarism and regulation can be divided by a narrow "bight line" is incorrect. In fact, I would like to suggest that there is a wide area of policies and programs that fall between "voluntary" and "regulatory." This in-between area is largely unexplored territory, and in my view, offers policymakers and program administrators the greatest opportunity to clean up nonpoint source problems in the 1990s.

Let me give you some examples of programs or policies that lie in between voluntarism and regulation that could reduce adverse water impacts attributable to agricultural sources:

A. Quid Pro Quo

The basic idea here is that government confers on farmers (and many other sectors and groups) certain benefits including commodity price and income supports, subsidized crop insurance, and low-interest loans, to name a few. But, as we all know, nothing comes for free, and each of these benefits carry with them certain obligations. The essence of quid pro quo as it relates to agriculture is to assure that those obligations serve the purpose of pollution abatement.

We have seen this approach already in the 1985 Farm Bill. That law created "swampbuster," "sodbuster," and "conservation compliance" which were all predicated on the idea that the Federal government ought not to be in the business of subsidizing poor land use practices. Each of these programs require farmers to comply with conservation measure in order to maintain eligibility for Federal farm programs.
A host of opportunities to build on this approach exist. Dairy producers, for example, collect hundreds of millions of dollars annually through the dairy price support programs which could be tied to improved nutrient management planning. In addition, the states confer benefits on farmers that could be tied to soil and water conservation. One example of this is use-value taxation. Presently, many counties within the watershed allow for reduced property taxes on farmland in order to encourage farmland preservation. This lower assessment should be tied to proper farm management, especially for landowners that are not farm operators. Another state-funded benefit that should be tied to improved conservation is drainage construction and maintenance.

In summary, Quid Pro Quo stands for the proposition that, if you want government assistance, by all means take it-- but take it with the proviso that you spend it wisely and in concert with efforts to improve our environment.

B. Point and Pay

Point and Pay begins with the proposition that conservation is not free, and that there is a limit to the money available (both public and private) to spend on nonpoint source pollution abatement. It stands to reason, therefore, that we have to maximize the returns to our conservation dollars if we are to attain the water quality goals we have established. To do this, we must target our limited resources to address the worst problems first.

Under a purely voluntary system you cannot effectively target your remediation resources to the most serious problems because even after you identify the source, there is no guarantee that the "problem" will participate in one or another of the voluntary programs. It is not surprising, therefore, that at present we spend much, if not most, of our program money and technical expertise on the better farmers, the ones who are better informed, and probably better managers because they are the ones who ask for assistance.

The exclusively voluntary approach also suffers from the fact that there are no assurances that sufficient numbers of farmers will volunteer to either meet our water quality goals, or to spend all the money allocated for these programs. Presently more than one Bay state faces the embarrassing situation that it cannot give away all of its nonpoint source program dollars.

Point and pay is an effective targeting technique that falls well short of heavy handed regulation. The idea is simple: the government agrees to pay the full cost of establishing water quality BMPs and in turn is granted the authority to mandate which farmers shall install them. In that way the government can target its remedial efforts to the most serious problems without unfairly burdening farmers. This is not "regulation" in the usual sense because the government is paying the full freight. It is also not purely voluntary because wherever the government points, farmers must act.

This approach is not likely to bust the budget either. Indeed, the added cost of 100 percent cost-share is small: in Maryland it would amount to a 15 to 33 percent cost increase per BMP, an increase that could more than be offset through greater program efficiency resulting from better targeting. Conversely, program surpluses would vanish because the state could keep "pointing" until all funds were expended.

In a nutshell, point and pay offers the opportunity to better target our resources without simply shifting the clean-up burden onto farmers who cannot pass on costs to consumers. It would markedly improve the efficiency of our programs and eliminate any program surplus.

C. Concentrated Livestock Operations

There are very good reasons why farmers should not be subjected to excessive regulation. The foremost rationale is that it is impractical. There are simply too many farms and fields and too much producer variation to enable effective centralized water quality regulation. The fact that all farms should not be regulated, however, does not mean that no farms should be regulated. Indeed, some types of farming, notably concentrated livestock operations, readily lend themselves to conventional point source pollution regulation. And, not surprisingly, authority already exists to require Clean Water Act NPDES permits for concentrated livestock operations above certain federally established thresholds.

The attraction to increased regulation of animal production stems not only from the fact that regulatory authority exists, but from the fact that ownership in the livestock industry tends to be highly concentrated. This is particularly true for the chicken and hog industries. The largest layer operations, for example, constitute less than 1 percent of producers, but generate as much as 40 percent of production output, which is a good proxy for manure and nutrients. If the Bay program can control the manure on these mega-farms, then significant water quality reductions can be achieved without impacting a large number of farmers.

The essential point here is that not all farms are alike, and not all farms are equally important to water quality. If we focus on the largest and most concentrated operations, we will get greater water quality benefits for our efforts, and we will not have to pass new laws to do it: authority already exists to regulate animal agri-industry.

D. Alternative Technology

When people think of "regulation" they usually are imagining government edicts, usually of little apparent rationality or value, that are imposed by "faceless, nameless bureaucrats." But bureaucrats enforcing laws and ordinances are not the only mechanism by which human behavior is regulated. Consider the following example.

You are in the market for a new car. You stroll into your neighborhood Cadillac dealer's showroom, and there in the center of the showroom floor is the automobile of your dreams. It's a cherry-red, rag-top, eight-cylinder, El Dorado with power windows, brakes and seats. The salesman appears out of nowhere and tells you this car is yours for just $49,999 plus tax. So, you visit your banker, who upon reviewing your salary and credit report, advises that you consider a chevrolet. Result: no loan, and no El Dorado.

Now consider an alternative scenario. Once again you are in the showroom, and you decide that the same cherry-red El Dorado is the car for you. Only this time the salesman tells you that EPA has recalled the car because it does not meet national fuel efficiency standards. Result: once again, no El Dorado.

The point is, in both cases you did not get the car. In the latter case you come away convinced that you have been "regulated." But in the former case, you conclude you were merely "thrifty." The fact is both events "regulated" your behavior. The point is that economics is a potent influence on our activities, and where we can make economics work in our favor-- that is to encourage non-polluting behavior-- we can avoid governmental "regulation" altogether.

One example of this approach can be found in conservation tillage. Maryland and Delaware have the highest proportional rates of adoption of conservation tillage in the country. And while conservation tillage has salutary environmental benefits through reduced soil erosion, area farmers adopted this new technology primarily because it saves time and money. Integrated Pest Management (IPM) is a similar case in point. So is the fast developing alternative agriculture technology. Each of these alternative technologies offers economic incentives that improve farm profits and also bring environmental benefits. And, no doubt similar opportunities can be discovered if we spend the time and effort to look for them.

Conclusion

Incentives and motivation are the keys to changing human behavior. There are a host of incentives that farmers will respond to including voluntary stewardship, gentle persuasion, economic realities, and regulatory threats. The challenge ahead is big enough, and the benefits of success are important enough that I believe we ought to carefully consider and employ every valid option to ensure success. I have touched upon several incentive policies in my remarks, all of which, to my mind, fall between pure voluntarism and universal regulation. And whether it is the proposals that I have put forward or some others, I think that the area most likely to suit our water quality policy and program needs in the future lies in between those bounds.

SUMMARY OF STATE CAUCUSES

Conference participants met over breakfast on Wednesday morning in three groups: Pennsylvania, Virginia and Maryland. Each group was led by a neutral facilitator and was given the same set of questions designed to focus discussion. After introductions, each group was asked to take 5 minutes to quietly jot down answers to the questions. The facilitators then led each caucus in discussing the questions and attempting to reach some consensus on state priorities. Those discussions are summarized below.

STATE CAUCUS DISCUSSION QUESTIONS

1. Hypothesis: (Pennsylvania, Maryland,Virginia) is presently well positioned to meet the 40% nutrient reduction target from nonpoint sources. List as many yes's and no's as possible.

2. Pennsylvania's (Maryland's, Virginia's) most pressing research need in the nonpoint area is ______________________.

3. Pennsylvania's (Maryland's, Virginia's) most pressing program implementation need is ______________________.

4. If you could recommend one policy change in the nonpoint area, what would it be? ______________________.

Each group developed long lists of yes's and no's in response to the basic hypothesis. Some comments are state specific; many appear on all three lists.

On the following three pages, the responses to question #1 from Pennsylvania, Virginia and Maryland are listed. Responses to questions #2, #3 and #4 begin on page 117.

YES

* good education program has begun
* nutrient management legislation will be very effective in agriculture section
* dedicated folks in DER & conservation districts & cooperation among groups
* in a position to measure objectively
* our numbers are very conservative (doing better than we think we are)
* support of farm groups
* support of governor & legislature
* shifted focus to water quality
* media involvement & local organizations are helping
* if proposed regulations are adopted will help us get there (i.e. 102, wetlands, ground water)
* strong basic philosophy
* mandatory recycling/composting law presents opportunities (Act 101)
* nutrient management becoming more science than art (better plans)
* Penn Vest program helping improve STP's
* good startup program all-around (BMP, tech assist) - good base to build on
* phosphate ban now in place
* national visibility helps (ahead of Puget Sound & others)
* involving farmer (total farm involve)
* high percentage of FSA plans developed
* waste management plans effective
* increased technical capability
* public aware of growth management need
* public aware of agribusiness' understand/commitment (to include environmental concerns)
* training and guidelines for nutrient management technicians
* now include industrial and other segments of population - not just farmers
* moving toward individual comp. resource management plan (better integrated)
* NY involvement essential to PA progress

NO

* much rhetoric but funding limitations exist
* insufficient staff
* total economic picture (from values, ind. values, taxes, etc.)
* population growth
* growth of livestock industry & importance of livestock feed
* difficult to get more farmers to enroll in programs
* "green lawns" measure wealth - not reaching average homeowner
* not enough enforcement of E & S regulations
* comprehensive land-use planning doesn't exist
* need to get to grassroots level
* under best circumstances, will take a long time to accomplish goals
* competition for $ resources
* failing septic systems
* atmospheric deposition working against us
* greenways & forested buffers along streams (PA lags behind)
* over 2500 municipalities makes coord/progress difficult
* frontier mentality proliferates in PA
* targeting of resources is under emphasized
* lack of agreement between researchers re: nitrogen application rates and fate of N when applied
* programs driven by fiscal rather than nutrient reduction concerns
* national cheap food policy
* not all agriculture players are at the table
* our objectives are very expensive - public doesn't understand
* international competition from less regulated countries

YES

* Division of Soil & Water and Conservation Districts are excellent
* local and regional initiatives since 1970's have helped
* strong support from General Assembly
* effective cost-share program
* state plan for 40% reduction is in place
* some successful experiments ie. Occoquan
* educational activities have created high visibility
* good cooperation between state and federal agencies
* good forestry BMP's
* Tayloe Murphy Commission on growth
* Chesapeake Bay Preservation Act - resource management & protection areas
* VIRGIS program
* move to low input agriculture
* strong base for volunteer efforts
* Planning District Commissions' initiatives
* General Assembly authorized local Stormwater planning
* Political atmosphere for environmental issues is positive
* improved sewage treatment
* clear goals
* beginning of reasonable regulations
* basically sound governmental structure
* motivated, enthusiastic staff
* phosphate ban in place
* Farm Bill programs well underway
* Section 319 money will help
* good protection of tidal wetlands
* higher land values may deter some development
* needs have been identified
* localities seem willing to make changes

NO

* lack of nontidal wetlands protection
* lack of local enforcement, especially on construction sites
* lack of infrastructure planning
* failure to effectively address growth and development
* lack of coordination within nonpoint programs
* no I/M on urban storm systems
* no I/M on BMP's
* tension between economic interests & environmentalists on development
* need more local landowner involvement
* no handle on air pollution
* lack of open space acquisition money
* vesting legislation could restrict local efforts
* improperly installed BMP's
* Dillon Rule
* No funding or user fees for local stormwater planning
* ineffective targeting of resources
* agriculture needs to be more proactive
* need money to finish soil surveys
* lack of long term monitoring
* inadequate programs for homeowners
* need more forest buffers
* long term funding not guaranteed
* Department of Transportation not involved
* developers, farmers, citizens all need more education
* VA budget limitations
* need state-level planning leadership
* lack of incentives for conservation easements
* too much reliance on Farm Bill to solve problems
* need better ways to track and quantify nutrient reductions
* must address septic systems, other groundwater problems
* lack of technical expertise at local level
* need BMP's for highways
* landfill teaching
* groundwater problems not well understood
* too much reliance on voluntary participation

YES

* there is a strong, effective commitment in Maryland to nonpoint source reductions
* effective sediment control program
* agricultural community offered education in nutrient management techniques
* Soil Conservation Districts and Soil Conservation Service have the expertise to work on NPS problems
* strong retrofit stormwater management program in Prince George's County
* strong tree conservation and woodland preservation program in Prince George's County
* Metro Washington Council of Governments doing excellent job of coordinating programs
* more people interested in protecting the Bay
* strong commitment, adequate funding, good delivery system to farmers for NPS controls
* University of Maryland expertise
* wide variety of interests and programs support Bay cleanup
* there are lots of NPS programs and cooperation is improving
* there is good emphasis on providing implementation funds
* there are BMP's for large farmers... and a lack of BMP's for small property owners.
* modeling effort helps
* programs to preserve stream buffers/Green Shores
* use of agricultural chemicals is decreasing
* economic dependence generates strong motivation
* state Critical Areas program
* good education program in place
* SCD's are well-organized

NO

* inadequate technical information
* groundwater research inadequate
* weak enforcement; need more staff, funding
* inadequate maintenance of stormwater facilities
* current technology of moving sludge to uncontrolled rural areas poses problem
* uncontrolled population growth
* need to monitor local (planning/zoning) ordinances; too many exceptions and waivers granted
* development pressures drive decisions
* lack of knowledge about land conservation programs
* lack of of programs for plots of 5/10 acres or less
* too many chiefs, not enough Indians
* efforts are not coordinated..."We need more of a holistic approach."
* lack of funds for NPS compared to point sources
* stronger commitment by legislature needed (executive branch of government is committed to NPS reductions but legislative commitment is lacking. "They give us work to do, but not the funds to do it.")
* lack of urban stormwater retrofit
* State and counties should increase frequency of household hazardous waste collections (batteries, antifreeze, used oil, etc.)
* need more boat pumpout stations
* inadequate evaluation system to decide what is most cost-effective
* lack of social science involvement ("we are throwing technology at the the problem")
* inadequate understanding of value of various lands ("all wetlands do not have the same value")
* incentives to pollute have not been curbed

Question #2 concerning research needs also generated many responses:

Virginia - Several key needs emerged:

1. Information on program effectiveness
2. Correlations between programs and effects on living resources
3. Socio-economic research
4. Funding

Pennsylvania - Caucus identified these needs:

1. Research to refine nutrient management
2. Impacts of on-lot septic systems
3. Research on groundwater protection
4. Evaluation of cost-effectiveness
5. Waste disposal

Maryland - Participants saw needs for research in these areas:

1. Effectiveness of BMP's
2. Groundwater/surface water interface
3. Functional value of non-tidal wetlands
4. Contributions of urban sources
5. Growth management

Question #3 concerning Implementation needs elicited these responses:

Pennsylvania:

1. Need to reach farmers not presently involved
2. Need to coordinate into one plan individual components on pesticides, nutrient management, and erosion control.
3. Need to improve cooperation between PA and EPA
4. Develop better ways to measure and display program progress
5. Implement growth management efforts at the local level

Maryland:

1. Need better teamwork among urban and agricultural interests
2. Concentrate more effort on "low-input" agriculture
3. Focus programs on a watershed basis
4. Provide more technical training
5. Need more money

Virginia:

1. Need to develop ways to measure progress, account for work accomplished and results achieved
2. Maintenance of BMP's
3. Emphasize pollution prevention
4. Deal with development issues, costs associated with urban BMP's, and necessary legislation
5. Education to develop a nonpoint ethic in citizenry.