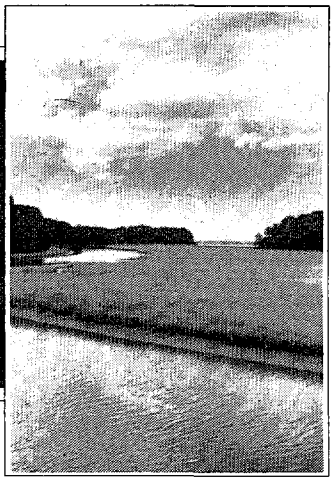
Task 13

Final Product

MANAGEMENT OF CUMULATIVE IMPACTS IN VIRGINIA: IDENTIFYING THE ISSUES AND ASSESSING THE OPPORTUNITIES

VIRGINIA
COASTAL RESOURCES MANAGEMENT PROGRAM



'a Coastal Resources Management Program links state programs to manage coastal resources. 'm's coastal boundary includes the 29 counties and 15 cities within Tidewater Virginia. The coordinated and monitored by the Virginia Council on the Environment.

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MANAGEMENT OF CUMULATIVE IMPACTS IN VIRGINIA: IDENTIFYING THE ISSUES AND ASSESSING THE OPPORTUNITIES

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Virginia Council on the Environment's Coastal Resource Management Program

by

The Institute for Environmental Negotiation
University of Virginia

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A working group of state agency personnel met several times with the Institute team to review the study plan, to offer suggestions and to comment on drafts. The group consisted of:

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Beth Lester	Dept. of Air Pollution Control
Alan Pollock	State Water Control Board
Bob Croonenberghs	State Department of Health

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EXECUTIVE SUMMARY

Purposes of the Study

This study was conducted in order to explore both the concept and practice of cumulative impact management. Consideration focused on the definition of cumulative impacts, obstacles which make their assessment and management a difficult challenge, current practices in Virginia as well as other states, and proposed options which have the potential for advancing cumulative impact management practice in Virginia. The study was supported by funds from the Virginia Coastal Resource Management Program and is responsive to the federal program's special interest in improving the overall management of cumulative impacts.

Defining Cumulative Impacts

Cumulative impact assessment can be contrasted with conventional impact assessment by the broader manner in which the temporal, spatial and jurisdictional boundaries of evaluation and management are conceived. As one source has put it, "Cumulative impact assessment takes a broader view: the boundaries it draws in regard to the number of disturbances, the geographic area, and the timeframe conceived are larger. Conventional impact assessments are typically bounded by the expected zone of influence of a single disturbance or proposed project . . . . While such a bounding process allows evaluation of the local impacts on resources, it does not allow evaluation of impacts of the project on these resources as a whole, of the total impact on these resources from all anthropogenic disturbances, or secondary impacts resulting from the interaction of impacts from the project with other anthropogenic disturbances." (Preston and Bedford, 1988, p. 566)

The most widely referenced definition of cumulative impacts is the one set forth in the Council on Environment Quality regulations for implementing the National Environmental Policy Act of 1969. It defines cumulative impact as:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (Sec. 1508.7)

The key words in this definition that broaden it beyond that of conventional assessment are "incremental," "when added to," "other past, present and reasonably foreseeable future actions" and "regardless of what agency or person undertakes such action." As the last sentence of the CEQ definition indicates, the concern is as much with a series of small but collectively significant actions as it is with larger projects.

Cumulative impacts come in a variety of forms. One is termed "additive" - where the environmental result comes from a series of repetitive actions. Also referred to as the "nibbling effect," this type of impact is well illustrated by a series of small wetland conversions which add up over a period of time to significant acreage. Other types of cumulative impacts addressed in the study include: cross-media or multi-media; synergistic/interactive; cross boundary; and catalytic or secondary impacts. In considering these various definitions, it becomes apparent that, for practical purposes, managing for cumulative impacts quickly merges with efforts at overall environmental management.

Findings

Effective management of these various types of cumulative impacts poses a major challenge to all states as well as to the federal government. Review of state by state reports filed with the Office of Ocean and Coastal Resources Management of the National Oceanographic and Atmospheric Administration, found that no state has fully achieved an effective cumulative impact management system. Virginia fits within this overall pattern.

There are substantial obstacles to implementing effective cumulative impact assessment and management. These include legal limitations; political obstacles; scientific and technical issues; financial and personnel constraints and organizational and jurisdictional patterns plus a range of philosophical obstacles which underlie many debates about the role of public policy regarding cumulative impacts. Various innovations are identified by the study for addressing the different types of obstacles but many are sufficiently new or are so inadequately evaluated that there is little evidence at this point upon which to base an assessment of their actual effectiveness.

Examination of the ways in which Virginia's regulatory and management agencies are currently considering cumulative impacts in their permitting decisions and other management activities, was found to

be like describing whether a glass of water is half full or half empty. Much is being done to control environmental impacts - including avoidance of cumulative impacts. The underlying philosophy of key programs is to allow emissions or discharges only up to the point that the particular resource can assimilate the load in question. This approach is entirely consistent with a cumulative impact management perspective. This study also found that while cumulative impacts are not going unaddressed in Virginia, there remain significant opportunities for advancing cumulative impact management.

Conclusions

The analysis of programs and initiatives, both in other states and those being explored in Virginia, does suggest that there are things which Virginia's agencies and departments could do to strengthen their ability to manage cumulative impacts. Some of these changes are modest in scope and could be implemented within the existing framework. Others are more fundamental and may be best viewed in a longer time frame. For these, more detailed study may be appropriate before a course of action is chosen.

Options for improving the existing framework include:

- improving coordination and interaction between regulatory agencies
- expanding state environmental impact review requirements
- authorizing or requiring cumulative impact assessment and management in existing laws and regulations
- modifying permitting procedures to promote facility-wide, cross-media management
- enhancing baseline data and monitoring capability
- increasing resources and funding for cumulative impact analysis and management
- removing or reducing exemptions of categories of impacts from cumulative impact assessment.

Other options would involve more significant changes in the framework of the state's environmental programs. Options for consideration include:

- reorganization and consolidation of environmental management functions
- greater emphasis on basin-wide and regional approaches
- strengthening the system of land use planning and growth management
- greater emphasis on waste reduction and pollution prevention
- developing methods for interstate or regional cooperation
- addressing equity issues in allocating limited assimilative capacity

Section VI of this report more fully discusses these various options.

No man, woman, launderer, or launderesse dare to wash any unclean linen, drive bucks, or throw out the water or suds of fowle cloathes in open streets, within the Palizadoes, or within forty foote of the same, nor rench, and make clean any kettle, pot or pan, or such like vessel within twenty foote of the olde well, or new pumps, nor shall anyone aforesaid within lesse than a quarter of one mile from the Palizadoes dare to doe the necessaities of nature, since by these unmanly, slothfull, and loathsome immodesties, the whole fort may bee choaked and poisoned...

--from the first sanitation law in Virginia, 1610

I. INTRODUCTION AND STUDY METHODOLOGY

The problem of managing cumulative effects is not a new one in Virginia, as the above quote illustrates. From the state's earliest period of settlement, human alterations to land, air and water have resulted in at least some degree of cumulative environmental impact. For most of our history, aggregate environmental results have generally not been seen as widespread or serious because human and development pressures have not overtaxed the assimilative capacities of the natural system. However, as Virginia's population continues to grow, and as the pressure to utilize its natural resources rises, long term cumulative impacts will likely become more evident. In recognition of this same pattern nationwide, improving the ability of states to manage cumulative impacts is one of the primary goals of the Federal Coastal Zone Management Program.

This study was commissioned by the Virginia Council on the Environment as part of the state's Coastal Resources Management Program to consider the issue of cumulative impacts in Virginia. The study seeks to assess the extent to which cumulative impacts are seen as a problem in our state and to examine the ways in which state environmental and regulatory agencies are currently taking cumulative impacts into account in their decisionmaking. The more specific objectives of this study include:

--to examine the ways in which Virginia regulatory and management agencies are currently considering cumulative impacts in their permitting decisions and other management activities; and to identify possible limitations and deficiencies in current approaches.

--to identify programs and strategies employed by other states and to judge whether these might represent models for Virginia to adopt, adapt or to learn from.

--to identify obstacles and impediments faced by Virginia and other states in effectively incorporating cumulative impacts into resource decisions.

--to identify potential opportunities for changes in current procedures, regulations, laws, etc., in Virginia which could be undertaken in either the short-term or the longer-term so that cumulative environmental impacts could be better managed.

To accomplish these objectives several research steps were undertaken. The authors first conducted an extensive search of the literature to identify articles, books, and reports addressing the cumulative impacts question. The existing published literature on the subject was found to be rather modest, but the search did unearth some literature useful in helping to identify different types of cumulative impacts and many of the scientific, methodological and other difficulties in considering and managing cumulative impacts. The materials found most useful are referred to later in this report.

Next, the authors sought to identify and examine the ways in which the existing regulatory and management framework in Virginia considers cumulative impacts and any impediments and obstacles which these efforts encounter. To this end the authors conducted a series of phone interviews with a small set of knowledgeable individuals representing various viewpoints. Approximately 30 interviews were conducted. These included representatives of key state agencies (13 individuals), business and industry (7 individuals), and the environmental community (7 individuals). Ten of the individuals were attorneys reflecting the legal and institutional emphasis of the scope of work of the study. Agency staff included people with technical backgrounds. The interviews were informal but generally included three themes: identifying current practices, assessment of these practices, and suggestions for improvements. The limited resources and objectives of the study precluded a larger number of interviews.

In addition to assessing the existing regulatory and management framework those interviewed were also asked if they knew of other states that might be taking different cumulative impacts approaches. Some useful leads were provided in this fashion and, in combination with literature references and additional consultations with knowledgeable organizations, states and programs were identified which might, in one way or another, offer examples of alternatives for addressing cumulative impacts. Among the additional groups and organizations consulted during

this process were: the federal Office of Ocean and Coastal Resources Management in NOAA; the U.S. Environmental Protection Agency; the Council of State Governments; the Fund for Renewable Energy and the Environment; and the National Governors Association. This analysis of innovative state programs focused on several key areas, including environmental impact assessment requirements and permitting practices.

Assessing the actual extent and nature of environmental change that is due to cumulative impacts was not part of the scope of this study. Rather, the study proceeded on the basis that if a policy decision were made that Virginia should do more to manage cumulative impacts, what management approaches might be available, what advantages might they hold over current practice and might they be feasible in Virginia given our current management institutions.

The organization of this report roughly follows the different research steps just described. Section II attempts to define what is meant by cumulative impacts and identifies several key ways of defining them. This section establishes some important terminology and conceptual distinctions useful to subsequent discussions. Section III identifies the primary obstacles and impediments to cumulative impacts management, both in Virginia and in other states as identified by the literature and through phone interviews. Section IV presents the findings of our review of the Virginia framework and summarizes many of the key observations of interviewees in Virginia. Section V describes in considerable detail what other states are doing to address cumulative impacts, emphasizing those states and state programs which are potentially transferable to Virginia. Finally, Section VI presents the major conclusions of the study and offers alternative ways which Virginia agencies might consider for better addressing cumulative impacts based on ideas which emerged during the study. Alternatives in this final section include actions and policy changes that could be undertaken in the short-term, as well as larger and perhaps more fundamental changes in Virginia's environmental management system that may require a longer timeframe to undertake or complete. References are provided in Section VII.

A separate Technical Appendix has been prepared which contains more detailed regulatory excerpts and program descriptions for several of the states discussed in Section V. It is not necessary to have the Technical Appendix in order to read the body of the report.

II. DEFINING CUMULATIVE IMPACTS

Explicit attention to cumulative impacts, as evidenced in the literature and in federal and state environmental legislation, has been relatively recent. One of the first major pieces of environmental legislation at the federal level with the potential for addressing cumulative environmental impacts was the National Environmental Policy Act (NEPA) of 1969. NEPA requires the preparation of an environmental impact statement for all federal projects or actions which may significantly affect the environment. Guidelines and implementation regulations prepared by the Council on Environmental Quality (CEQ) explicitly require federal agencies to consider the cumulative impact of their projects. (For a discussion of cumulative impacts and NEPA see Eckberg, 1986).

A "cumulative impact" is defined in the CEQ regulations as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (Sec. 1508.7). While this definition is a useful starting point, a more refined set of definitions and categories of cumulative impacts can direct attention to the many ways that cumulative effects manifest themselves.

Before presenting a more detailed typology of cumulative impacts, however it is also important to distinguish between cumulative impacts <u>assessment</u> or <u>evaluation</u> as an analytic task and cumulative impacts <u>management</u>. Much of what one encounters in the literature involves different approaches and techniques for better evaluating the cumulative impacts of various human activities. However, cumulative impacts management involves more than assessment or evaluation, and encompasses as well the policies, programs and strategies employed to mitigate or control them. Evaluation and assessment methodologies are often important components of cumulative impacts management but are not the only components. While a state may require that the cumulative impacts of a particular proposed facility, say a highway or industrial factory, be analyzed, management of those impacts implies much more (e.g. facility design, siting, permit conditions, etc.). It might also be observed that cumulative impacts management can occur with little or no formal cumulative impacts evaluation procedure. A state may enact a wetlands protection act, for example, that in effect manages cumulative

impacts but does not specifically include a cumulative impact review procedure. However, even in these cases there is usually an evaluation component in the sense that scientific studies, data or models are utilized to identify potential impacts that require managing. The emphasis in this study is on management approaches but attention is paid to a degree to assessment and evaluation issues.

In conducting this study it became evident that there are actually a variety of ideas about cumulative impacts and as a result there remains considerable terminological and conceptual confusion. Depending on who you talk to, cumulative impacts may be everything or they may be nothing. In its most expansive conception, cumulative impact management is virtually synonymous with overall environmental management. We suggest five primary definitions of cumulative impacts. These are: additive cumulative impacts; cross-media or multi-media impacts; synergistic/interactive impacts; cross-boundary impacts; and catalytic or secondary impacts. While this may not be an exhaustive list, these five broad types tend to capture most of the issues and concerns identified in this study.

ADDITIVE IMPACTS

Additive cumulative impacts are those environmental impacts or effects which are the result of a series of repetitive actions. The phenomenon has been described by some as the "nibbling effect," in that it results from the gradual and incremental degradation of a resource, such as a waterbody or wildlife habitat resulting from a series of small actions. The impacts of any single action may be negligible but the accumulated effect of many actions can be significant.

Considerable attention has been paid in the literature to the gradual loss of wetlands as a prime example of the additive category of cumulative impacts (e.g. see Preston and Bedford, 1988; Risser, 1988). Wetlands and wetland systems serve a number of valuable environmental and ecological functions and their loss over time, it is generally agreed, has serious consequences. Yet, the manner of their loss is typically gradual and through a large number of small actions--an acre filled here, a shorefront lot bulkheaded there. Focusing on the discrete action or degradation tends to overlook the larger pattern of loss and its long term consequences.

CROSS-MEDIA OR MULTI-MEDIA IMPACTS

Many projects or development proposals necessarily involve more than a single type of environmental resource or medium. An industrial activity, for instance, may as a normal course of its production process produce wastes which are discharged to both the air and water. Such an activity might be said to have "multi-media" cumulative impacts. The cumulative environmental impact of such a proposed factory or industrial plant is the total impact on these different environmental media, i.e. air, water, land. An industrial activity might also be said to have "cross-media" cumulative impacts in that a pollutant might start out in one medium and end up in another medium. Acid deposition is a classic example of this. These types of impacts are also referred to as trans-media cumulative impacts.

While many development activities or industrial projects have cross-media or multi-media impacts, historically the management and regulatory framework at federal and state levels has been highly segmented by medium. Air pollutants are typically regulated by one agency. Water pollutants are regulated by another. Impacts on wetlands and wildlife habitat are managed by still other agencies.

SYNERGISTIC/INTERACTIVE IMPACTS

Another form of cumulative impact is those which involve interactive or synergistic effects. These are circumstances where "the total effect of an interaction between two or more agents is greater than the sum of the effects." (Peterson at al, 1987, p.7). Photochemical smog, for instance, is the result of the interactive effects of pollutants such as nitrogen oxides and ozone, in the presence of sunlight.

In point of fact there are probably few environmental impacts or perturbations that are not interactive to some degree. The gradual loss of wetlands example above is also important because of the interactive effects of such losses with other environmental variables. At the same time that wetlands are being reduced, other elements of the ecological system are also being altered. This combination can have serious interactive consequences for wildlife, for water quality, etc. As universal as these synergistic effects seem to be, they are also difficult or expensive to document and to manage.

CROSS-BOUNDARY IMPACTS

Clearly an important dimension to the cumulative impacts problem is the fact that environmental pollution knows no jurisdictional boundaries. When a factory emits air or water pollutants very frequently environmental impacts are "exported" to other localities, states and even nations. These cross-boundary or cross-jurisdictional impacts are often not fully understood or considered in the permit and other decisions made by governments either at the local, state or federal level. Much of the increase in global environmental awareness of late is due to the existence of these cross-jurisdictional/cross-boundary effects.

CATALYTIC OR SECONDARY IMPACTS

In some cases concern about a particular action or decision is expressed not simply because of the direct or immediate impacts but because of the secondary impacts which will be brought about or stimulated as a result. Classic examples include the construction of major facilities, such as highways or shopping malls, which may themselves cause impacts but which also generate additional growth and development pressures which in turn bring further impacts. These types of impacts might also be referred to as catalytic, in the sense that they spur or provoke additional impacts. The actual types of secondary effects generated may range from automobile traffic to air pollution to urban sprawl.

DISCUSSION

There are, then, several different ways of thinking about and classifying cumulative impacts. It is useful to note that while every category of our impacts typology was mentioned at some point in the phone interviews, there did seem to be a natural tendency to view cumulative impacts in a more compressed two-dimensional fashion. Concerns were expressed about, on the one hand, intra-agency/ single-medium impacts (additive and interactive), and cross-media/cross agency impacts, on the other hand.

From these various definitions it is apparent that cumulative impacts management generally involves taking a broader view of environmental management--one which goes beyond the conventional

approach of focusing on the limited impacts of a single action on a single site at a single point in time under the authority of a single regulatory agency. Rather, cumulative impacts evaluation and management take a more comprehensive view. As Preston and Bedford (1988, p.566) describe it:

> An essential difference between conventional impact assessment [and cumulative impact assessment] lies in the manner in which spatial and temporal boundaries of the evaluation are established... Cumulative impact assessment takes a broader view; the boundaries it draws in regard to the number of disturbances, the geographic area, and the timeframe considered are larger. Conventional impact assessments are typically bounded by the expected zone of influence of a single disturbance or proposed project. The effects on environmental resources falling within that zone are then estimated. While such a bounding process allows evaluation of the local impacts on resources, it does not allow evaluation of impacts of the project on these resources as a whole, of the total impact on these resources from all anthropogenic disturbances, or secondary impacts resulting from the interaction of impacts from the project with other anthropogenic disturbances.

While the distinctions between the categories of cumulative impacts listed above are not hard and fast, they do suggest considerable implications for how to go about managing them. Concern about additive cumulative impacts, such as in the case of the gradual loss of wetlands or wildlife habitat, may suggest that a single regulatory or resource agency can achieve change through better internal analysis and decisionmaking procedures. If concern lies with cross-media or multi-media cumulative impacts, effective management may require procedures and strategies which involve multiple agencies. If the concern is with cross-boundary impacts, management may require the creation of new institutions more consistent with the parameters and boundaries of the natural system (e.g., a regional management entity). The wide array of these potential policy responses and management strategies is discussed in the sections to follow.

III. OBSTACLES AND IMPEDIMENTS TO MANAGING CUMULATIVE ENVIRONMENTAL IMPACTS

The task of environmental management, particularly as it attempts to take cumulative impacts into account, is complex and difficult. It is not surprising that agencies in all the states contacted report difficulty managing cumulative impacts and cited various limitations under which they operate. This section describes and discusses the major obstacles which have been identified from a number of sources, including those interviewed for this study and the relevant literature. The obstacles to managing cumulative impacts identified here apply both to Virginia and to other states. What follows is an attempt to identify, categorize, and discuss these major obstacles and impediments. Once identified the challenge becomes finding ways to overcome them - that is the task of Section V and VI.

REPORTS FROM THE STATES

As an initial attempt to get a better understanding of the experience of other states, we examined the program status reports submitted by states participating in the federal Coastal Management Program. These reports are submitted to NOAA on a yearly basis. They contain considerable information about the different state coastal programs and for the last two years (1989 and 1990) have contained questions explicitly asking about management of cumulative impacts, specifically on wetlands and estuarine resources. One of these questions asks about the types of problems faced in implementing a cumulative impact review policy or process. While many of the states had no program or policy on which to base a reply, a number did provide comments about implementation problems. These problems are summarized in Table 1, and are listed in order of frequency cited. It should be noted that in tabulating the list, responses from two different years were combined.

Table 1: Problems cited by coastal states in implementing a cumulative impacts review process or policy for wetlands/estuarine resources (listed in order of frequency)

	Implementation Problems	Frequency of Citation
1.	the case-by-case decisionmaking process	12
2.	lack of methodology for evaluating impacts	9
3.	lack of baseline acreage data	9
4.	inexperienced personnel	8
5.	inadequate data on functions	7
6.	lack of established thresholds	7
7.	exemptions for small wetlands	6
8.	lack of legal authority	4
9.	limited financial resources	3
10.	definitional difficulties	3
11.	absence of standardized practice	2
12.	lack of land use plan	2
13.	disagreement between agencies on criteria	2
14.	lack of long term monitoring	1

Source: Yearly state program reports, Office of Ocean and Coastal Resources Management, NOAA

As Table 1 indicates, coastal states have experienced a range of problems in implementing a cumulative impacts policy or program, at least for wetlands and estuarine management. The most frequently cited problem was that agencies made decisions on a case-by-case or permit-by-permit basis and that this did not lend itself to a more comprehensive cumulative impacts approach. Among the other more frequently mentioned problems were: the lack of a methodology for making cumulative impacts decisions; the lack of baseline data; the lack of experienced personnel; and the lack of established thresholds for making cumulative impact decisions.

A general discussion of these and other impediments follows. It reflects our literature review as well as interviews in Virginia and elsewhere plus the results above. We have grouped obstacles into several categories, subsuming some of the more specific implementation problems already cited in Table 1. These broad categories include: philosophical issues; legal constraints; political obstacles; economic and personnel obstacles; scientific and database factors; and organizational and jurisdictional limitations. Each is described in more detail below.

LEGAL OBSTACLES

Several legal obstacles to cumulative impacts management have been cited by those interviewed for this study and by the literature. Among them are: whether state regulatory agencies have or need explicit statutory authority to make decisions based on cumulative impacts; whether single-purpose regulatory agencies can take actions which are based on controlling impacts in a different medium (e.g., an air quality agency making a decision based wholly or in part on water pollution effects); whether agencies can deny or condition permits based on speculation about what will happen in the future; whether or not an agency can control a use or activity in order to prevent the establishment of a precedent with significant cumulative impacts; the extent or level of scientific precision or study that is required to uphold the legality of a threshold used in allocating limited assimilative capacity; and a host of potential legal impediments, constitutional and otherwise, to controlling land use and private property to managing cumulative impacts - most notably the "takings" question. (For a review of many of these legal issues see Reiser and Quintrell, 1986). This list of questions, even without elaboration, is daunting and sufficient to discourage many from innovation without clear legislative authorization. Nonetheless, brief discussion is useful.

One important legal issue revolves around the question of whether an environmental and resource management agency has the explicit authority to take cumulative effects into account. If an agency has a broad mandate to protect and manage the natural environment, or some component of the environment, is this sufficient or is explicit statutory language necessitated? Some states have modified existing environmental statutes to specifically allow or require consideration of cumulative impacts (e.g., the State of North Carolina, for example, has amended its Coastal Area Management Act to explicitly address cumulative impacts; see Section V to follow).

A related issue is the extent to which single-purpose regulatory agencies--i.e., those with responsibility for air, water, wetlands, respectively--can take actions on environmental grounds broader than their own narrow charges. Can, for instance, a state wetlands agency (e.g., VMRC) deny a permit request to fill a wetland because it feels the overall environmental damage from the proposal (e.g. air pollution, water pollution, traffic generation, etc.) is too extensive? Generally, are environmental and resource agencies restricted from such a broader cross-media review? This type of problem represents a significant legal

obstacle in Virginia, and is discussed in greater detail in Section IV. One innovation to overcome this type of legal limitation is "whole facility permitting" discussed in Section V.

Another set of legal questions centers on the permissible scope of the permit decision. More specifically, what is the temporal and geographical scope which agencies are permitted to consider? Can resource agencies deny permits, or substantially condition permits, based on projects and proposals that they believe will occur in the future? Can a regulatory agency make permitting decisions which take into account the other permits "in the pipeline" or that might be reasonably foreseeable as NEPA specifies? In Virginia, this issue has been brought to the fore by the large number of co-generation permit applications filed this past year. This also raises questions of temporal and geographic scope. Can a resource agency deny a permit, or substantially condition a permit, based on impacts which will occur beyond its jurisdictional boundaries (e.g., to another state)?

Another legal issue identified is the difficulty in denying a particular desired use or permit where similarly-situated parties have already been issued such permits in the past. This is sometimes described as the problem of setting precedents. Once a government agency has issued a permit allowing, for instance, the filling of a certain type of coastal wetland in a certain circumstance, the perception is that it then becomes difficult legally to deny a similar permit request in the future. Taking back a permit or seriously modifying the conditions of a valid permit would also raise legal questions.

Because successful management of cumulative impacts will likely involve some degree of land use management, there are also a host of legal issues and potential obstacles here. If preventing the cumulative water quality impacts of bayfront development requires substantial restrictions on what private landowners are permitted to do with their property, will such regulations violate any federal or state constitutional safeguards? The most frequently mentioned of these is the so-called "takings" issue, where government is required to compensate landowners when land use regulations are so onerous as to amount to an expropriation of land. Other constitutional challenges of concern include substantive and procedural due process, and equal protection challenges. Several states have faced such issues and the outcome of these is discussed in Section V.

POLITICAL OBSTACLES

Significant political obstacles to effective management of cumulative impacts can also be identified. They derive in large part from the lower priority assigned by the political process to these often less evident and less immediate types of impacts. Because the ramifications of cumulative impacts are often not felt until some time in the future, and are often exported to communities and populations in other places, there is a natural tendency to undervalue them in the political process. As well, controlling cumulative impacts frequently requires the loss of certain short term benefits, and usually incurs the wrath of identifiable constituents. In the words of one individual interviewed, "Who's going to tell Old Joe he can't fill a wetland..." Moreover, state and local officials are often confronted with the choice of adding to the tax base and enhancing economic prosperity, or seeking to control impacts that are difficult to measure and see. Especially at the local level there is a natural tendency for elected officials to feel that their first and foremost priority is to the local populace and to the constituents who actually elected them. There are few political points to be won by working to protect the interests of those living outside one's political or jurisdictional boundaries.

Equally true, there is a tendency in the political system to favor actions and policies which involve a short timeframe. Political leaders have few incentives to consider the long term and cumulative effects of a particular policy or action. Emphasis is frequently given to benefits and projects that can be realized in the timeframe of elections and reelection campaigns.

The often intangible nature of cumulative impacts also puts them at a disadvantage when evaluated through benefit-cost analyses and other techniques. While it may be very easy to identify the costs, it is typically much more difficult to assess the long term benefits of actions to minimize cumulative effects. Put another way, it is difficult to assign cumulative impacts a high priority compared to other values which have organized constituencies where compelling personal pleas are presented. Cumulative impacts can be a difficult sell in the political arena.

SCIENTIFIC, TECHNICAL AND INFORMATIONAL OBSTACLES

There is little doubt that a major difficulty in taking a more aggressive cumulative impact approach is that the science to support it

may not be fully developed. The scientific impediments are several and clearly relate to numerous other impediments mentioned here. First, many of the more significant environmental impacts of concern may be indirect and, as a result, causal pathways are poorly understood. While we may be able to say with great certainty that uncontrolled urban development will have negative, perhaps even fatal effects on shellfish resources, it may be difficult to discern the actual impact of a single project or a single acre of development. Moreover, it may be especially difficult to determine ecological and biological thresholds; that is, amounts of degradation that will cause certain fundamental changes in the functioning or productivity of the natural system. (For a good discussion of these scientific and methodological difficulties see Preston and Bedford, 1988; Bain et al, 1986) At what point can it be justified that enough is enough?

Determining causal pathways and establishing thresholds is perhaps easiest where the focus is on a single pollutant and on a single biological parameter (e.g. sub-aquatic vegetation). Ideally, though, cumulative impacts management should consider the effects of not only this water pollutant but others potentially present and their combined effects. Furthermore, cumulative impacts management ideally requires, as discussed earlier, not simply the consideration of the impacts of waterborne pollutants but other types of degradation as well, e.g. air pollution, wetland filling. There is little doubt that regulators are hesitant to impose environmental restrictions on companies and landowners where they feel the science to back them up is uncertain.

Some of these obstacles may tend to be more informational than scientific or causal. For instance, several people observed that decisionmakers have been hesitant to make decisions on the basis of cumulative impacts because they lack certain basic background data from which to make these judgments. The lack of baseline data is a problem frequently mentioned in the literature and by program administrators in all states. (See Table 1 above.) This type of impediment is perhaps most pronounced in the case of the nibbling away of resource lands, such as wetlands and wildlife habitat.

FINANCIAL AND PERSONNEL OBSTACLES

We heard quite frequently in our discussions with state officials that they could indeed more carefully incorporate and consider potential cumulative impacts if they had the additional personnel and money for scientific evaluations. State environmental agencies in Virginia, and

elsewhere, frequently feel that they lack the resources and manpower to do any more than what is absolutely required in reviewing and assessing impacts. Agencies also report lacking the personnel to provide full analysis and critique of proposed projects sent to them for comment by other agencies. There is also an indirect effect of the budget constraints facing states during the present period - this is the effect on employee attitudes and morale. Few are as excited about their work as they once were and fewer still see much to be gained from initiatives that would only complicate their lives during these lean times.

Many of the more serious obstacles to more effective cumulative impacts management are fundamentally fiscal. Preparation of carrying capacity plans for watersheds or estuaries, for example, can be very expensive. Several people suggested, for instance, that they had serious doubts about the effectiveness of Virginia's Bay Act as a result of the very small amounts of state funding made available to local governments to prepare and to implement the mandated plans. Furthermore, some of the more effective strategies for controlling cumulative impacts may require very large amounts of money. The most effective approach to preventing cumulative impacts on wetlands, shorelines, wildlife habitat, and similar resourcelands, may be for the state or some other entity to purchase many of these areas. The costs of land acquisition, however, especially where significant urban development pressures exist, are very high.

ORGANIZATIONAL AND JURISDICTIONAL OBSTACLES

Effective cumulative impacts management may not be supported by existing organizational structure. Division of environmental management responsibilities into a variety of agencies and offices was frequently identified in the literature and in our interviews as a significant obstacle working against more comprehensive and holistic approaches. One author, Butler (1990), concluded that Virginia's efforts suffer from bureaucratic fragmentation and that the General Assembly has tended to address environmental management in a piecemeal and crisis-oriented way. Moreover, she finds that different agencies are "turf" conscious. "Development of more comprehensive and better coordinated environmental laws should help to alleviate the problem of turf-guarding that now exists among many environmental agencies. As Virginia's experience indicates, an uncoordinated and incomplete regulatory structure tends to produce an uncooperative atmosphere among environmental agencies. Instead of taking a holistic view, agencies in

such a regulatory structure tend to focus only on their responsibilities and, as a result, become overly protective of their own programs. Improved coordination should create more positive feelings among agencies." (p.886)

Not everyone would agree with Butler's assessment of the severity of this problem but to the degree that units within a larger environmental protection organization find it difficult to work in concert, for whatever reason, it is clear that it will be more difficult for anyone to address cross-media impacts.

Another generic organizational problem - procedural inertia - also came up in the literature and our review of various organizational studies. Agencies develop particular procedures and processes for making resource decisions (albeit based on certain legislative and legal mandates) which over time become highly institutionalized. Once "standard operating procedures" are firmly established, agencies and agency personnel may have a difficult time visualizing alternatives. Combine with this the fact that more integrative and comprehensive approaches are more demanding (in terms of information needed, level of scientific understanding, etc.) and it follows that many regulatory agencies will operate on a case-by-case approach, as indicated by the NOAA state survey.

Heavy reliance on local governments in land use decisionmaking as in Virginia, may also work against area-wide cumulative impacts management. The more decentralized the focus, the less able the system is to consider impacts in an overall fashion, particularly when it comes to cross-boundary resource issues. Granted, there are many positive benefits of a localized and decentralized approach to government, including the potential for greater participation and involvement of the average citizenry. It should also be recognized that moving these decisions to higher governmental or jurisdictional levels is politically difficult. However, where the resource of concern spans many local jurisdictional boundaries (such as a river basin or an airshed), regional or substate institutions may become necessary and appropriate.

PHILOSOPHICAL OBSTACLES

From the literature and from discussions with agency officials in Virginia and elsewhere it appears that officials also have difficulty taking tough cumulative management stances for philosophical reasons. Managing cumulative impacts often requires establishing limits on

environmental resources and restricting the freedoms of individuals and groups based on these limits. This is true of all forms of environmental regulation, of course, but in addressing cumulative impacts this difficulty is heightened. In dealing with cumulative impacts, cause-effect relations are less obvious and more indirect. New forms of specialized expertise may be needed. There may also be a fear that if all forms of cumulative impacts were to be taken into account it might be more likely that projects would be denied than is currently the case. These facts suggest that for public officials decisions about managing cumulative impacts, and about how aggressively to manage them, may be difficult ones.

There are a number of difficult philosophical and ethical questions which are likely to arise in environmental management generally but particularly in the course of the managing cumulative impacts. A primary philosophical issue is whether, in the minds of elected officials (and their constituents), the benefits obtained from managing cumulative impacts are indeed worth the societal costs of controlling them. Should Virginia agencies work towards the goal of preventing the generation of non-point water pollution, for instance, at any cost? Is it necessary and desirable that all such impacts be eliminated? Is some degree of pollution or degradation of the state's resource base permissible and even desirable, taking into account the costs of controlling these impacts and the benefits produced by them? Many of these questions, especially those involving pollution control, boil down to fundamental disagreements about acceptable levels of risk. Should society expend large amounts of its resources to reduce risks from substances such as dioxin to extremely low levels (e.g. carcinogenic risk levels of one death per million people exposed)? Many would argue on philosophical grounds that only the most significant and serious cumulative impact problems ought to be addressed where the costs of managing them are very high.

There are other ethical positions and considerations beyond simply weighing the relative societal benefits and costs. It could be argued, for instance, that stringent controls of air pollution or water pollution are morally justified on the grounds that these types of impacts represent instances of individuals and firms inflicting "harms" on other individuals and the larger public. It is one thing for an individual to freely choose to subject himself or herself to a certain risk (say from dioxin or some other toxic pollutant), but another entirely to have these forced upon them through someone else's decision. Such logic is at work when people feel indignant about the impacts of electric plants and industrial enterprises wherever they might be located on visibility and air quality in the national parks. Such activities are viewed as imposing harms on the public and

degrading a "public" resource and consequently, they feel, it is entirely fair to hold polluters culpable for these actions. Those who hold these types of views, of course, have an easier time supporting stringent public controls on cumulative impacts.

Involved here as well are basic questions about the personal and societal value placed on those elements of the natural environment that may be threatened by cumulative impacts. If public officials see little value in protecting wildlife and wildlife habitat, especially when compared with jobs and economic activity, taking strident actions to manage cumulative impacts on these resources will be a low priority. On the other extreme, there appears to be increasing recognition (especially by many in the environmental community) that the natural environment, and its constituent parts, have intrinsic value and inherent worth irrespective of the human value (monetary or otherwise) attached to their use and enjoyment and that there consequently is a moral obligation to protect them.

Cumulative impacts management is premised on the philosophical and policy position that the boundaries of analysis ought to be expanded in time and space over current practice. Managing cumulative impacts places importance on identifying and controlling impacts that cross jurisdictional boundaries and which occur or manifest themselves in the future. At the heart of these questions are assumptions about the extent of the moral community to which obligations are owed. It can be argued, as many have in the past, that obligations to consider the interests of the future, and future generations, are of a lesser moral weight. The first obligation is to think about the immediate present, and the needs and concerns of citizens as they exist in the present. Similarly, it has been argued that ethical priority should be given to members of one's own community. The first obligation is to consider the interests and welfare of one's own community, with concern about those communities, states and nations beyond one's borders being, again, of lesser moral weight. It is not hard to see how these different philosophical positions could directly influence public and private decisions about cumulative impacts.

There are numerous questions here as well about the fairness and equity with which people and groups are treated in the process of managing cumulative impacts. It is difficult for a public official to deny a permit to a landowner to build a shoreline home when she or he knows that such permits have in the past been issued to many other similarly-situated property owners. The fact that some designated environmental threshold has been exceeded, from the point of view of personal fairness,

may be irrelevant. In the minds of public officials it may appear that this particular property owner is being asked to bear a disproportionately greater burden than others in similar circumstances. Parallel concerns can exist at a community level. For instance, the limited carrying capacity of the environment might preclude the location of new polluting industries in certain localities or regions, translating into real economic hardship (e.g. has an impact on jobs, income, tax base). Impacted communities will feel unfairly treated when compared with other similarly-situated communities or regions where such polluting activities have been allowed in the past. These are not insignificant concerns when public officials are weighing the merits of managing cumulative impacts.

Often tied into these concerns are basic philosophical views about the sanctity of private property. Almost irrespective of the legal or constitutional dimensions, many people have basic philosophical difficulties with public policies and regulations which severely constrain the use of private land--especially where there appear to be few opportunities to use one's land in an economically profitable manner. Effectively managing cumulative impacts may regularly require land use restrictions which seem harsh to private landholders and their elected representatives.

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This review of obstacles and impediments suggests that managing cumulative impacts is not easy. Identification of obstacles, however, helps to point the way to programmatic and legislative changes that might overcome them. The sections to follow, especially Sections V and VI, describe a variety of alternative approaches to promote more effective cumulative impacts management. Before turning to these alternatives, we will first examine the ways that Virginia addresses cumulative impacts as part of its environmental management efforts.

IV. CUMULATIVE IMPACT ISSUES IN VIRGINIA

As mentioned in Section I, the authors conducted a series of phone interviews with selected individuals whom it was believed would represent different perspectives on the cumulative impacts issue in Virginia. Interviews were conducted with representatives of the environmental and business communities, and with representatives of the major state agencies or departments involved in environmental management in Virginia. Interviewees were asked about how existing programs were structured and how well, in their view, they succeeded in addressing cumulative impacts. Individuals were also asked to identify obstacles or impediments that might exist to considering cumulative impacts, legal or otherwise, and also to suggest approaches that might make for more effective cumulative impact management in Virginia if they felt that was needed. Interestingly, most people had suggestions even where they felt that current practices were not bad. Others saw the need for change as great. Others, while not opposed to change, were concerned with its costs to the state or to the applicant. It is important to stress that our review of the existing framework is much like the proverbial glass of water that is either half full or half empty, - what one hears depends to a large degree on the speaker's perspective.

While neither exhaustive nor random, the interviews did provide the authors with a sense of how well various people perceive the state to be doing. In addition to these interviews, the authors analyzed relevant statutes, legislative provisions, programmatic descriptions, and other materials, to obtain a more accurate understanding of how these state regulatory and management systems are structured.

Overall, there was a general sense that while existing laws and programs do address cumulative impacts to a considerable extent, opportunities for advancement in the current system also exist. These include wetlands, air quality, water quality and quantity, wildlife, and land use. This is not to say that these are the only resource where attention could focus on cumulative impacts but is to say that these were the areas that came up most often in our investigations. Each of the resource areas discussed below begins with a brief summary of the key legislative provisions and the agencies responsible for implementing them.

THE OVERALL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

A frequent observation made by those we talked with about cumulative impacts was the shared nature of environmental management responsibilities in Virginia (and in many other states as well). Some refer to this as fragmented, some as segmented, others as unconsolidated or divided. This factor was cited by a number of the people interviewed as a major reason for why cumulative impacts - especially those of the cross media variety - are not more often taken into account. Regulatory and management agencies tend to take a single-permit, single-project approach, making permit decisions and imposing mitigation and other project design requirements based on their own particular statutory provisions and environmental missions.

One interviewee used the example of an industrial facility considering how to respond to the various demands of different regulatory agencies to illustrate one pitfall of this fragmented approach. To satisfy concerns with surface water, the facility might decide to substantially reduce its surface water emission and in turn to increase its use of lagoons or land applications. Reducing the surface water emission would be a positive result from one perspective but the alternative land disposal could raise groundwater concerns. Fortunately, in this example both surface and groundwater are under the same agency. In most instances, however, this is not the case so what could happen is shifting pollution around between agencies and media until one was found that would allow the facility to be approved. At least theoretically, a facility could obtain permits from several media each of which would be at its allowable maximum and no one agency would be aware of the total pollution discharge from the particular facility.. This would be perfectly legal but run contrary to a goal of overall pollution reduction.

With multiple permits one respondent also cited another potential problem which could result where an applicant uses a permit granted by one agency to gain momentum for his case in seeking a permit from another. Another respondent indicated that this was unlikely and that industry often went for the toughest permit first in order not to invest money unwisely in a project that would eventually not be approvable. Whichever situation prevails, the point is that people on all sides uses the fact of segmented approval to whatever advantage they can and cumulative impact consideration is likely to enter in.

The segmented nature of Virginia's environmental management system is conveyed in Table 2. It presents a list of selected state

environmental programs and laws and the primary state agencies responsible for implementing them. While not a comprehensive or exhaustive listing, the table does illustrate that environmental programs and policy are scattered over a number of different agencies and institutions and come under several different secretariats. Each agency has different personnel, missions, and procedures. While there is debate about whether such unconsolidated management systems inherently make it difficult to manage cumulative impacts, many people interviewed for this study - both inside and outside Virginia - felt that more coordination would be desirable and that the current structure might make this difficult to achieve.

TABLE II

Selected State of Virginia Environmental Programs & Agencies

State Agency	Type of Activity Regulated/Managed	Legislative Authority
State Water Control Board	Discharge of point source pollutants into surface waters	State Water Control Law
	Groundwater withdrawals in designated management areas	Virginia Groundwater Act
	Regulation of underground storage tanks	State Water Control Law
	Surface water withdrawals in surface water management areas	Surface Water Management Act
State Department of Health	Minimum drinking water standards for public water supply systems	Virginia Public Water Supply Act
	Regulation of septic systems and shellfish sanitation	Sewage Handling & Disposal Law
Department of Air Pollution Control	Emissions in both attainment and non-attainment areas	Virginia Air Pollution Control Law
Department of Waste Management	Solid waste disposal (e.g., design and siting of sanitary landfills)	Virginia Waste Management Act
	Monitoring, transport, and disposal of hazardous wastes	Virginia Waste Management Act
	Siting of hazardous waste facilities	Virginia Waste Management Act
	Clean up/recovery of hazardous waste sites	Virginia Waste Management Act
Department of Agriculture & Consumer Services/Pesticide Control Board	Manufacture, sale, application and storage of pesticides	Virginia Pesticide Control Act
Marine Resources Commission	Filling and alteration of tidal wetlands	Virginia Wetlands Act
	Alteration of/construction on primary dunes	Coastal Primary Sand Dune Protection Act
Department of Conservation and Recreation/Division of Soil and Water Conservation	Erosion and sediment control plan required for land disturbing activities	Virginia Erosion and Sediment Control Law
Chesapeake Bay Local Assistance Department	Designation (by localities) of Chesapeake Bay Preservation Areas	Chesapeake Bay Preservation Act
Department of Game & Inland Fisheries	Taking of endangered species	Virginia Endangered Species Act
Council on the Environment	Coordinate review of state agency environmental reports	Virginia Environmental Quality Act

Having identified the number of the separate programs existing in Virginia and having spoken about the division of labor between agencies, it is also important to identify a number of ways that these agencies coordinate their activities. Permit applications under the Virginia Pollutant Discharge Elimination System, and the Virginia Wetlands Act and section 404/405 (federal wetlands provisions/water quality certification), for example, are routinely sent for comment to other agencies. The Virginia Department of Game and Inland Fisheries, for instance, is very actively involved in commenting upon proposed streambed modifications and wetlands alterations, with particular concern about their possible impact on fish and other wildlife. On the other hand, the Department of Game and Inland Fisheries (DGIF) is not, according to a number of respondents, very involved (with recent exceptions) in the permitting activities of the Air Pollution Control Board, despite the fact that the air quality impacts on streams and wildlife could be substantial.

Another coordinating mechanism - which at this point is not being used - is a special provision in the Code allowing the Council on the Environment to coordinate multiple agency permits for a single project or proposal. Referred to as the Multiple Permit Coordination Process, it allows an applicant of a project requiring permits from multiple agencies to make a single application to the Council. After receiving and reviewing the application the Council may, at its discretion, "consolidate, coordinate and expedite the permit review process including but not limited to the elimination of redundant or overlapping procedures; consolidation of any formal hearings that may be required into one hearing; and coordination of the processing of the permits where both federal and state requirements are involved" (section 10.1-1206). The hearing for a multiple permit must be conducted within sixty days of application and action by each relevant board, commission or state agency is to be completed within ninety days. This mechanism, however, appears entirely procedural in nature, allowing for some streamlining of the application review process but doing little to promote substantive cross-agency decisionmaking. Indeed, the provisions explicitly protect the authority of each individual agency to make its own permit decision based on its own judgments. In the words of the state code: "Judgments of the merits of each required permit shall remain the responsibility of each respective board, commission, or state agency." (Section 10.1-1206). As well, a 1977 opinion of the Virginia Attorney Generals Office concludes that an agency's permit decision could be legally challenged if it includes in its decision record information not directly relevant to its regulatory charge.

> For example, the record upon which the State Air Pollution Control Board makes its decision must not contain evidence relevant to whether the State Water Control Board should issue its NPDES permit. If such evidence is present in both records, the decision of either Board would be subject to challenge that it did not base its decision upon information relevant only to that decision. (Ryan, 1977).

According to state officials, this multiple permits review procedure has never been used since its creation. One industry attorney indicated that there was considerable uncertainty about the process and a perception that it was generally safer simply to go through the usual (and better understood) agency-by-agency review process. Several people suggested that the consolidated review idea was a good one but the law should be changed to make it workable.

There is also currently underway in Virginia an EPA Facility-Wide Pollution Prevention Project, which may represent a model for future cross-media impacts management. The Amoco Project is a joint initiative between Amoco and EPA at the Amoco Yorktown refinery. This refinery is a study site to inventory current releases into the environment; develop possible source reduction, recycling and emission control options; assess the relative impacts, benefits and costs associated with these options; and identify present and potential barriers to implementing the options. A key feature of the project is the opportunity to address issues which cross media boundaries between air, water and land. Representatives from the Departments of Air Pollution Control, the Water Control, Board and the Department of Waste Management are involved in a project workgroup that developed and is judging the options for pollution prevention at the Yorktown refinery.

The Virginia Department of Waste Management has also recently received a two-year grant from the U.S. Environmental Protection Agency to develop a program to promote interagency pollution prevention. Referred to as "Virginia Interagency Multimedia Pollution Prevention Project," the program will utilize an interagency team to coordinate pollution prevention activities between the Departments of Waste Management and Air Pollution Control, and the Virginia Water Control Board. Among other functions, the team will identify pollution prevention opportunities, promote coordination of pollution prevention activities in these different agencies, and promote education and training both within the agencies and within polluting industry. A pollution prevention policy statement has been recently approved by the Directors of the Departments of Waste Management and Air Pollution Control, and the State Water Control Board (Kenneally-Baxter, 1991). These initiatives, while still in

the early stages, hold considerable promise for reducing cross-media cumulative impacts.

For some of the individuals interviewed for this study, one possible solution to these problems was some type of governmental reorganization which would better integrate and coordinate the implementation of these different environmental laws, taking a more holistic approach to the management and protection of the State's environment. Some individuals had specific suggestions about other states which had undertaken such reorganizations, and a discussion of several of the more promising of these is contained in Section V.

Regarding Virginia's existing legal framework, a number of interviewees, particularly those representing regulatory agencies, pointed to legal obstacles that would prevent decisionmaking based to a greater degree on cumulative impacts. While this study did not undertake an exhaustive legal analysis, we did review the major state statutes and regulations and confirmed that there is a general lack of explicit legal authority for considering cumulative impacts. The Virginia State Attorney General's (AG) office, along with a number of other attorneys, was contacted in an effort to clarify the legal situation. Our interviews confirmed that there was little or no specific statutory language, that they were aware of, allowing or compelling agencies to consider cumulative impacts, and no case law dealing specifically with the cumulative impacts question. No applicant had challenged a permit denial or conditions based on any agency rationale of cumulative impacts. No environmental groups had sought to overturn agency action by claiming that cumulative impacts had been inadequately considered. Though there is not statutory language expressly dealing with cumulative impacts, it was suggested that many of the existing permitting programs did contain implicit cumulative impacts provisions, in that they involve permit allocations based on permissible loads or limits. Moreover, the view was expressed that the courts have historically given wide discretion to regulatory agencies involving single-media permit decisions and will tend to give agencies the benefit of the doubt when a reasonable case can be made for a standard or permit condition. From a legal defensibility point of view, however, incorporation of explicit language allowing or requiring consideration of cumulative impacts would be favored as a way to substantially buttress the legal position of agencies.

A number of other more specific observations and concerns were expressed about particular environmental resource sectors. The

paragraphs to follow provide a more detailed examination of cumulative impact issues as they relate to particular resources or media.

WETLANDS

Historically, wetlands have been a resource strongly susceptible to the gradual nibbling effect. The filling of an acre here and an acre there might not seem to fundamentally threaten or jeopardize the overall resource base, or the integrity of the larger ecosystem of which wetlands are a part, but gradually over time the losses can be dramatic.

Virginia has had a state Wetlands Act since 1972. Under the Act's provisions a permit is required before filling or otherwise altering tidal wetlands under state jurisdiction. Responsibility for issuing permits at the state level lies with the Virginia Marine Resources Commission (VMRC), although local governments may take over these responsibilities by creating local wetlands boards. VMRC retains appeal authority. Permit decisions are to be made consistent with a set of state wetlands guidelines which stipulate, among other things, that alteration to wetlands should be discouraged except in the case of water-dependent uses and where no feasible alternative locations exist. State wetlands are classified according to their function and productivity, and the guidelines mandate that alterations should be directed to lower-productivity classes. There is no explicit mention of the cumulative impacts in the guidelines. However, cumulative impact consideration is believed by some to have entered the decisionmaking of local wetlands board members in a number of instances. Pier construction and marina expansion, for instance, have been denied because of concern that too much pressure would be put on a creek. As well, there is the general feeling expressed on the part of many that while there is some variation between the local boards, the Virginia Wetlands Act is fairly restrictive and fairly stringently enforced.

Complicating things is the fact that there are two primary sets of regulatory requirements for tidal wetlands--the provisions of the Virginia Wetlands Act and the federal Section 404 requirements, under the Clean Water Act. The federal 404 wetlands protection program mandates consideration of the cumulative impacts of wetlands degradation in its permit review but Corps of Engineers officials indicate that as a practical matter cumulative impacts are generally not identified or considered. For tidal wetlands, there is a perception that the Virginia standards are tougher than the federal standards and some regional permits have been

issued which stipulate that where a permit is issued by VMRC, Section 404 approval is also granted.

There is also concern about impacts on non-tidal wetlands, which are not regulated under the Virginia Wetlands Act. While there have been attempts in recent years to enact similar provisions which would apply to non-tidal wetlands, these have so far been unsuccessful. Attention to nontidal wetlands was given added momentum by the creation of the Nontidal Wetlands Roundtable in 1989. In January 1990 the Roundtable issued its final report recommending, among other things: expansion of funding and staffing for 401 certification; decertification of certain U.S. Army Corps of Engineers nationwide permits deemed to undermine protection efforts in the state; promotion of greater educational, incentive-based and non-regulatory approaches to nontidal wetlands protection; undertaking of a comprehensive study of the impact of existing state programs on nontidal wetlands, and the incorporation into all state programs of a recognition of the importance of protecting these resources (including the need to minimize impacts, and to provide full compensation when nontidal wetlands are destroyed or altered, etc.); and the need to establish a current inventory of these resources and to undertake research on the basic structure and function of nontidal wetlands (See Commonwealth of Virginia, 1990).

Regulation of non-tidal wetlands is at present addressed in two ways: by reliance on the Section 404 provisions of the Corps of Engineers and through the 401 water quality certification procedure under Virginia's water quality program. Reliance on 404 has been criticized and is seen by some as problematic for a variety of reasons including the frequency with which permits are issued. A very small percentage of permit requests are turned down outright. (See General Accounting Office, 1988.) There are a number of exclusions and exemptions in the program (e.g., normal farming practices). As well, there are several nationwide permits which exempt from review wetlands alterations of a certain type or size (e.g. filling parcels less than 10 acres in size) though Virginia is seeking to modify this for conversions in the state. (For a general review of the issues associated with the federal 404 program see Conservation Foundation, 1988). Recent changes in the federal wetlands delineation manual will also substantially reduce the amount of acreage considered wetlands under the 404 program and thus subject to cumulative impact consideration. A number of people interviewed are concerned that the Virginia Water Control Board still lacks the personnel sufficient to undertake 401 review in all cases needing careful attention. Extensive assessment of cumulative impacts would add to the workload of already

bordered docets Staff to carry out 401 certification at VWCB was increased in 1990 and then reduced. Now we understand staff numbers may be higher by the end of the year. It should also be acknowledged that the full burden of non-tidal wetland protection does not fall on SWCB alone since non-tidal wetlands receive some level of added protection under the Chesapeake Bay Preservation Act.

There currently exist several mechanisms for coordinating review of federal and state wetlands permits, and which facilitate interaction between different state agencies and consideration of cross-media impacts. For most proposed alterations to tidal wetlands and subaqeous lands, the VMRC takes the lead and sends out applications to other state agencies for comment. These agencies include the State Water Control Board, the Game Commission, the Department of Conservation and Recreation, and the Health Department's Bureau of Shellfish Sanitation. Concern about particular proposals and suggestions for mitigation, can be submitted in writing and agencies are encouraged to present their concerns at regular Commission meetings if they choose to. Where these proposals are not covered by a nationwide or regional Corps of Engineers permit, the Corps undertake a similar process of coordinated review. Specifically the Corps holds a joint permitting meeting monthly to solicit comments from federal and state agencies. These monthly meetings are usually attended by VMRC, the Council on the Environment, SWCB and Game and Inland Fisheries staff. These sorts of joint application and review processes represent one of the directions in which the state could move in order to achieve better coordinated and more comprehensive review of permit applications.

Wetlands mitigation, including the creation of new wetlands or the restoration of damaged wetlands in exchange for permitting certain wetlands alterations, is another issue of significance to cumulative impacts management. In theory, if mitigation is required on an acre-for-acre basis, "nibbling" does not occur, i.e. there is no net cumulative impact. However, recent studies suggest that while it may be possible to replicate certain functions of natural wetlands with considerable success (e.g. their stormwater containment functions) other functions (e.g. their importance as habitat for wildlife) are less replaceable (see Kusler and Kentula, 1989; Zedler, 1991). Cumulative impacts management for wetland alterations in the future will have to resolve this mitigation question.

In neither the federal nor state program are wetlands permitting decisions based on larger basin-wide or statewide plans. The Virginia Institute for Marine Science (VIMS) has been working on developing a

functional analysis system on a regional landscape level which might provide more guidance for such permit decisions in the future (Hershner, 1991).

Part of the problem with the wetland management, as identified in Table 1 above, has been the lack of baseline information. Neither the VMRC nor local wetlands boards have been in a position until recently to place their individual wetlands decisions in the context of the larger picture of how much has been converted and is being converted in a cumulative fashion. A pilot project, recently initiated by the VIMS, may do much to correct this data deficiency. VIMS has established a wetlands database which contains information about the extent of alteration allowed through wetlands permits. This information is also coded by watershed and the types of wetlands affected. The first summary data available is for 1988 and is contained in a recent VIMS report entitled Cumulative Impacts of Shoreline Construction Activities on Tidal Wetlands (VIMS, 1990).

Table 3

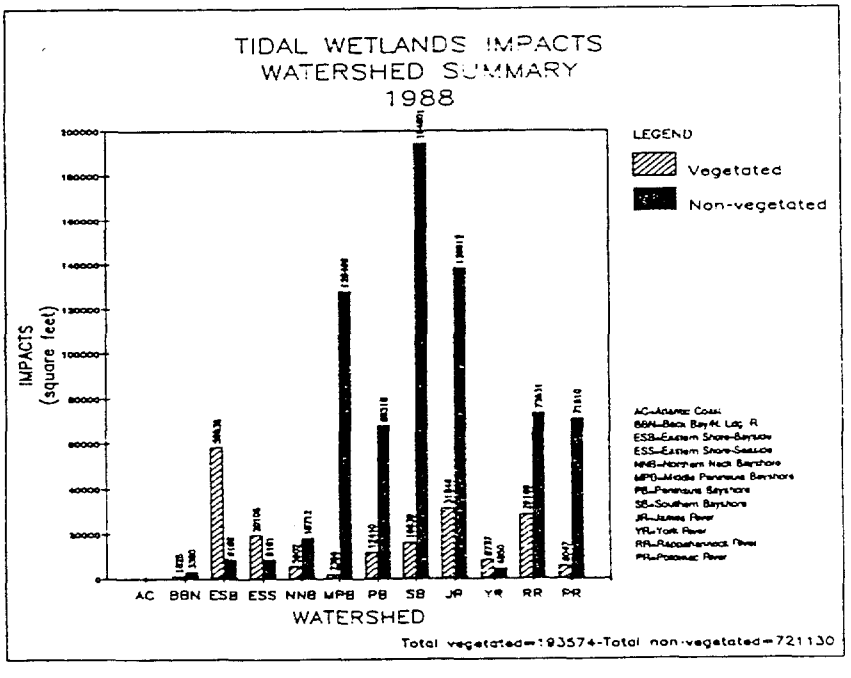

Table 3 above is an example of the type of summary information generated from the database. For 1988 a total area of 21 acres of tidal wetlands was altered by permit, with the greatest impacts occurring in the Southern Bayshore, James River, and Middle Peninsula watershed units.

The VMRC also has responsibility for implementation of the Coastal Primary Sand Dune Protection Act. This has potential for managing the cumulative impacts of shorefront development. Similar in structure to the wetlands provisions, the act requires a permit for major activities in dune and beach areas. Among other things, the act prohibits the placement of structures seaward of the crest of the primary coastal dune. The issue of cumulative impacts has been explicitly considered by VMRC in evaluating proposals to allow second-home construction on Cedar Island, a seven-mile long barrier island on the seaside coast of Accomack County. A major point of concern has been the cumulative impact of development, and development-related activities (e.g. sand fencing) on the erosion of the island. VIMS prepared a special study of the island which concluded that "the long term cumulative adverse impacts of building on the island will be a continued narrowing of the active sand strip and an accelerated erosion rate due to the greater loss of sand offshore." (VIMS, 1986, p.6). Consideration of these types of cumulative impacts led VMRC to adopt a special "Barrier Island Policy," in 1986 placing certain additional restrictions on development in these sensitive locations (e.g. restrictions to shore-hardening structures, roads, etc.; see VMRC, 1986). An even more restrictive set of barrier island quidelines were adopted by VMRC in the Fall of 1990. Those guidelines specifically cite the problem of "cumulative and secondary impacts." Among other things, these supplemental guidelines call for restrictions to the density and size of barrier island structures, erosion-based setbacks for structures and septic tanks, restrictions on the use of automobiles largely modeled after the Accomack County's Barrier Island Zoning District; (see VMRC, 1990). This explicit mention of cumulative and secondary impacts may be a starting point for similar provisions in other components of state wetland policies and programs.

AIR QUALITY

Protection of air quality in Virginia is the responsibility of the Virginia Air Pollution Control Board. Virginia is required under the federal Clean Air Act to restrict emissions from point sources to achieve National Ambient Air Quality Standards. Virginia is required under the Act to prepare a State Implementation Plan (SIP) which stipulates how the state plans to bring air quality into compliance with the National Ambient Air Quality Standards (NAAQS).

For areas where the air is already cleaner than the national ambient standards the state must impose restrictions which prevent significant

deterioration of these areas ("PSD" requirements). Fortunately, much of the state is covered by these clean air/PSD zones. For these areas the federal Clean Air Act mandates that air quality not be permitted to deteriorate beyond certain allowable increments. The allowable increment depends upon the type of land area affected. The extent of allowable deterioration is smallest for Class I lands which include national parks and wilderness areas. Two of these Class I areas exist in Virginia--the Shenandoah National Park and the James River Face Wilderness area. (For a review of these provisions of the federal and state air programs see Mays and Valentine, 1990).

For non-attainment areas of the state (i.e., where the ambient levels are above the NAAQS) new point sources are subject to an offset requirement. No new major point source is permitted unless an offset can be obtained from an existing source for the specific pollutant of concern. This has the effect of preventing the creation of additional cumulative impacts or capping cumulative impacts in non-attainment areas. While it could be said that the underlying rationale of both the PSD and non-attainment area programs is essentially one of preventing additive and other forms of cumulative impacts, there appear to be a number of limitations surrounding these programs which constrain their potential.

One major problem is that much of the deterioration in air quality in recent years has been the result of non-point sources, largely from automobiles, rather than the point sources covered by this requirement. New emission inspection programs in several areas will help, but critics argue that the state has not yet been able to effectively address this mobile aspect of the air quality problem.

Another limitation in addressing cumulative impacts occurs when several permit applications are in the pipeline at the same time. The current system is not well adapted for this situation as has been shown by the intense debate over the large number of co-generation plants proposed for PSD/clean air areas in the western portion of the state. Particularly vocal in expressing concern over possible long term cumulative impacts has been the National Park Service, which is worried about the potential impacts on visibility and other ecological effects in the Shenandoah National Park. The Department of Game and Inland Fisheries has expressed significant concern about incremental damage to mountain streams which over recent years have seen declines in trout populations and changes in invertebrate life that may be due to acid deposition and other air pollutants. Members of several environmental organizations have been

critical of the state's inability to consider the total expected effects of all of these different co-generation plants when finally on-line.

As of the Spring of 1991 there were some 17 power plants proposed or in the planning stages. In evaluating each application, the Air Board has considered the effects of each plant as an increment added to all existing plants. In other words, they have addressed the additive effect of each plant to the total but not the effect of all plants combined. The Air Board's position is that it has no authority to consider the potential effects of other point sources and is restricted to considering individual permit requests as they are submitted. They also point out that a certain number of applications are approved but the facility is never built or developed for economic or a variety of other reasons. Thus to treat applications as if they were all existing would not be reasonable. The Air Board has also responded that it lacks the modelling capability to fully determine the effects of these plants on the Park and other sensitive areas and has requested EPA to assist in developing such models.

A positive outcome from one of these controversial permits is illustrated by the recent agreement over the proposed Multitrade 79 megawatt power plant at Altavista, in Pittsylvania County. The plant was issued a permit in April, 1991 but it was shortly appealed. Subsequently a settlement agreement was reached which provided for substantial reductions in pollutant levels by Multitrade in exchange for the dropping of the appeal. It is reported that Multitrade has agreed not to burn coal at its new plant (reducing sulfur emissions by 87% and nitrogen oxides by 20% from permit approved levels), to purchase pollution offsets from a polluting plant in Hopewell (ensuring permanent shutdown of the Aqualon Corporation boiler, and reducing the new Multitrade facility's emissions by a reported 150%), and to contribute funds for future air quality studies in the state. To the appellants, this agreement indicates that more stringent controls on power plant emissions are possible. The question, under existing arrangements at least, is whether the Air Board itself would be able to negotiate with applicants the way that the appellants were in arriving at the settlement. Opinion is divided on that question.

While the Air Board's regulations do not appear to explicitly mention consideration of "cumulative" impacts, they do call for the Board to analyze the "secondary" air quality impacts associated with proposals in PSD areas. The regulations call for permit applicants to include an analysis of "'the impairment to visibility, soils and vegetation' taking into account associated commercial, residential, industrial and growth associated with the source. The impact of that growth on air quality must

also be shown." (Mays and Valentine, 1990, p.5-18). None of the people interviewed stated that this provision had come into play in a significant way but its existence is noted.

Some of the people interviewed would like to see the Air Board take a more proactive comprehensive management stance - the consequence of which would be reduced impacts of all sorts including cumulative. For them such a strategy ought to include, among other things, consideration of a range of alternatives for providing energy, including efforts to promote energy conservation measures. They argue that when additional plants are needed some effort ought to be made to locate them in places where their air quality impacts will be minimized. However, it seems clear that much of the substance of such a larger strategy, including promoting energy conservation, is really beyond the mission (and likely authority) of an agency like the Air Board. It was suggested by one interviewee that these issues were in the domain of, and ought to be addressed by, the State Corporation Commission.

The air quality issue also illustrates the inherent limitations of state-by- state approaches, in that a significant percentage of the pollutants coming into Virginia are generated in other adjacent states, especially West Virginia and North Carolina. The interstate nature of many environmental problems indicates the importance of maintaining and strengthening national and multi-state initiatives. On this point the Air Board and many other groups would likely agree.

While the Air Board has been in the hot seat by virtue of the unusual circumstances surrounding the multiple proposed co-generation facilities - most permits are not this controversial - this situation does highlight some of the inherent limits of a system by which states and the federal government are now managing the environment. Another such area is water.

WATER QUALITY AND QUANTITY

Cumulative impacts are also a potential major concern in the areas of water quality and quantity. The quality of Virginia's surface and groundwater resources can be negatively affected by a variety of activities and practices which generate both point and non-point source pollutants. Point sources include industrial facilities and municipal wastewater plants which discharge into streams and rivers. Non-point

pollutants include agricultural runoff, urban runoff, sedimentation from construction sites, and acid deposition, among others.

Virginia has a number of regulatory and other programs which address these types of water quality impacts. The greatest share of resources goes into managing and controlling point source discharges. The State Water Control Board (SWCB) requires a permit for effluent emissions into surface waters, as mandated by the federal Clean Water Act and the State Water Control Law. More specifically, the state operates the Virginia Pollutant Discharge Elimination System (VPDES), and restricts permitted discharges based on a combination of national technology-based standards, and state water quality standards (the federal Clean Water Act requires discharges to be based on whichever is more stringent). The state has also adopted an "anti-degradation policy" which is intended to ensure that waters that were cleaner than the established standards be maintained in this condition (e.g. Mays and Valentine, 1990).

The state water quality standards and anti-degradation policy represent an effort to identify desired uses for surface water bodies and to restrict the overall level of pollutant loading to ensure the protection of these uses. Water basin plans also exist for each of the state's river basins (with the exception of the Rappahannock River) and these are used by the SWCB in establishing discharge limits. In these ways, the existing water quality framework does incorporate the concept of cumulative impacts even if that term itself is not used.

Some individuals interviewed for this study have been critical, however, of several features of the implementation of the system. In assessing the likely water quality effects of a proposed point source, modelling is required but apparently only for oxygen demanding pollutants. Other pollutants are typically involved in such point sources but the required impact modelling has been described as too rudimentary to adequately assess them. Models, it has been pointed out, are best at estimating impacts to waters close-by, and not very good at predicting downstream effects. Heavy reliance on establishing substance-by-substance control standards (e.g., for toxics) may also overlook the interactive chemical and biological effects of different combinations of pollutants. Representatives of environmental groups that we interviewed also felt that the standards established for certain pollutants, such as dioxin, were too lenient. They frequently cited the anti-degradation policy as a potentially useful tool for controlling cumulative impacts but they also saw it as as not very stringently enforced by the SWCB in its

decisionmaking. Industry does not generally share this view and has challenged state regulations which it finds excessive.

One important feature of the present point source control system is the SWCB's Toxic Monitoring and Management Program. Under Virginia's program, point source discharges are surveyed for the presence of 129 toxic substances - those on EPA's priority list of toxics - and subject to specific discharge limitations. In addition, a "whole effluent toxicity" test is required when such substances are found. This test mandates minimum survival standards (a certain percentage of organisms must survive exposure) for discharges. These types of toxicity tests are able to gauge the synergestic and interactive effects of different toxic substances found together in a point discharge itself. Where an industry or other discharger fails the whole effluent toxicity tests (or where pollutants are found to exceed specific toxic standards), the facility must develop a toxic reduction program and long term toxic monitoring. While the toxic monitoring and management program is an effort aimed at considering the potential interactive effects of toxic pollutants, this approach is itself not without its limitations. The system is generally unable to consider the synergisms and interactions of the discharge with other toxics in the waterbody though the SWCB has been able to make adjustments for this in some cases.

Non-point water pollution is an area where a number of interviewees expressed concern about cumulative impacts. While much progress has been made over the years in regulating and controlling point sources such as industrial factories and municipal sewage treatment plants, there is a feeling that much progress remains to be made in the non-point area before it catches up to the level of protection achieved for point sources. This observation is not unique to Virginia. The Chesapeake Bay Foundation's recent comprehensive assessment of the condition of the Chesapeake, for instance, concludes that agricultural runoff (e.g. fertilizers), runoff from construction sites, and urban stormwater runoff are major causes of water quality degradation in the Bay and are largely unaddressed. (Horton, 1991). Furthermore, according to the report, as population growth in the Bay's multi-state watershed continues the non-point source problem will also grow. In the words of the study:

> We have not even come close to being able to develop the Bay's watershed without causing substantial and lasting degradation of adjacent waters. Development is accelerating, and there is no reason yet to believe losses of water quality are not going to accelerate along with it. (Horton,1991, p.66).

The State of Virginia has made substantial progress in this area, most recently through the enactment and early steps to implement the Chesapeake Bay Preservation Act, and through the preparation of a state non-point source control plan as called for under the federal Clean Water Act. Some are critical of the Bay Act, though, and question whether its heavy local-orientation will result in adequate non-point controls. Some of the specific provisions of the Bay Act guidelines are also cause for concern. For instance, while many people feel that agricultural runoff is the single most significant factor in degradation of Bay waters this activity is partially exempted from some of the key provisions (e.g., while a 100 foot shoreline buffer is required adjacent to waterways this buffer can be reduced to 25 feet for agricultural operations where a farm management plan is prepared). Control of non-point pollutants is also provided through Virginia's erosion and sedimentation control requirements. Under the Virginia Erosion and Sedimentation Act, localities must adopt minimum local erosion and sediment control ordinances. However, these programs have historically suffered from great inconsistency in their stringency and implementation. (For a review of local non-point programs in Virginia see Cox and Herson, 1987).

New mechanisms also exist to promote more effective local and regional control of stormwater runoff. Stormwater management legislation was passed by the General Assembly in 1989 giving local governments the authority to enact local stormwater management ordinances and mandating the preparation of stormwater management plans for state agency projects. Local stormwater management ordinances are not mandatory, however, and the laws automatically exempt certain activities from coverage (including agricultural and forestry activities, single family residences not part of a subdivision, and land development involving less than an acre of land).

Protection of groundwater is also a concern in Virginia. Under the Virginia Groundwater Act of 1973, the SWCB has the authority to designate "groundwater management areas" and to control the withdrawal of groundwater in these areas through a permit requirement. Groundwater management areas have been designated in the York Peninsula, Tidewater and Eastern Shore areas of the state. This mechanism provides the state with some degree of control over the use of groundwater resources. However, extensive exemptions and grandfather clauses reduce the state's ability to manage cumulative impacts as evidenced by recent reports by SWCB to the Water Commission showing the consequences which could result if all currently permitted and grandfathered users were to

withdraw the amount they are allowed under current laws. Possible changes in this system are under study.

The potential for excessive withdrawal from the state's surface waters has also been a concern and is a potentially important category of cumulative impacts. Legislation in 1989 expanded substantially the State's control over surface water withdrawals. Specifically, the SWCB is now authorized to designate surface water management areas where permits would be required for withdrawals exceeding 300,000 gallons per month. Among other things, permits would be conditioned on protection of certain minimum instream flow levels. (For a review of the legislation see Collins and Dotson, 1989). These provisions hold the potential for substantially expanding the State's ability to manage the cumulative effects of development and growth on sensitive riparian ecosystems. The regulations to implement the program are still being developed.

LAND USE CHANGES

Because land use decisionmaking is decentralized to the local level, a number of people expressed concern about "larger than local" or cross boundary cumulative impacts. In many parts of the state, perhaps most evident in the high growth corridor from Northern Virginia to the Tidewater, local governments are making land use decisions, from approvals of rezoning requests to subdivision approvals, that together result in cumulative environmental changes of substantial proportions. From an understandable self interest standpoint, local governments in making such land use decisions tend to focus on the more immediate benefits of development including tax base expansion, jobs and economic activity, rather than the cumulative long term or adverse consequences that they might have on nearby localities or the region. Local self interest recognizes the beneficial economic multiplier of development but affords little attention to ecological impacts somewhat removed from the immediate setting. (For a discussion of some of the philosophical dimensions of such a view, see Section II.)

Some provisions in state and local law do currently exist to address the cumulative effects of local land use decisions, but many feel that these are inadequate. Specifically, local governments in Virginia are required by law to prepare a comprehensive plan and subdivision ordinances. Zoning is optional though most counties have by now adopted some form of zoning. Some, however, are critical of Virginia's local planning system because it does not require zoning and other land use

implementation decisions to be consistent with the local comprehensive plan. There is no state plan or policies with which local plans are required to be consistent except to a degree in the Bay Act jurisdictions.

As indicated above, the enactment by the General Assembly of the Chesapeake Bay Preservation Act in 1988 represented a major expansion of control over land development activities in the state, especially in coastal areas. Under this act Tidewater localities must delineate and manage Chesapeake Bay Preservation Areas (Resource Protection Areas and Resource Management Areas), consistent with criteria promulgated by the Chesapeake Bay Local Assistance Board, also created by the Act. Resource Protection Areas, for example, generally include tidal wetlands, connected non-tidal wetlands, tidal shorelands, and a buffer zone around these areas. Once protection areas are delineated, localities must manage development consistent with a set of performance standards. While the program is still very much in its infancy, some are optimistic that the goals will be achieved. Others are concerned that the requirements may not be as effective at managing and minimizing cumulative coastal land use changes as they would hope.

Many cumulative impacts of land use actions are most effectively dealt with at regional levels. While Virginia does employ a system of regional planning district commissions (PDC's) the authority and influence of these bodies has been quite limited. Several recent efforts to establish regional environmental/growth management initiatives may better address cumulative impacts and suggest important new directions. While still in their initial stages two such initiatives can be cited: the Thomas Jefferson Regional Planning District's ongoing Study to Preserve and Assess the Regional Environment (TJSPARE) and the Chesapeake Bay Foundation's Lower Rappahannock River regional planning initiative. Effective control and management of the cumulative impacts of land use changes will likely require greater emphasis on these types of regional assessment and planning approaches. Such approaches from other states are described in Section V.

Many land use changes are largely uncontrolled in the sense of requiring a specific permit. These include loss of wildlife habitat, harvesting and conversion of forests to other uses, and agricultural activities, among others.

WILDLIFE AND HABITAT

While there have been few comprehensive studies or analyses of changes in wildlife and wildlife habitat in Virginia, there is a concern on the part of state wildlife officials that incremental development and other land use pressures in recent years have resulted in substantial habitat alteration and destruction. Wildlife management represents another area where there may also be numerous and long term indirect effects of human alterations that may not be apparent by evaluating a single project. Over the years reductions in fish populations have been witnessed in rivers like the James due to a combination of the effects of population growth and construction of dams and other obstructions. This is not as great a problem now as in the past because of the construction of fish ladders and other mitigation measures. The reduction in fish in turn affects populations of wildlife, like the Bald Eagle and Osprey, that depend on this food source. Use of pesticides and insecticides may have major cumulative effects on the state's wildlife, but is poorly understood. There has been gradual yet significant loss of forestlands on the Eastern Shore, habitat very important for a variety of migratory bird species. The Chesapeake Bay Foundation's recent comprehensive assessment of the Bay found, among other things, a significant decline in the diversity of waterfowl (e.g., redhead ducks and American Widgeon; see Horton, 1991). There are potentially many of these kinds of wildlife "ripple effects." It should also be noted that some species such as deer may be developing populations larger than desired as a result of reducing predators and other natural population controls so cumulative impacts do not always have the effect of reducing populations - balance rather than numbers appears to be the key management objective.

Primary responsibility for wildlife resources in the state lies with the Department of Game and Inland Fisheries. Historically the focus of DGIF has been on managing and regulating game species, such as white tail deer and the black bear. The department also implements a non-game program and regulates the take of endangered and threatened wildlife under Virginia's Endangered Species Act. Responsibility over endangered flora in Virginia falls to the Endangered Plants Division in the Department of Agriculture.

State control over habitat alteration is quite limited. Conversion of a forested habitat to a pastureland habitat, for instance, is generally beyond the regulatory control of any agency, unless a rare or endangered species is directly affected, and even then the agency's practical level of control is quite limited.

Despite the limited jurisdiction over habitat alteration the Department is involved in non-regulatory activities, including the education of farmers and landowners about wildlife issues (e.g., initiation of a stewardship program), managing certain state wildlife areas, working with ASCS to ensure that crop reserve lands are converted to wildlife habitat, and the propagation and reintroduction of species such as the peregrine falcon, among other activities.

The Virginia Department of Conservation and Recreation is also involved in management of wildlife resources through its Natural Heritage Division. The Division maintains a computerized database of rare and endangered species of both plants and animals, as well as exemplary natural communities, and is frequently called upon to assist in identifying potential species and habitat impacts of proposed projects in the state (e.g., power transmission lines). The Division is also involved in conducting more detailed field surveys of rare species and natural communities at the local level, under contract with local governments. While relatively little of this local work has been completed, the Division plans to become much more involved in local planning and management activities. The Division recognizes the need to assist local governments in identifying appropriate biodiversity conservation alternatives and developing conservation strategies (e.g., integrating biodiversity conservation more directly into local comprehensive plans and land use controls) to manage impacts to heritage values.

Another potentially important set of cumulative impacts from a wildlife perspective are the effects of various pesticides and insecticides. Over a period of time, these can have a potentially significant affect on wildlife population. In the Virginia framework, responsibility for regulating these types of substances falls to the State's relatively new Pesticide Control Board (created under the 1989 Virginia Pesticide Control Act). In the Board's short period of existence it has so far taken few actions. However, it has been given the power to ban or severely control the use of certain pesticides and consequently has domain over a potentially very important type of cumulative impact. Recently the Board took the notable action of banning the sale or use of granular carbofuran, a systemic crop insecticide shown to kill songbirds and raptors. In the future, the Board will be developing a Pesticide Management Plan for the state under an EPA initiated program which may become mandatory in the future for certain specific pesticides. This plan may provide a vehicle for addressing cumulative impacts.

ENVIRONMENTAL IMPACT REVIEW

When the U.S. Congress enacted the National Environmental Policy Act (NEPA) in 1969 mandating the preparation of environmental impact statements for major federal actions or projects with potentially significant environmental impacts, the notion of environmental impact review was a new one. Since that time a number of states have enacted their own "little NEPAs", imposing similar environmental impact review requirements for state actions or projects. (e.g., see Renz, 1984). Virginia has adopted similar provisions under the Virginia Environmental Impacts Reports Act. State agencies are required to prepare environmental impact reports for each major state project and to submit these to the Council on the Environment. At a minimum these reports must include (section 10.1-1208):

1. The environmental impact of the major state project;

2. Any adverse environmental effects which cannot be avoided if the major state project is undertaken;

3. Measures proposed to minimize the impact of the major state project;

4. Any alternatives to the proposed construction; and

5. Any irreversible environmental changes which would be involved in the major state project;

In addressing alternatives the report must "contain all alternatives considered and the reasons why the alternatives were rejected. If a report does not set forth alternatives, it shall state why alternatives were not considered." While most state environmental review laws are fashioned after NEPA it is important to note that Virginia does not include in its law specific references to cumulative impacts.

While the above environmental impact review requirements could potentially highlight cumulative effects of various state projects, many of the individuals we interviewed felt that the limited jurisdiction, exemptions and exceptions contained in the law, including what has until recently been a very significant exemption for road and highway projects, undermine its potential effectiveness.

Recent developments, however, suggest that these environmental impact review requirements may soon come to have more effect. Specifically, a memorandum of agreement was recently completed between the Secretary of Natural Resources and the Secretary of Transportation which will establish an environmental review procedure for state highway projects. Under the agreement an Interagency Environmental Coordination Committee has been created to coordinate and oversee this review process. Highway projects initiated on or after July 1, 1991 are subject to these environmental review procedures. The level of environmental review will depend on the size of the highway project involved. For "major" projects a special environmental "scoping" process will be undertaken, whereby state environmental and historic resource agencies will be given extensive opportunity to review and comment upon such proposals. The scoping process will occur through a monthly interagency meeting. The elements of this scoping process are described in greater detail in the actual agreement (Virginia Department of Waste Management, 1991, Appendix I, p.3):

> The scoping process will extend from project initiation through completion of construction and will include the determination of impact significance, continuous coordination with the Interagency Environmental Coordination Committee, the evaluation of environmental impacts for alternative alignments and the review of construction activities. The scoping activities will interface with the Virginia Department of Transportation project development process which includes a series of actions such as plan development, informational meetings and public hearings, right of way acquisition, Commonwealth Transportation Board approvals, and advertisement for construction.

As with most environmental impact review provisions (those under NEPA and of many other states) EIA's in Virginia are considered to be "informational" and there are no requirements that state agencies choose the least-damaging alternative or project design. There is also no assurance that if cumulative impacts of a proposal are predicted that the agency or department involved will have the ability or authority to control them (e.g., land use impact resulting from a VDOT project). Virginia's environmental review requirements do not apply to regulatory agency permits and thus cannot be a tool in addressing cumulative impacts resulting from the permitting process. All in all most people seem to agree that EIA's play a fairly limited role in the state at the present time.

OTHER AREAS WHERE CUMULATIVE IMPACTS OCCUR

These are not the only environmental areas where cumulative impacts were thought to be important. Other environmental sectors

mentioned by those we interviewed included: fisheries management, energy decisions (e.g. oil drilling), waste management, soil erosion, floodplain encroachment and vulnerability to natural hazards, among others. Our purpose in this study, however, was not to exhaust the topic or to examine every instance where someone felt that there were serious cumulative impact issues. Rather our purpose was to make a broad survey before looking elsewhere to see how similar issues might be addressed in alternative formulations.

V. SELECTED CUMULATIVE IMPACT MANAGEMENT APPROACHES FROM OTHER STATES

An important part of this project has been a search for approaches which other states have adopted which might serve as models for Virginia to consider as alternatives or supplements to its current practices. Before discussing what has been found several caveats are in order. First, the search process has not been exhaustive. We were limited to pursuing those ideas which we were able to learn about either through the literature search, from suggestions made by NOAA, EPA and various national organizations; or from individuals spoken with during the study. To a significant degree, we believe that if there are good ideas "out there," it is unlikely that we would have totally missed them proceeding as we have. Second, there is no guarantee that any of the alternatives identified are actually superior or that they would work in Virginia. Many of the approaches we have identified are quite recent and so there is little track record upon which to base a judgment. Third, because the emphasis in this study has been to "cast a wide net" in order to pick up on any ideas that are out there, we have not been able to pursue ideas in depth. Compared to our examination of practices in Virginia where we spoke with both a number and a variety of individuals, our information from other states frequently came from only one individual - often a person who could be expected to see a program or approach in its most favorable light. Therefore, these other state models have not been exposed to the same sort of close scrutiny which characterized our examination of Virginia programs. Because of this, we would recommend that ideas which appear interesting at this broad-based level of analysis be pursued further before final conclusions are drawn. Fourth, in several instances, Virginia is already experimenting with innovations which it turns out are also being tested in other states. Comparing results with other states is something that should be pursued for it is in these areas where there is already some momentum underway that change may make the most sense.

What follows is a summary of what has been learned organized under six headings:

- statutory language and case law issues
- environmental impact laws
- planning approaches
- permitting practices
- organizational structure
- technical support

Each of these sections refers to laws, reports or other documents - many of which are contained in a separate Technical Appendix accompanying this report. The reader interested in greater depth or particular details may want to consult that Appendix.

STATUTORY LANGUAGE AND CASE LAW ISSUES

Concern for cumulative impact assessment is on the rise and, as a result, a number of states have added explicit language in their environmental legislation and regulations that provides legal authority to or mandates that agencies consider cumulative impacts in arriving at permit decisions. In some cases, equivalent language is used that calls for consideration of indirect or growth inducing impacts, secondary impacts, or cross-media impacts rather than "cumulative impacts" per se. (Discussion of state EIS language is reserved for the next section.)

Because of the direction being taken in the federal Coastal Zone Management Program, a number of states have included cumulative impact assessment requirements in their coastal and wetlands protection laws. Recent hazardous substances pollution prevention legislation has also addressed assessment of cross-media impacts. Water and air quality permitting regulations that address additive or nibbling activities to a single resource are also beginning to require consideration of cumulative impacts. Statutory language in these types of environmental legislation is highlighted in the list below. Statutory language in Environmental Impact Statement laws and Growth Management legislation is discussed in subsequent sections of this report.

SELECTED STATUTORY LANGUAGE

North Carolina (CAMA)
Cumulative impacts are listed as a reason for permit denial in the Coastal Area Management Act (CAMA), Section 113A-120 Grant or Denial of Permits (a)(9) and (10). Paragraph (10) defines cumulative impacts as "impacts attributable to the collective effects of a number of projects and include the effects of additional projects similar to the requested permit in areas available for development in the vicinity."

North Carolina (Water Quality Protection)
The Water Control Law of North Carolina in Section 143-215.1 Control of Sources of Water Pollution: Permits Required; states in (b) (2): "The

Commission shall also act on all permits so as to prevent violation of water quality standards due to the cumulative effects of permit decisions. Cumulative effects are impacts attributable to the collective effects of a number of projects and include the effects of additional projects similar to the requested permit in areas available for development in the vicinity. All permit decisions shall require that the practicable water treatment and disposal alternative with the least adverse impact on the environment be utilized."

Mississippi

Permitting authorities are required to consider cumulative impacts under Chapter 8, Rules, Regulations, Guidelines and Procedures of the Mississippi Coastal Program, (MCP), Section 2, Part E Basis for Decisions, (2) Decision Factors (b)(i), (d), (e), (f), (g). Paragraph (d) says "Precedent setting effects and existing or potential cumulative impacts of similar or other development in the project area" should be considered. (e) and (f) address direct, indirect and intended or unintended effects induced by the project if they can be reasonably anticipated.

Louisiana

The state is directed to address cumulative impacts in the development of Coastal Use Guidelines by subsection 214.27, C(9) of the State and Local Coastal Resource Management Act (SLCRMA) which reads: "minimize detrimental effects of foreseeable cumulative impacts on coastal resources from proposed or authorized uses." The promulgated Coastal Use Guidelines that respond to that directive are 1.6 and 1.7. Guideline 1.6 describes the type of factors used by the permitting authority in evaluating a project. Guideline 1.6 (g), (k), (l), (n), (o), (p), (q), (s) address cumulative impacts. Guideline 1.7 describes the type of adverse impacts the coastal program hopes to avoid. Guideline 1.7 (j), (o), (t), (u), address cumulative impacts. Cumulative, secondary and long-term impacts are specifically mentioned in both guidelines.

Wisconsin

Wisconsin Department of Natural Resources Bureau of Water Regulation and Zoning is required by the policy statement in NR 1.95, Section 6 Implementation, 6(b) to consider limited cumulative impacts to wetlands. The department shall also consider: 6(b) the cumulative effects on wetlands of piecemeal alterations.

Oregon
Removal-Fill Program Regulations, Fill Permit Policy Section 141-85-050 says: (1) The director shall evaluate the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the water resources by considering:." Six items, (a) through (f) are listed. All six can be construed to require cumulative impact assessment. Direct and indirect impacts are mentioned, economic and environmental consequences are mentioned.

Maryland
Maryland's Non-tidal Wetlands Protection Act (COMAR .08.05.04.07) mandates watershed management plans that address protection, cumulative impacts, mitigation, water supply and flood management.

Massachusetts (Toxic and Hazardous Substances)
The Toxics Use Reduction Act, Chapter 265, Section 2 regarding approval of toxic reduction plans and permits states: "the department may consider the potential effects of such plans, strategies and technologies on public health and safety and the environment that may arise through any environmental medium or route of exposure that is regulated by the department pursuant to any statute: and said department shall act to minimize and prevent damage or threat of damage to the environment." Chapter 21 I, Section 2, Definitions, defines Toxics Use Reduction as in-plant changes in production processes or raw materials that reduce, avoid, or eliminate the use of toxic or hazardous substances or generation of hazardous byproducts per unit of product, so as to reduce risks to the health of workers, consumers, or parts of the environment, without shifting risks between workers, consumers or parts of the environment."

Going beyond noting the inclusion of such language, the question remains of whether it makes a difference. Insofar as questions of authority might go, it can be observed that explicit statutory language can overcome the "lack of legal authority" obstacle to addressing cumulative impacts. If the language is permissive to the effect that cumulative impacts may be considered, such consideration is left to agency discretion. If consideration is mandatory, an agency could be challenged in court if it failed to take cumulative impacts into account - assuming that state law allows citizens standing to bring suit to enforce the provisions of environmental law and regulations. Authorizing language alone, however, cannot guarantee that cumulative impacts are considered or that the intention of the legislation is enforced. For example, Wisconsin's NR 1.95 specifically contains a policy that calls for

assessment of the cumulative impact of piecemeal alteration of wetlands but, state officials report that there is no established procedure for implementing this directive, and that, as a result, it is not really carried out at this time.

On the other hand, North Carolina's cumulative impact assessment language has been the basis for permit denials and these denials have withstood political and legal challenges. In a recent case, North Carolina's Division of Coastal Management denied a permit to the state Department of Transportation (DOT) for a new bridge due to anticipated secondary impacts. The new bridge was to replace an old one, and was significantly higher. The higher bridge would have allowed greater boat access to the waterway and it was determined that this would in turn spur additional development. The plan for the new bridge had the approval of the County Commissioners and the Chamber of Commerce. DOT had already begun to purchase rights-of-way but the bridge was opposed by several state resource protection departments. The Division of Coastal Management cited "significant indirect or secondary impacts on water quality, area wildlife habitat and important wetlands" in denying the permit. The denial letter stated " These cumulative impacts will contribute to the continued degradation of the already stressed Pamilico River system." (Dew, Raleigh News and Observer, 7/11/89) Initially, DOT planned to appeal the denial but eventually, due to strong public opposition and CAMA's clear statutory authority, reconsidered and altered their proposal to accommodate the cumulative impact and secondary impact concerns.

Case Law Issues

Although our interviews in Virginia have turned up no cumulative impact case law in this state, it is nevertheless useful to consider the types of legal issues which might arise if Virginia were to become more explicitly involved in addressing cumulative impacts.

A report prepared for the State of Maine Planning Office is of particular assistance in this regard. (Maine State Planning Offices, 1988) This report identifies three issues which could form the basis of legal challenges.

(1) determining the appropriate geographic and temporal scope of cumulative impact review

(2) equitable allocation of resource use

(3) forecasting potential cumulative impacts

To this list we would add the more general takings challenge possibility.

An important aspect of defining the scope of action is determining what other actions or projects should be considered in the analysis. Connecticut, in their EIS requirements, states that all "past, present and reasonably foreseeable future actions "should be taken into account by the sponsoring agency" as part of assessing the cumulative impacts of the proposed action (Connecticut Environmental Policy Act, Section 22a-1a-3b). California law expands this to explicitly include projects which are outside the sponsoring agency's control (California Code of Regulations, Title 14, Section 15130). Wisconsin's regulations include consideration of whether an action will establish a precedent for future actions or limit future options (Wisconsin Administrative Code, NR 150.22(2)(a)4). In each of these instances, applying these general specifications poses difficult administrative questions and raises possible legal challenges.

The North Carolina bridge case mentioned above could be considered to be a challenge based on the appropriate scope of review question. The courts in that case affirmed that the Coastal Commission was able to deny DOT a permit to build a highrise bridge based on area wide growth inducing and secondary impacts. In another case, A. Ballance, et al v. Coastal Resources Commission of North Carolina, the question was whether all potential future piers be considered when evaluating a current application for a permit to build a pier. Because the North Carolina statutory language is clear in both cases, these questions were determined to be part of the appropriate scope of review and were upheld by the state court.

In a case in California, Kings County Farm Bureau et al v City of Hanford, the court held that the city had unduly limited the geographic scope of its analysis. The court found the city's cumulative impact analysis legally deficient "(1) when projects are omitted that it were 'reasonable and practical' to include, and (2) when the analysis understates "the severity and significance of the cumulative impacts." (Remy, Thomas and Moose, 1991, p 225).

Another way to view the cumulative impact question is as one of equity in treating precedent setting permit applications. Many actions, if considered one at a time, would not be environmentally significant, but in

conjunction with other similar actions could significantly degrade the environment. When an action is permitted to one property owner (i.e., building a dock), then every similarly situated property owner might claim a right to build a dock under an equal protection principle. Many docks might result in a cumulative degradation of the water resource and property values for all owners might ultimately diminish.

Denying everyone outright to avoid setting a precedent has been upheld in North Carolina's courts, again in A. Ballance, et al v. Coastal Resources Commission of the State of North Carolina. The CRC issued a permit to a developer to build a pier. Several citizen's challenged the permit based, among other things, on the fact that the pier "could set a precedent whereby other boat docks would lead to a cumulative loss of this important fishery habitat." The court agreed with the challenge and denied the permit based on cumulative impacts (State of North Carolina, County of Wake, Alton Ballance, et al v. Coastal Resources Commission of the State of North Carolina, May 29, 1991).

The most vulnerable legal aspect of cumulative impact assessment may be the adequacy of its technical and scientific support. Many authors argue that scientific methodologies are not yet well developed in the cumulative impact assessment field. If a permit applicant can find technical fault with the methodology used when denying a development request, there may be grounds for a legal challenge. In a California case, Citizen's to Preserve the Ojai v. County of Ventura, however, the plaintiff citizen group challenged the adequacy of an EIS because the County's Air Quality Management Plan did not include off-shore impacts of an oil refinery. The County claimed there was no adequate scientific model in existence to conduct the necessary analysis. The court's decision stated that "assuming that a sophisticated technical analysis for such impacts was not feasible, the lead agency was at least bound to conduct some reasonable, albeit less exacting, analysis, if such could be performed." (Remy, et al, p 226).

Legislation that provides for protection of a resource from adverse cumulative impacts has also been challenged in some courts as a regulatory taking of property without just compensation. In 1988, South Carolina adopted a Beach Front Management Act to preserve and restore their beaches and protect public safety that had been jeopardized by the accumulation of beach front development. The law stipulated that when a property was over two-thirds destroyed by natural causes within a certain distance to the beach, an owner could not rebuild the property. After his property was destroyed by Hurricane Hugo, a property owner

challenged this provision as a regulatory taking. In John V. Esposita, et al v. The South Carolina Coastal Council, decided this summer, the court ruled that protecting the beaches was a legitimate public purpose and that the property had not been taken.

The Maine Report offers the following conclusions and guidance for addressing these difficult political and legal issues. We quote:

> Defining a scope of review to provide for adequate assessment is one of the major challenges in addressing cumulative impacts. Cumulative impact assessment goes beyond traditional environmental review of individual projects to include both temporal and spatial considerations. Moreover, cumulative impacts can encompass a variety of direct, indirect, synergistic or growth-inducing effects. Designing precise guidelines to cover all possible situations is difficult and leads to reliance on standards of "reasonableness and practicality." However, statutory language can provide guidance by requiring consideration of the temporal scope of review by explicitly mandating consideration of "past, present, and reasonably foreseeable projects," similar to NEPA's requirement. By using "reasonably foreseeable future projects,' a broader scope of review is ensured than the more narrow requirement of 'existing and proposed,' which may overlook important developments not yet at the level of a proposed project. Spatial reviews are best guided by ecological considerations, such as watershed boundaries, but are often delineated by the phrase "in the area." To ensure that all relevant factors are considered in assessments, and to stress their importance, indirect or growth-inducing effects may be addressed separately, such as in New York State's EIS and California's CEQA requirements.
>
> Related to defining review boundaries, is forecasting the potential for cumulative effects. Ecological thresholds of tolerance, beyond which degradation should not be permitted, can provide guidance for the management of future impacts. However, given the current status of scientific knowledge and the complexity of ecological systems, identifying absolute thresholds is not yet possible. State management programs have employed a variety of techniques - monitoring past and present effects, potential build-out, alternative development scenarios and planning techniques - to provide insight into future impacts. These measures can assist management by highlighting problems which could be mitigated by adopting new policies.
>
> Equity concerns for the allocation of resources are handled in a variety of ways. Under Florida's consistency doctrine, the question of allocation is partially addressed by restricting activities which may lead to cumulative impacts. Frequently, allocation issues are resolved by the establishment of resource protection criteria as public policy and the use of planning tools such as protection zones or performance standards to implement these policies. Allocation of resources is accomplished by subjecting all landowners to the same restrictions. One planning tool, the transfer of development rights, can provide an effective method of protecting resources by providing a mechanism for development potential in less sensitive areas. (p. 107)

These comments appear to be realistic and to offer sound suggestions.

ENVIRONMENTAL IMPACTS LAWS

In many people's minds, cumulative impact assessment is associated and virtually synonymous with laws requiring Environmental Impact Statement preparation. As was indicated above in Section II, NEPA was one of the first of the environmental laws to call for and to define cumulative impacts.

National Environmental Policy Act

NEPA and the CEQ guidelines require federal agencies to examine cumulative impacts beginning with the initial environmental assessment and scoping process and continuing through any subsequent EIS. The CEQ guidelines mandate that all major Federal actions be reviewed for their direct, indirect and cumulative impacts. (40 CFR Ch. V, Section 1508.25) Direct effects are defined as those resulting from and concurrent with the proposed action. Indirect effects are those removed in space or time from the proposed action. These include growth inducing and transmedia effects. A cumulative impact is defined by NEPA guidelines as one "which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or Non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR Ch. V, Section 1508.7).

NEPA encourages a tiered EIS approach (40 CFR Ch. V, Section 1502.20). Tiering refers to the process of preparing a sequence of EIS's for complex actions, starting with broader issues and successively becoming more focused. It should be noted that the NEPA definition of actions includes plans, programs and policies. By tiering, each EIS is addressing the most relevant issues that are "ripe" for decision at each level of review. The CEQ guidelines suggest that when preparing broad EIS's, agencies evaluate proposals based on their similarity, (e.g., geographic region, timing, impacts, alternatives, methods of implementation, media or subject matter). Tiering means evaluating programs in advance of individual projects. In this way, it is intended to deal in advance with cumulative impacts. The project-by-project process has been one source of criticism of the EIS process.

State Environmental Impact Assessment Laws

Although many major actions fall under the federal EIS requirement, a number of states initiated their own EIA requirement during the 1970's to cover significant state or local actions. (Note: States use a variety of terms - EIA, EIR, EIS - to describe their environmental documents. To avoid frequent shifts we have chosen to use the 'EIA' term throughout when referring to states.) A 1987 study by the Council of State Governments indicates that thirty-five states have adopted EIA requirements similar to that of NEPA (CSG Backgrounder, 1987). Virginia is one of the states to do so though, compared to NEPA and to some states, the reach of Virginia's law is relatively limited. Neither the statute nor the procedures to implement it address cumulative impacts. Also coverage is limited to major state facilities as discussed in Section IV.

In order to choose states whose "little NEPA" requirement we would survey, we selected the top ten states based on the Renew America (a.k.a. Fund for Renewable Energy and the Environment) *State of the States* report which ranks state environmental programs according to their effectiveness. We assumed that states with the best overall rating would also likely have the best EIA programs. Interestingly, only eight of the top ten states had EIA requirements, and there was a wide range in the extent and manner in which these states addressed cumulative impacts. Seven of these eight do explicitly mention cumulative impacts in either their statutes or regulations. When we contacted them and asked their self-evaluation, none of the states indicated that they had what they considered to be a firm grasp on cumulative impacts, notwithstanding their EIS requirements. Like Virginia, they too would be interested in ways to make improvements.

From our reading and interviews, three elements appear to be key in the ability of EIA regulations to effectively assess, mitigate or avoid cumulative impacts. Paired with this is the backing of state courts. First is the extent of the state's authority to address cumulative impacts. Second is how a state defines the scope of the actions subject to the EIA requirements. This determines how comprehensively cumulative impacts are examined. Third, the role of the EIA in the decision process will influence the extent to which cumulative impacts are actually avoided or mitigated.

AUTHORITY TO ADDRESS CUMULATIVE IMPACTS

Wisconsin, California, Connecticut, Michigan, Massachusetts and New York are states which explicitly require that cumulative impacts be assessed within an EIA, but to varying degrees.

Most of the states have adopted NEPA-like definitions of cumulative impacts, but California has developed a definition which incorporates synergistic effects as well as nibbling and cross-media effects. California's Code of Regulations Title 14, section 15355 defines cumulative impacts as:

> Two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts: a) The individual effects may be changes resulting from a single project or a number of separate projects; b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

By being slightly more descriptive in their definition, California points agencies toward the types of cumulative impact they must examine in the environmental impact report and provides direction for the courts regarding what constitutes an adequate document. Our California informants felt that the courts have generally provided strong backing on this California Environmental Quality Act (CEQA) requirement.

Illinois and Florida were the only states ranked in the top ten programs which did not have an EIA requirement, although Florida does have a similar policy called a Regional Impact Assessment which focuses on sociological and infrastructure impacts. North Carolina mentions indirect effects in addition to direct effects in its EIS regulations.

New Jersey had an administrative EIA requirement based on an executive order. According to a New Jersey state official, this arrangement has functioned as effectively as other states with statutory authority in addressing the more clearcut direct effects, but he was not satisfied that cumulative impacts were dealt with regularly or adequately.

While it is difficult to assess the role played by statutory language, it does appear that states which explicitly use the term "cumulative impact" and which define it more thoroughly are more likely to find agency officials or courts taking cumulative impacts seriously.

SCOPE OF ACTION

Assessing cumulative impacts involves broadening the established limits of assessment as has been indicated at a number of points above. Therefore, defining the scope of action to be studied in an EIA process is critical to properly assessing cumulative impacts. If an "action" is defined narrowly or if exemptions are extensive, it is unlikely that indirect and less obvious effects will be taken into account.

a) Types of Actions Requiring An EIA

NEPA has a very encompassing definition of an action. The CEQ guidelines define an action, or project in CFR Ch. V, Section 1508.18, as:

> new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies; new or revised agency rules, regulations, plans, policies or procedures; and legislative proposals.

It goes on to say:

> Federal actions tend to fall within one of the following categories: Adoption of official policy, adoption of formal plans, adoption of programs and approval of specific projects.

With the exception of California, the states we examined limit state EIA requirements to actions conducted by the state. Connecticut limits their EIS requirement to state initiated projects and state funded projects (Connecticut Environmental Policy Act, Section 22a-1c), but the other states require EIA's for state approved permits and projects as well.

In order to address less significant projects and to avoid becoming overburdened by cumbersome EIA requirements, Wisconsin has categorized actions into four types from the most significant to the least. Type I actions are "major actions which would significantly affect the quality of the human environment." Type II actions have the "potential to cause significant environmental effects and may involve unresolved conflicts in the use of available resources." Type III actions are ones that "do not have the potential to cause significant environmental effects, normally do not significantly affect energy usage and normally do not involve unresolved conflicts in the use of available resources." Type IV actions are routine, ancillary actions, actions "which individually or cumulatively do not significantly affect the quality of the human environment, do not

significantly affect energy usage and do not involve unresolved conflicts in the use of available resources." These are primarily ministerial actions, such as issuing fishing licenses. (Wisconsin Administrative Code, Department of Natural Resources, NR 150.03).

Under this system, Type IV actions do not require any environmental investigation. Type III actions require public notice of the action, and if there is sufficient response or controversy, an action can be reclassified as Type II. Type II actions require the preparation of an Environmental Assessment - an abbreviated EIA. All Type I actions require a full EIA and if the Dept. of Natural Resources, upon review of an EA, finds sufficient reason, it can require an EIA for a Type II project as well.

New York also classifies state actions into categories requiring different levels of examination. Only actions listed as Level I always require an EIA (6 NYCRR Part 617.12). Unlisted actions require the completion of an environmental assessment form to determine whether an EIA should be prepared. In addition, the New York law provides that all actions are treated as Level I actions when they are located in designated critical environmental areas (New York State Dept. of Environmental Conservation, p.B-2). This could be an important feature in a state like Virginia concerned about is coastal areas, the Chesapeake Bay and other sensitive sites.

New Jersey sets their EIA policy by the cost of the project. Any project with construction costs over $1 million requires an EA, and any project over $5 million or disturbing five or more acres of land requires an EIA (State of New Jersey, Executive Order No. 215).

If Virginia were interested in adding EIA requirements only for certain highly significant projects, the idea of defining "levels" might have applicability.

b) Addressing Phased Actions

In order to facilitate financing and project management, businesses and government agencies sometimes phase a project. For instance, the DOT may plan to expand a highway from two lanes to four, and may divide the project into ten-mile segments. If individual EIA's were prepared for each segment, cumulative impacts might not be readily apparent.

Connecticut mandates that if an action is part of a sequence of planned activities (connected actions in NEPA terminology), then the entire sequence must be the action which is evaluated in the EIA (Connecticut Environmental Policy Act, Section 22a-1c). The general rule used to determine whether an action requires an EIA is whether the action is part of a larger plan or does not serve a purpose in and of itself, then an EIA must be prepared for the entire program.

In California, local government comprehensive plans are also subject to EIA requirements (Remy et al, p. 40). These EIA's serve as programmatic documents and can be referenced in zoning and other private project decisions in a tiered fashion. Local governments have the option of combining the plan and the EIA into one document.

In its definition of 'action,' New York includes "agency planning and policy making activities that may affect the environment and commit the agency to definite course of future decisions" and "adoption of agency rules, regulations and procedures, including local laws, codes, ordinances, executive orders and resolutions that may affect the environment." (6 NYCRR Part 617.2b). New York provides for a programmatic, or generic environmental impact statement similar to the tiering process in NEPA and California. The generic EIS follows the same format as the site-specific EIA, but it is broader in scope and more conceptual in nature. Generic EIS's can help link the assessment of separate actions in a geographic area, a sequence of projects by one sponsor, or separate actions by different sponsors having common impacts (New York State Dept. of Environmental Conservation, p. B-39-40).

Generic EIA's provide several advantages over site-specific or project- specific EIA's in assessing cumulative impacts. The "big picture" view of generic EIA's is supportive of the examination of indirect and secondary impacts. The New York format also encourages the establishment of thresholds, criteria and conditions for future actions, which can be quite beneficial for effectively avoiding cumulative impacts. Generic EIA's prepared in the initial stages of a program enable mitigation measures and alternatives to be developed at a time when there is still flexibility. The early EIA also provides baseline data for reference and scoping of supplemental EIA's. Finally, from an efficiency standpoint, a generic EIA abbreviates future site-specific or project-specific reports.

It should also be noted regarding cross-media impacts that, like NEPA, some states have a "single EIA" policy. Where projects involve more than one approving agency or when implementation is phased, one agency

is designated the lead agency for purposes of EIA preparation. The lead agency's responsibility includes seeing that the EIA addresses all issues not just those pertinent to the resource or media which fall under its own permitting authority.

ROLE OF THE EIA IN THE DECISION PROCESS

For an EIA to have an effect on cumulative impacts it must influence the decision to move forward with the proposed project or how the project is implemented. In a nice turn of phrase, the CEQ calls for NEPA "not to generate paperwork - even excellent paper work - but to foster excellent action." (40 CFR Ch. V, Section 1500.1). To combat the tendency to view EIS only as "information" documents, some states have sought ways to increase the consideration given to environmental impacts.

California's Code of Regulations Title 14, Section 15091 requires formal findings relating EIA identified impacts to the project approval decision. Agency determinations must be based on "substantial evidence." Judicial support is felt to have been strong in California based, at least in part, on their clear and explicit regulations which aid in disclosing the amount of consideration given to cumulative and other impact factors.

To assure that high quality work goes into each EIA, some states, such as Connecticut, require that the EIA be submitted to a review committee for approval and recommendations (Connecticut Environmental Policy Act, Section 22a-1a-5). This review is concerned both with procedural and substantive matters and is believed to cause project sponsors to better address the environmental ramifications of proposed projects.

Florida, which does not have a traditional EIA requirement does require Regional Impact Assessments for development projects. The state has denial authority based on these assessments. Any project which would have a significant effect on the health, welfare or safety of citizens of more than one county must obtain a development order. To do so, the sponsor must prepare a RIA and submit it to the Bureau of State Planning. Although the RIA is concerned primarily with infrastructure and socio-economic conditions, the environmental effects of the project are considered as they relate to the health, welfare and safety of the citizens. When asked whether the ability to deny projects based on cumulative impacts had actually been utilized, state officials replied that no orders have been denied based upon the cumulative impacts of a project (Alto,

1991). It is difficult to say whether this indicates a discrepancy between theory and practice or whether it indicates that the law has been successful in discouraging submittal of seriously detrimental projects.

Several states complained that the lack of denial authority in their EIS's causes a lack of motivation for environmental agencies to address or enforce cumulative impact requirements (Birch, Nasca,1991). Courts seem to have difficulty understanding concepts like secondary or cumulative impacts according to one New York informant.

No published studies have come to our attention which systematically evaluate the effectiveness of state EIA programs. At a recent conference, Robert Olshansky from the University of Illinois (1990) made the following observations about the California process and how it relates to that state's planning and land use decision making. We suspect that these same observations might have validity generally.

> On the negative side, CEQA (1) encourages incremental planning, (2) encourages reactive planning, (3) facilitates NIMBY rejection of all major projects, (4) sometimes generates too much information, (5) sometimes makes the project planning process interminable, and (6) continues the trend toward using development fees to pay for planning, thereby compromising the public perspective of planning departments. CEQA requires consideration of cumulative impacts and long term environmental goals but, in reality, does not deliver.
>
> On the positive side, CEQA (1) mandates public participation, (2) makes decisions on controversial projects more publicly visible, (3) generates information, (4) emphasizes the importance of clear communication of information, (5) empowers local planners, by improving their position to negotiate conditions of approval, and (6) provides an extra level of assurance that General Plans are founded on adequate information.

PLANNING APPROACHES

One of the more frequent criticisms of EIA requirements is that they emphasize project-by-project assessment or incremental planning which makes cross-project cumulative impact assessment difficult if not impossible. The concept of a tiered EIA system begins to address the cumulative impact question more effectively by anticipating their occurrence. It is but a short step from a programmatic EIA to a plan - in fact, California allows local governments to combine these two documents as long as the merged document meets all the requirements of the separate reports.

Planning seeks to work backwards from identification of a desired future condition - a desired cumulative impact in a sense - to consideration of projects which will achieve the plan. Private initiatives as well as public agency actions can then be judged based on consistency with the plan.

A number of authors have attested to the importance of planning in cumulative impact assessment. The State of Maine Report (1988) referred to earlier describes the merits of a planning approach this way.

> Whether a state employs a regulatory or a planning/regulatory system to address cumulative impacts will determine how troublesome the issues of allocation and thresholds will be. Regulatory programs which decide permit applications on an individual basis violate the underlying tenet of cumulative impacts assessment which seeks to consider impacts comprehensively and before ecological stress is apparent. At some point under a regulatory approach limits of tolerance will be reached, prohibiting further development. Determining what those limits are and justifying them, however, raise difficult legal and technical questions.
>
> To a certain extent, comprehensive planning techniques can remedy this dilemma. By incorporating predetermined resource values into comprehensive plans, resource use decisions can be guided by ecological priorities. Specific thresholds of tolerance do not have to be proven, as may be required in a strictly regulatory system. Local plans in California and North Carolina establish resource protection values in special management areas. North Carolina not only specifies protection areas but details permissible and nonpermissible uses so that applicants and permit reviewers are well aware of what is acceptable for a given area. New Jersey's coastal program also establishes resource values in a planning context but does so at the state level. Comprehensive planning provides protection against cumulative impacts by establishing guidelines before submission of a permit application.
>
> Planning approaches can also address the small-scale, incremental development which contributes to the cumulative impact problem but may escape review under regulatory programs. However, simple implementation of comprehensive plans may be too general to provide adequate protection, unless modified to address specific resource concerns. (p.109)

Statewide Growth Management Planning

According to Judith Innes from the University of California at Berkeley, state growth management plans "reflect a public recognition that many functions of government, from water quality control to transportation, play out and interact on the land. They establish the principle that both state and local governments and many public agencies share an interest in all the uses of land across the state." (Innes, 1991, p.

3) As such, growth management plans can assess and prevent accumulating impacts on a broad scale, and incorporate input from a large number of players in arriving at a consensus view. Among the topics typically addressed by these plans are agricultural/forestal preservation, water quality, natural resource protection, open space and energy conservation. Future funding is sometimes conditional on localities compliance with the state plan. Development decision making, at least for regionally significant projects, is typically coordinated with both local and higher level review.

A recent survey of state growth management legislation (Newmann, 1991) found that nine states have adopted state growth management legislation. These are:

- Florida
- Maine
- Rhode Island
- Georgia
- New Jersey
- Vermont
- Hawaii
- Oregon
- Washington

States with Growth Strategy Commissions but who have not yet adopted legislation include:

- California
- Pennsylvania
- Virginia
- New York
- Maryland
- Massachusetts
- West Virginia

Because Virginia's Commission on Population, Growth and Development will be reviewing the efforts of other states in greater detail, here we will only report selected findings specifically related to cumulative impacts.

Oregon began statewide land use planning in 1972. They have the longest experience with this practice. Many states that have adopted growth management more recently have used Oregon as a model. Their method is based on the development of a series of statewide goals that have the force of law. Local governments are charged with development of comprehensive plans, and the zoning and land division ordinances needed to put the plan into effect, consistent with the statewide goals. Local plans require approval by the state planning office. Once a comprehensive plan is approved, all land use activity in that jurisdiction must be consistent with the plan - essentially local decisions must tier off the state goals. Coordination of plans between cities and surrounding counties is required. State agency and special district plans must be coordinated

with local plans. A major feature of Oregon's program is active and extensive citizen involvement.

Examples of the directives to address cumulative impacts in the Oregon statutory language include: Goal 6 "To maintain and improve the quality of air, water and land resources of the state, all waste and process discharges from future development, when combined with such discharges from existing developments shall not threaten to violate, or violate applicable state or federal environmental quality statutes, rules or standards.. . . such discharges shall not (1) exceed the carrying capacity of such resources, considering long range needs, (2) degrade such resources; or (3) threaten the availability of such resources." (Oregon, 1990, p. 7)

In Goal 16 which protects estuary and wetlands resources, it is required that localities write their comprehensive plans to "Consider and describe in the plan the potential cumulative impacts of the alterations and development activities envisioned. Such a description may be general but shall be based on the best available information and projections." (Oregon, 1990, p. 15)

Washington State is one of the most recent states to adopt growth management legislation. It too requires localities to develop coordinated comprehensive plans that are approved by the state. State agency activities must then be consistent with local plans and vice versa. Section 38 of the legislation requires identification of natural resources of statewide significance and development of minimum standards to protect such resources. (Washington, 1991, p. 36-37)

The Washington law also specifically requires attention to cumulative impacts that may accrue due to the planning program itself. Section 20 calls for what are termed Environmental Planning Pilot Projects. "These projects should be designed and scoped to consider cumulative impacts resulting from plan decisions, plan impacts on environmental quality, impacts on adjacent jurisdictions, and similar factors in sufficient depth to simplify the analysis of subsequent specific projects being carried out pursuant to the approved plan." (Washington, 1991, p. 19)

Vermont began statewide land use planning in the 70's with Act 250 but has quite recently supplemented its legislation to address cumulative impacts. Act 250 legislation embodied a planning program regulating critical areas and large scale development. Vermont's recent statewide

planning legislation, Act 200, has grown out of what has been described as the inability of Act 250 to protect the state from cumulative impacts of smaller scale development decisions which escape review under Act 250.

Vermont has grown very rapidly over the last three decades and discovered that there can be serious negative consequences to persistent growth unless development is sensitively managed. The state has lost large amounts of prime agricultural soils, both ground and surface water quality have been degraded and man-made infrastructure systems are overtaxed. The Vermont legislature developed Act 200 as an additional statewide growth management policy to try to overcome the rapidly accumulating impacts associated with growth and development of small as well as large projects in the state. (Cowert, 1985)

Before Act 200 was adopted, Vermont introduced legislation that would amend Act 250 to require areas of rapid growth to consider cumulative impacts on natural and man-made resources. Carrying capacity studies would be required in rapidly growing areas and past, present and potential future development would be considered. This legislation was not passed because the state opted instead for a stronger state growth management planning initiative that it was argued would better protect their state's character and accomplish the same purpose as envisioned in the cumulative impact proposal. The proposed cumulative impact assessment legislation (Vermont, H295, 1985) is interesting as a general model even though not approved. The language which is of interest is the Bill's Statement of Purpose and the provision for the designation of "rapid growth areas." In these, resource capacity studies would be preformed. Act 250 would be amended to require the consideration of cumulative development and subdivision impacts on resources, taking into consideration the results of any rapid growth study. A rapid growth area is defined in the Bill as "one or more towns which are experiencing growth at such a volume or rate, or both, that cumulative demands may surpass the existing limits of the area's natural or human-made support systems."

Growth management tools used by localities are fairly well known and fall into several categories. These may include traditional zoning, performance standard zoning, designation of urban growth boundaries, concurrency requirements, permit requirements for potentially polluting actions, etc. Another tool used for growth management is the preparation and adoption of plans for specific local needs. Commonly adopted plans include flood plain and natural disaster protection and mitigation plans, and open space and recreation plans. Resource protection and growth management are sometimes accomplished through outright acquisition of

critical land. Governments use financial incentives including taxation, impact fees, easements and transfer of development rights, to direct growth. And finally, public spending, including capital budgets and transportation plans significantly impact the direction growth takes within political boundaries. A discussion of these tools can be found in "Managing Growth: Small Communities and Rural Areas" by Timothy Beatley and David Brower (1988).

It is possible that Virginia's Commission on Population Growth and Development will recommend some form of statewide planning. If that is the case then a sounder basis will be provided for considering a variety of cumulative impacts in Virginia.

Planning Initiatives Based on Natural Resource Boundaries

In contrast to statewide growth management, environmental planning initiatives are frequently delineated by the natural boundaries of the resource to be protected. Using this method, the naturally occurring ecosystem is the focus of protection rather than the state. In resource based plans accumulating inputs to a particular natural system are inventoried and considered together and thus the detrimental cumulative impacts of inputs to the resources are more identifiable.

Resource or ecosystem based plans can cover extensive land areas and require broad based coordination efforts. Planning initiatives to reduce pollution to the Great Lakes are an example of an international resource based plan. Closer to home, the interstate agreement to reduce pollution and improve water quality in the Chesapeake Bay is a broad based plan that includes many jurisdictions and a variety of pollution reduction and prevention strategies. Generally, natural resource protection plans are focused on more manageable areas - frequently regions within a single state. Coastal zone, floodplain, wetlands and most river basin management plans are sub-state regional plans that focus on a particular resource of concern.

Resource based plans can be organized to attempt to assess all types of inputs to a region or they can address only the detrimental inputs of a single type to a resource. North Carolina's whole basin approach to water quality management is a planning tool that addresses water quality specifically by accounting for and considering at one time all point source discharges into a common receiving water body. North Carolina's Coastal Areas Management Act (CAMA; NC Code General Statute 113A-100 to

113A-134.10) on the other hand, is a land use planning tool that attempts to assess all the impacts of growth in a particular region.

Federal coastal zone management and "no net loss" wetlands policies have led to wetlands protection planning initiatives in various states that attempt to analyze and prevent cumulative loss or deterioration of wetlands. (See Maryland Non-Tidal Wetlands Protection Act discussed below, and Oregon's Wetlands Conservation Plans; see also Brower and Carol Managing Land Use Conflicts which describes a variety of Special Area Management Plans.)

Other federal and state planning initiatives that have a cumulative impact assessment component include local floodplain management plans required by the National Flood Insurance Program, disaster mitigation and recovery plans encouraged by the Federal Emergency Management Act and Forest Management Plans developed by the USDA Forest Service. (See "Inventory of Federal Agency Activities on Cumulative Impact Assessment". This report discusses procedures, planning techniques, methodologies, research, court cases, and related literature for all Federal Agencies' activities related to cumulative impact assessment through 1988.)

The EPA is currently encouraging geographic area based initiatives for environmental protection and has indicated that proposals that have this component are likely to receive more consideration for limited funds. Partly because of this emphasis, a number of new permitting and planning programs around the country have a strong geographic area basis - most often a watershed. Watershed based plans from Maryland and North Carolina that may provide models for assessment of cumulative impacts to natural systems are discussed below.

Watershed Based Plans

One of the most frequent foundations for resource based planning is the watershed or basin plan model. Considering complete watersheds allows for analysis of all inputs to a common resource and thus cumulative impacts of all types are more readily apparent. Notable watershed planning efforts in neighboring states are North Carolina's "Whole Basin Approach to Water Quality Management" and the Maryland Watershed Management Plans mandated by their Non-Tidal Wetlands Protection Act of 1989.

The TMDL (Total Maximum Daily Load) coordinator of EPA's Region 4, has suggested that North Carolina's new Whole Basin Approach to Water Quality Management is an outgrowth of EPA's new geographic area emphasis. There are both permitting and planning components to this model. A basin wide plan for water quality management is drafted for each of North Carolina's 17 river basins. The basins have been put on a schedule with the first plan to be completed by 1993. All the plans to be finished by 1998.

Under this system, NPDES permits in each basin are reviewed and renewed at one time, every five years. Modeling, monitoring and public participation activities are organized around this five year review schedule. Cumulative impacts of land use non-point source and point source discharges are studied together. "Linkages between aquatic and terrestrial systems are addressed and all inputs to aquatic systems and potential interactive effects are considered." (Creagar, et al, 1991, p. ii) This procedure has been developed to take advantage of a growing body of baseline data, as well as new assessment methodologies and management strategies, to be incorporated into the plans over time.

Maryland's Non-tidal Wetlands Protection Act calls for the preparation of watershed management plans. "The planning process includes mapping and formulation of technical management plans that will address protection, cumulative impacts, mitigation, water supply and flood management." (COMAR .08.05.04.07). The Water Resources Division of the Department of Natural Resources carries out this mandate. The effort attempts to coordinate three water resource issues - water supply, floodplain management and non-tidal wetlands - into a single comprehensive plan. Separate plans are initially created for each water related element and then merged into one comprehensive final plan. In the process, discrepancies in separate plans are addressed and reconciled.

Performance Based Plans

Cumulative impacts can be addressed by establishing maximum limits for whatever activity is being regulated and then working backwards to individual permits. These threshold or sustainability limits are generally defined as the sustainable level of a certain type or class of activity beyond which the quality of the environment is degraded. This is a level which allows activity up to a point but once the limit is reached, no additional activity can be permitted. Theoretically, this approach should eliminate cumulative effects excesses, but we have learned that problems

frequently arise in establishing the threshold limit, allocating the available capacity, determining when the threshold limit is reached and addressing activities not subject to the limit.

Carrying capacity studies can be used to determine the maximum population that could inhabit a given area or to determine infrastructure limits, such as roads and wastewater treatment facilities which are affected by growth. For instance, North Carolina conducted several carrying capacity studies for cities and counties on the Outer Banks. In Currituck County, North Carolina, five factors were analyzed to arrive at the county's carrying capacity: availability and suitability of land for development, hurricane evacuation ability, road system adequacy for access and internal circulation, wastewater treatment and drinking water supply availability (Bell et. al.,1983, p. 1-6). Besides drinking water supply, which the studies decided could not be determined, the most limiting factor was found to be existing wastewater treatment capacity. At the time there were no wastewater treatment plants in the county and the carrying capacity of 2,680 dwelling units was determined based on the amount of available land suitable for septic tanks. By increasing the county's infrastructure, in this case building a wastewater treatment plant, the carrying capacity could be increased indefinitely. Thus the threshold of sustainability is not an absolute or fixed value intrinsic to the area.

Despite the imprecision of the results of such carrying capacity studies, the concept of carrying capacity can still be effective in their actions. Additionally, infrastructure limits may in fact be lower than ecological limits, in which case the human population would be held to a sustainable level if the decision was made not to increase the capacity. (Dickert, Tuttle, 1985, p. 4l)

Establishing maximum limits based on ecological considerations is difficult for two reasons. First, no two ecosystems are exactly the same, therefore each has its own unique maximum limits. Second, there are no discreet limits as there may be in engineered infrastructures. Ecological tolerances are expressed as continuums instead of definitive points. Because of these two difficulties, determining ecologically based threshold limits requires large amounts of data and research. With such information studies can be conducted as illustrated by two University of California, Berkeley researchers who studied a coastal wetland watershed in Monterey County, California. They had the benefit of extensive research which had been conducted previously on species variations and several decades of aerial photographs were available. Four major studies were

conducted: a hydrologic analysis, an upland erosion and deposition analysis, a time series analysis and a measure of impervious surface and bare ground. Using all of this information, it was determined that the amount of bare ground from clearing and fill was the most influential factor on water quality. Land disturbance targets were then expressed as a percentage of available area and were formulated for each of the 37 subwatersheds in Elkhorn Slough. These levels were then compared to actual land disturbance values to establish guidelines for development. (Dickert & Tuttle, 45-59)

In the absence of concrete, scientifically established limits, it has been suggested that panels of experts be used to estimate threshold limits. This approach may in many cases be the best alternative because rarely are ecological studies undisputed or exact. Estimating and debating threshold limits also openly addresses the political nature of regulations. Panels, of course, have been used in regulatory negotiations in Virginia. For example, the Instream Flow and other Roundtables.

Once the difficult task of setting threshold limits for an area is accomplished, implementing them creates another difficulty: allocating the available resources. Whereas the formulation process is hampered by financial and technical requirements, implementation is impeded by political, legal and philosophical obstacles of the types discussed in Section II. To address these, economic incentive mechanisms have been developed. One of the most notable is the emissions trading program under the Clean Air Act.

Emissions trading essentially establishes a limit for the amount of an air pollutant allowable in a designated area. Although these limits are adjusted through a political process, they are rooted in scientific reasoning based on the effect of the pollutant on biological resources. Theoretically, once this limit is reached, no new sources of that pollutant are allowed in the airshed unless offsets are created within the same airshed. What is unique about emissions trading is its attempt to fairly distribute the available capacity of air pollution by making emissions permits tradeable. Emission sources are able to buy and sell permits such that the person to whom the permit is most valuable is able to compensate the seller for their interest foregone.

The Dillon Reservoir in Colorado provides an interesting water quality example. Point source water polluters are allowed to increase their discharges above the applicable limit by taking measures to reduce non-point source pollution at a ratio of 2:1. For example, by reducing 1000

pounds of phosphorous runoff from a farm with buffer strips or snow fencing, an industrial plant could increase its phosphorous discharge over its permitted limit by 500 pounds. This results in less pollution for less money because it is often cheaper for the industrial plant to reduce non-point source pollution than to reduce its own pollution (Hahn & Hester, 1989, p. 393-396).

PERMITTING PRACTICES

It is at the permit stage that cumulative impact considerations become translated or not into permit issuance, denial or conditions. It is perceived inadequacies at this permitting stage which have generated much of the concern and interest in looking into better ways to deal with cumulative effects.

To address these difficulties, several states - with cooperation and support from EPA - have developed pilot programs to test alternatives to the usual ways of doing business. New Jersey and Massachusetts are in the process of instituting multi-media whole facility permitting procedures. The Amoco facility at Yorktown is part of a similar approach and pilot program. Illinois is now using an early multi-agency permit conference to head off cross-media and cumulative effects that could result from traditional separate agency, site-specific permitting procedures.

Facility-wide Permitting

Pollution prevention initiatives in several states are beginning to grant a single multi-media permit for discharging facilities rather than separate permits for water, air and waste disposal. Several goals are being addressed by these initiatives:

1. Reduction of overall pollution by coordinating inspection, planning and permitting activities.

2. Developing a more holistic approach to pollution prevention that encourages source reduction of waste materials thereby improving the occupational health in pollution-generating processes and decreasing waste discharged to the environment.

3. Eliminating separate regulation of various media thereby eliminating the tendency to reduce discharges in one media by increasing discharges in another.

4. Increasing efficiency of permitting procedures and staff time. Reducing duplication required by single media permitting. (New Jersey)

New Jersey

New Jersey recently passed The Pollution Prevention Act which calls for phased development of a Facility-Wide Permit Program. The goals of the Act are to achieve a 50% reduction in the use of hazardous substances at industrial facilities and a 50% reduction in the generation of hazardous substances as non-product output. Air, water and land discharges are considered simultaneously by a multi-agency permitting team. The crux of this legislation is the development of pollution prevention requirements and permissible emission/discharge limits for major industrial facilities through a pollution prevention plan.

The pollution prevention plan is to include an investigation of source reduction opportunities. The facility is encouraged to explore all options for reducing, reusing and recycling in their production process. Pollution prevention technologies are to be preferred over treatment and disposal technologies. Source reduction and recycling opportunities are to be fully exhausted before reuse, treatment or disposal techniques are approved.

Priorities for implementing source reduction measures are to be established by ranking the processes and sources which generate non-product outputs. An implementation schedule is to be developed which becomes an enforceable permit condition. Discharge/emission limits must also comply with existing single-media regulations. The objective of the permit limits will be to reflect the implementation of source reduction options and elimination of cross-media transfers to the extent practical.

New Jersey's program is currently in a pilot stage where three volunteer industries are working in conjunction with the Department of Environmental Protection.

Massachusetts

In 1989, Massachusetts adopted the Toxics Use Reduction Act (TURA). Like New Jersey, the purpose of this Act is to reduce the generation of toxic waste by 50% by 1997. The Massachusetts law seeks to achieve this goal by reducing, avoiding or eliminating toxic substances without shifting the associated risks between workers, consumers or parts of the environment. Cross-media cumulative impacts are specifically forbidden by this legislation.

TURA has set guidelines for achieving these goals through cross-media coordination, inspections and pollution prevention initiatives. Section 3, (C) authorizes the Department of Environmental Protection to seek unified reporting and enforcement authority from EPA on federal toxic laws and regulations. Paragraph (D) says:

> the department shall develop and implement, by January 1, 1992, guidelines and regulations on inspections which (1) ensure that, where appropriate, inspections are multi-media in approach; (2) ensure that, where appropriate, the inspections are preformed by teams of inspectors representing existing programs within the department; and (3) minimize duplication of inspection and enforcement efforts being conducted with other agencies.

Paragraph (E) requires any toxic user found to be violating any toxic standard to adopt pollution prevention techniques to come into compliance.

A precursor to TURA was the Blackstone Project which was proposed in 1987 and got underway in 1988. A joint-pilot project involving the Department of Environmental Protection and the Department of Environmental Management, its goals are to improve environmental protection through a combination of multi-media compliance inspections and enforcement rooted in waste prevention and expanded technical assistance. Having been underway for at least a couple of years, this project is able to report some preliminary results.
Findings to date from the project include:

1. Multi-media inspections have been found to be faster and more cost efficient for the same quality inspection than traditional single media inspections.

2. These inspections aappear to be more effective than traditional methods for detecting illegal or unregistered waste streams.

3. It was felt that technical advice and assistance for all regulatory programs was more effectively disseminated through the multi-media approach.

4. Source reduction opportunities become more easily identified.

5. Cross-media professional staff development was enhanced and staff time was used more efficiently.

Because of these successful experiences and the new TURA law, Massachusetts is expanding the program from one region to the whole state and from one type of industry to many. One could speculate that while the current emphasis is on inspections and compliance, this multi-agency approach could also spread to the full range of permitting activities. EPA is interested in encouraging such efforts.

Basin-wide Repermitting

Single-media point source discharge permitting takes place originally on a project-by-project basis. In contrast, if all projects in an affected area were assessed together, better information about total systemic loads and accumulating effects could become available. North Carolina and Michigan use a basin-wide approach for permit renewals in their NPDES programs hoping to achieve this bigger picture. In the land use area, Petaluma, California has been cited for its once a year development approval process motivated in part by similar considerations. Besides improving assessment of cumulative impacts, it is also hoped that such approaches will help increase efficient use of resources and staff time.

Michigan

Michigan's Surface Water Quality Division of the Department of Natural Resources has developed a schedule for NPDES permit renewal that is tied to river basin watersheds. The schedule is repeated every five years. This system was developed to 1.) provide a uniform statewide total annual rate of permits being processed; 2.) provide a relatively uniform annual rate of permits being processed by each district; 3.) group permits being processed by hydrologic basin.

The basin-wide approach established a predictable schedule for permit issuance. This pre-determined schedule is known to applicants, the public and staff far enough in advance to allow timely and systematic studies of watersheds so that current data will be available when needed. This schedule also provides a method of considering clusters of dischargers so that all facilities which are allocated portions of the assimilative capacity of the same receiving water segments can be evaluated simultaneously.

Since this procedure was instituted, studies to support cumulative impact assessment have been tied to the five year schedule. Stream monitoring surveys are conducted two years before a basin's permits expire. Pretreatment facilities are audited one year before permits expire. As a result, needed monitoring information is available at the time applications come in for renewal. State officials report that through this coordinated approach to permit review, critical areas can be identified and whole basin planning is advanced.

North Carolina

North Carolina has also developed a Whole Basin Approach to Water Quality Management and EPA has designated it a model program. The first phase of its implementation, which has already begun, is the rescheduling of NPDES permitting activities and associated routine support activities (field sampling, modeling, wasteload allocation calculations, etc.) to renew simultaneously on a basin-by-basin schedule. Eventually, it is intended that the North Carolina program will integrate and coordinate all activities in the Water Quality Program by river basin - not just renewals. Included will be permitting, monitoring, modeling, non-point source assessment and planning. Through simultaneous water quality and aquatic resource assessment, the state hopes that basin-wide water quality management plans and strategies can be substantially advanced.

There are three major benefits North Carolina hopes to achieve through this approach: 1.) improved efficiency; 2.) increased effectiveness; 3.) greater consistency and equity. They report that:

> By reducing the area of the state covered each year, monitoring, modeling and permitting efforts can be focused; as a result, more can be achieved for a given level of funding and resource allocation. The whole basin approach is consistent with basic ecological principles of watershed management, leading to more effective water quality assessment and management. Linkages between aquatic and terrestrial systems are addressed (e.g. contributions from nonpoint sources) and all inputs to aquatic systems, and potential

> interactive effects, are considered. Whole basin management will facilitate the incorporation of nonpoint source pollution assessment and controls, since these diffuse pollutant sources extend to the watershed boundaries and accumulate from a basin's headwaters to its mouth. The whole basin plans will provide a focus for management decisions. By clearly defining the program's long-term goals and approaches, these plans will encourage consistent decision-making. Consistency, together with greater attention to long-range planning, in turn will promote a more equitable distribution of assimilative capacity, explicitly addressing the trade-offs among pollutant sources (point and nonpoint) and allowances for future growth. (Creager, et al. p.iii)

Coordinated Pre-Permit Review

Illinois has developed an informal program that coordinates the permitting activities of the various media for major projects. The stated purposes of the procedure are to reduce the burden of permit requirements on the applicant and to improve Illinois' Environmental Protection Agency's review of the environmental impacts of the project. A coordinated permit review committee made up of section heads from the divisions of water pollution, air pollution, land pollution and water supply meets twice a month to administer this process. According to the chairman of the committee, one of the most lasting benefits of the process is improved communication between agencies and increased coordination of their actions.

The review is a five step process that begins with an informal presentation of the applicant's plans. Actions that require permitting and cross-media interaction are identified from this presentation. Based on the presentation, agency representatives decide whether the applicant will need a permit from their division. A project leader is selected from the agency that carries the greatest permitting burden. This gives the applicant a single point of contact for all subsequent permitting activities.

Concurrent review and coordinated issuance of all permits is a major component of this procedure. This concurrency reportedly reduces potential political pressure on a single agency which might result when other agency permits are issued earlier.

The coordinated permit review process has been developed by the Illinois' Environmental Protection Agency as an internal procedure. Since all the regulatory divisions are part of the same agency and under one director, it was determined that the procedure could be adopted internally, rather than as a promulgated regulation. Such a regulation was once proposed but was dropped when it was felt to be unnecessary.

ORGANIZATIONAL STRUCTURE

Organizational structure can play a significant role in how a state's environmental programs address cumulative impacts, especially cross-media impacts. An effective organizational structure which facilitates communication, coordination or joint action can assist in coordinating permit reviews and improving consideration of trans-media effects. Good coordination also improves consistency in permit decisions. In addition, organizational structure can promote more efficient use of departmental resources and make funds more available for technical support and other important functions. An improved sense of overall mission and teamwork can boost staff morale.

Having cited these factors, it should also be noted that there is no single organizational structure that is universally better than any other. Neither is organizational structure the panacea for all environmental problems. As Mark Mahoney, author of an organizational evaluation study commissioned by North Carolina, states, good organizational structure is "necessary, but not sufficient." (North Carolina Governor's Task Force, 1988, p. 2) Nevertheless, many states have found the structure of their environmental programs so important that they have initiated costly restructuring programs, even during economically tight times. North Carolina and Pennsylvania are two such states. The reports which they prepared in studying alternative organizational structures serve as the primary sources of our findings and extend similar earlier research by authors such as Haskell and Price (1973). Between the Pennsylvania and North Carolina reports, they surveyed seventeen states examining the advantages and disadvantages of various types of organizational structures.

These studies characterize state environmental programs as reflecting one of four models of organizational structure: what they term the unconsolidated model, the health department model, the EPA model and the superagency model. Unconsolidated programs are those where each agency is substantially independent. The Health Department model places several, but not all, of the primary permitting departments (air, water, land, groundwater or hazardous waste) in one location, traditionally the Department of Health. The EPA model goes a step further and places all of the primary permitting departments in one agency. The superagency model has all the primary permitting agencies under one roof but also includes at least one natural resource or development program. Virginia comes closest to the unconsolidated prototype though several agencies are

grouped under the Secretary of Natural Resources. The Secretary's office, however, is not staffed or organized to play a major role in permitting activities and agencies are generally left alone to manage the resource assigned them. The Secretariat was established fairly recently, it should be noted, and it may be that as the office evolves that a greater role in coordination will evolve.

Unconsolidated Program Model

Unconsolidated programs are not without their advantages but they also possess several disadvantages compared to other organizational patterns when it comes to addressing cumulative impacts. The primary advantages are the clear assignment of responsibility and the direct access to inhouse technical expertise. From an applicant's point of view or the public seeking information, having separate agencies simplifies communication as long as only one permit is involved. The fact that a state already has an unconsolidated structure and that it is familiar and understood is also an advantage compared to change. Many people working in such settings feel that any disadvantages of the unconsolidated format can be overcome by coordination and cooperation.

Mahoney identifies a number of generic problems which arise from unconsolidated environmental programs. Their largest hindrance to addressing cumulative impacts would be their divided approach to regulatory activities. One agency may deny a permit while another approves one for the same project, thereby encouraging the operator to increase the amount of pollution in the approved media and to decrease it from the denied media. There is also potential duplication and inefficiency. There is a tendency when programs are disjointed and detached for some activities to be performed by more than one agency. This wastes valuable resources which could be devoted to more comprehensive assessment. (North Carolina Governor's Task Force, p. 5)

Also, in programs with little coordination, there is a tendency for agencies to avoid taking responsibility for controversial projects. The end result can be a lot of finger-pointing while an important project escapes thorough overall examination. This stems from unclear responsibilities and a lack of full accountability when multiple permits are involved.

No states have reorganized into the unconsolidated structure but several have changed from the unconsolidated pattern to one of the other forms according to those sources.

Health Department Model

Environmental regulations began coming into existence in the 1960's and because the main impetus at that time was human health, units charged with environmental regulatory responsibility were generally placed in state departments of health. Primary concerns were drinking water and other areas where humans came into direct contact with the environment.

The health department model can be seen as suffering from many of the same disadvantages as the unconsolidated program model according to these authors. Within the overall health department the environmental agencies can still be disjointed and other important environmental agencies are still outside the health department. Health Departments also tend to be one of the largest departments in the state, so environmental programs compete with and can be overshadowed by other health programs.

EPA Model

The EPA model calls for a single agency housing all the major environmental regulatory programs. Consolidating the environmental regulatory activities theoretically facilitates coordinating permits by reducing the separation between agencies. The economies of scale for administrative services also increase when all regulatory programs are housed and coordinated under one roof. (Pennsylvania Department of Environmental Resources: 1990, p. 3) It also creates a single focal point for all environmental regulation so there is no question of what agency should address controversial projects. There may still be some confusion as to which office within the department will handle the project, but the EPA model allows disputes to be settled by a person close to the issue, the agency head or a secretary. By contrast, in most states with unconsolidated or health department models, the governor or the courts would have to be the ultimate decision maker.

The disadvantages of the EPA model, besides the loss of technical support functions for each sub-unit, include the negative perception the

department could develop with respect to economic progress and beneficial impacts. If the department's activities only include regulation, then the agency may become viewed as an impediment to economic progress and find its influence counter- balanced by others in the administration. (North Carolina Governor's Task Force, p. 8)

Superagency Model

The superagency model diversifies the goals of the environmental department, but also dilutes them. Departments with natural resource and development functions could be viewed as having conflicting goals between development, regulatory, and management functions. Such was seen as the case in Virginia prior to the creation of the separate environmental and economic development secretariats. On the other hand, this more inclusive approach is more comprehensive and acknowledges the close proximity of natural resource management, development and environmental regulation. These advantages can assist in managing cumulative impacts. Often flora and fauna are initial indicators of disturbances in the ecosystem, so a close link between natural resources and regulation can also help minimize impacts. A larger organization could mean larger budgets and larger projects. On the other hand, a larger organization could also bring on greater bureaucratization. (North Carolina Governor's Task Force, p. 9)

Moving toward the superagency or EPA models is what most states which have modified their organizational pattern have done. Both Pennsylvania and North Carolina have done so recently.

Other Structural Patterns

Due to the orientation of federal environmental legislation, most environmental programs are structured according to media -- air, water, waste, etc. Each agency performs all the necessary functions to carry out its regulatory mission (modeling, field operations, monitoring, permitting, enforcement, etc.). While this may be effective in regulating the intended media, this type of management structure can be criticized as providing poor coordination between media and resulting in duplication of services. (North Carolina Governor's Task Force, p.12)

One option, which has been investigated by several states is to organize around functional lines. This would mean the creation of

modeling departments, monitoring departments, and so forth. It is possible to have enforcement personnel grouped together in the Attorney General's office, but other functions are not typically grouped in this way. A functional management structure has the advantage of encouraging personnel to take a more comprehensive view of their activity, instead of concentrating on just one medium and ignoring the others. This could serve to further consideration of trans-media effects and make for more consistent results across media lines.

Until 1973, Ohio was organized by function, but it was found to have a number of disadvantages including the experience that it was difficult for the public to identify who to go to when there was a problem. Functional structure also presents difficulties in implementing regulations. For instance, once a problem was identified by the field operations group, it would have to cross departmental lines to the permitting group thus resulting in delays and increased permit review time. Functional organization appears to be an interesting idea but one which does not lend itself as an overall model for organizing environmental protection efforts. Its utility may be in selected functions.

The alternative could be to create some hybrid between media and functional organization where some activities are organized along media lines and others are grouped by function. Iowa, for instance, has its field inspectors examine pollution control devices for all media instead of having different inspectors for each medium as many states do. This would not only help in identifying cumulative impacts, but it is reported to have increased job satisfaction for the inspectors as well. (Pennsylvania Department of Environmental Resources, p. 6)

New York has initiated a similar program in their regulatory affairs department. Permit coordinators serve as single contact points for all types of permits which an applicant may require. The permit coordinators monitor the permits as they progress through the media-specific review. Media-specific personnel are responsible for performing all of the technical analysis related to the individual permits, but the regulatory affairs department has the final approval authority on all the permits.

Within a given organizational structure, program activities can be centralized in a headquarters office, decentralized to field offices, or set up according to a matrix organization. Most environmental programs are centralized and controlled from a headquarters office. This has some advantages with respect to cumulative impacts in that a centralized agency may be more able to review all activities in the state and

coordinate them and maintain consistency. This works especially well in small states where the number of activities is limited. For example, Delaware has only a few field offices and these report directly to the central office.

Decentralized programs allow regional or field offices more autonomy and enable more detailed study of activities within the region. At the same time, that they may sacrifice some of the state-wide coordination of a centralized program, decentralization can be more convenient for clients and the public. Because they are smaller, field offices may be less bureaucratic. The Virginia Water Control Board and the Health Department are examples of agencies assigning important permitting roles to field offices.

Some states employ a matrix organization where regional offices have their own management, but individual media personnel also report back to the central office. This approach utilized the advantages of both centralized and decentralized structures, but is susceptible to conflicting directives. It can be very confusing for program staff when regional managers and central office personnel want two different things. New York and Michigan use this arrangement with their field offices. New York's program seems to work well, but Michigan's regional managers complain of not having control over the staff. (Pennsylvania Department of Environmental Resources, p. 4) In Virginia these conflicts are sometimes apparent in the split loyalties of Health Department sanitarians who are simultaneously in the employ of state and local government and under the supervision of a regional health official.

Other Organizational Tools

Strategic Planning for the Environment

Pennsylvania surveyed other states and concluded that it lagged behind in implementing a strategic planning process for defining its environmental priorities and for communicating these priorities to staff and the general public. Georgia, Iowa and Wisconsin are cited as states which have developed, published and distributed strategic plans.

> Georgia's Five-Year Strategy is developed at the executive level, with the section/work units asked to submit suggestions. Georgia's Five-Year Strategy lays out the agency's vision for the future, the specific goals for the various program areas, and highlights of last year's accomplishments. Iowa's Future Agenda is developed "Top Down," establishing flexible priorities which are

> modified on a yearly basis. Iowa's Future Agenda is formally approved by its oversight Commissions. Wisconsin's Environmental Quality 2000 strategic plan is developed by each division (equivalent to DER's Deputates). These strategic plans include a mission statement for each division, several major objectives, the goals required to meet these objectives, a summary of previous accomplishments, and future trends that influence this plan." (Pennsylvania Department of Environmental Resources, p. 8)

Having such a strategic plan could provide a common framework for environmental agencies to follow regardless of how they were organized. The process of creating such a plan could bring agencies together for fruitful discussion about cumulative impacts on the environment. In a state with a loose structure of the type found in Virginia, the Secretary of Natural Resources could utilize a strategic planning process to achieve greater unity of purpose and to identify functional impediments to cumulative impact consideration.

Consolidated Field Offices

In states with unconsolidated organizational patterns, field offices tend to be separate for each department and the regions they serve are defined in different ways. New York, Vermont and Wisconsin exemplify a pattern of combined field offices.

Michigan has three consolidated regional offices containing all functions plus fourteen consolidated district offices containing the functions relevant to each district. In Vermont, the majority of environmental protection functions share combined facilities. Wisconsin has six large all-purpose regional facilities and smaller district offices in each county.

According to the Pennsylvania study, consolidated offices offer several advantages:

> This structure offers the general public a local point of contact for any environmental problem. The general public doesn't have to understand the department's complex structure to get a simple question answered. Also, by having staff together in one place, communication and coordination of environmental issues are enhanced (p. 11).

For purposes of cumulative impact assessment and management across agency and media/resource lines, shared facilities not only offer potential economies of scale but a potential synergy in environmental permitting. Last year, the Virginia Legislature asked the Secretary of Natural Resources to report on the possibilities for the Water Control Board, the

Air Board and the Department of Waste Management to share data bases and other services and facilities. Consideration of consolidated offices might grow out of that study.

Training

Cumulative impact assessment and management involves breaking old habits and learning new approaches that are more inclusive and synthetic. Most agency training budgets are oriented linearly within the agency's own customary realm. Turf issues may be more common than common interests.

Organizational development, team building and problem-solving skills could be taught to personnel from a variety of agencies as a way of bridging between agency turfs and as a way of improving communications. Training to expand managers' scientific understandings outside their own area of traditional expertise could also assist in providing the base from which cumulative impacts could more adequately be assessed. Training could boost morale and productivity and make resources go further. A number of states have developed training priorities on a variety of topics. None that we contacted focused specifically on cumulative impacts but such an approach could be taken and a training program developed to meet this need.

TECHNICAL SUPPORT

In order to avoid potential charges of arbitrariness and either administrative or legal challenges to action based on a concern for cumulative impacts, it is essential that these actions have the best available technical/ scientific backup. Adequate technical support is also needed to provide agency staff the confidence needed to take cumulative impacts into account to a greater degree.

Scientific methodologies for cumulative impact assessment are not the primary focus of the present study. Nevertheless it is important that several aspects of technical support be addressed - namely, establishing baseline data; and selecting assessment methodologies. A related technical issue, that of setting maximum carrying capacity limits and similar performance-based approaches was addressed earlier under planning and permitting approaches to cumulative impact assessment.

Baseline Data

Baseline data represent the current and historical condition of the environment necessary in order to determine if cumulative impacts have already affected the area or resource and what tolerance for additional impacts might remain. Baseline data also defines the seasonal and annual variability in the resource in order to determine the nature and extent of impact problems under different conditions possibly involving high and low assimilative capacities. Baseline data is also essential for identifying trends and for comparing one location with another in order to establish relative health or stress. Data on a common geographic basis can point to actions which have already been permitted by all agencies and which could have combined effects in a particular location or area. Baseline data is thus fundamental in many ways.

It is not surprising, given the costs of data, to learn that except in a few special instances, comprehensive monitoring of environmental conditions leaves much room for improvement. This places environmental agencies in a difficult position when tight state budgets make it very difficult to initiate extensive monitoring programs to build the necessary baseline data. Monitoring and research studies are often among the first activities to be cut when funds are reduced. The good news, however, is that some states have, nonetheless, made the financial investment or have developed feasible methods to compile enough baseline data to begin addressing cumulative impacts even when faced with tight budgets.

The advent of geographical information systems (GIS) has increased the accessibility and versatility of natural resource data and promises to do so at reasonable costs to such an extent that some agencies are beginning to be able to justify the considerable amount of time and effort required to bring such systems on line. For instance, the U.S. Fish and Wildlife Service has begun using aerial photographs covering three decades to examine habitat changes in the Mississippi River Deltaic Plain. These aerial photographs are digitized into a GIS system and comparisons are run to determine land loss, erosion rates, changes in vegetation, water chemistry, water regimes, etc. From these, the Fish and Wildlife Service has been able to identify areas of cumulative impacts and how habitats have changed over time.

Maryland, through its Critical Areas Program, is in the process of mapping all land uses in the 1000-foot critical areas bordering the Chesapeake Bay and eventually will do so for entire counties. (Taylor,

1991) With this system, Maryland hopes to be better able to identify changes in land use and the causes of those changes.

As part of the Albemarle-Pamlico Study, North Carolina is not only mapping land uses, but water uses and water resources as well (Clark, 1991). A model program conducted for Carteret County is now also being applied to all the counties bordering the Albemarle and Pamlico Sounds. Data is being compiled regarding natural resources, navigation channels, marinas, and point source discharges into Bogue Sound. This information is run through a weighting program to create overlay maps showing water areas of high and low value. Performance standards will in the future be formulated for similar classes of water. This technique is seen as having the advantage of integrating land and water uses, thereby addressing trans-media effects.

Permits also offer historical information on changes to the environment. The Chesapeake Bay Foundation has recently initiated a project to track all Section 404 Dredge and Fill permits in order to monitor the loss of wetlands. (Robertson, 1991) A drawback of using permits to monitor changes is that small activities or other exempt activities do not require a permit, but may significantly contribute to cumulative impacts. For instance, in Virginia, alteration of less than ten acres of wetlands has not in the past required a permit and therefore will not be included in the study.

As innovative effort to develop baseline data using volunteers has been initiated in Northern Virginia. The Northern Virginia Soil and Water Conservation District has helped- start a grassroots citizen group which has accepted the responsibility of monitoring and planning in the Difficult Run Watershed. (Jeffries, 1991) As their motto suggests, "Volunteering is an action," the Difficult Run Project emphasizes active management. The watershed is broken down into fourteen subwatersheds, each with its own planning committee. Representatives from each subwatershed unit make up a steering committee to formulate water quality goals. In turn, each subwatershed until develops water quality standards to meet those goals. Then, using land use inventories supplied by the Soil Conservation Service, the steering committee develops a management plan for the watershed. The Izaak Walton League of America is training members to conduct biological monitoring and the group is currently looking for business sponsors to assist in physical/chemical monitoring. The group is also trying to establish a conflict resolution program to use when actions by developers or the government do not comply with the adopted management plan. The entire initiative emphasizes volunteer activism

and encourages government and professional agencies to stay in the background. The Alliance for Chesapeake Bay also is involved with citizens from Virginia in monitoring efforts. These approaches have intriguing possibilities in both weak and strong fiscal economies.

EPA has also reported using volunteer senior citizens and retired persons to carry out land use and industrial activity surveys in wellhead protection areas. Not only do these seniors provide free labor, they also have memories of past activities which are invaluable in uncovering many types of abandoned facilities.

Assessment Methodologies

In order to fully utilize available baseline data, various assessment methodologies can be used to interpret the data, to make forecasts, and to identify areas where cumulative impacts might be a problem. It appears from our brief study that many assessment models have been created over the past ten to fifteen years, usually in response to a particular problem or issue. These multiple methods are quite dissimilar as revealed in a study prepared for the U.S. Army Corps of Engineers which concluded that:

> There have been several extensive reviews of evaluation methods for assessing wetland values (U.S. Water Resources Council 1981), cumulative impacts (U.S. Army Institute for Water Resources 1981, Horak and others 1983), and environmental impact analysis (Hollick 1981, Nichols and Hyman 1982, Hobbs 1985). There has also been a study evaluating a particular CIA approach developed for the Corps (Contant and Ortolano 1985). None of the reviews explain the wide disparity among methods, nor do they form a basis for choosing one evaluation system or one model over another. As a result, different approaches are treated as equally valid, even though the procedures and models reflect substantially different theoretical premises and evaluation philosophies.
>
> Cumulative impact analysis is, by definition and by virtue of its purposes, a complex analytical task that requires many methods and models. . . (Horak, et al, p. 38)

This study conducted for the U.S. Fish and Wildlife Service, then meticulously evaluated 64 CIA methods before concluding that the Service really would be best advised to develop its own procedure. The evaluation was based on eight criteria. The ability of each of the 64 methods to take account of:

1. Emphasis on multiple project and actions
2. Consideration of off-site impacts and effects

3. Interaction and synergism among actions, impacts and effects
4. Ability to aggregate effects
5. Consideration of ecological functional aspects
6. Consideration of ecological structural aspects
7. Ability to predict, and
8. Adaptability

After evaluating the 64 methodologies against these criteria, the authors found that a broader view -- one that takes into account both ecological prediction and socio-economic trade-offs -- is needed.

> Many different approaches to CIA have been discussed. Each has its strengths and drawbacks. None is ideal, nor is a comprehensive, rational analytical system likely to be available in the near future, given the numerous gaps in our knowledge of ecosystem theory, economic forecasts, and environmental trends.
>
> The ideal CIA model must assess the interactions and feedback mechanisms between growth and environmental consequences, an assessment that stems both from the original purposes of NEPA and from sound public-choice theory. (Horak, et. al., p.54)

Their specification for more adequate methodologies in the future include the following components:

1. New concepts and perhaps alternative thinking processes (combination of reasoning and imagination) are needed if we are to answer questions of "significance," "overall effects," "transformation," and others.

2. Proposed methodologies should exhibit a synthesis of traditional causal techniques and more holistic, alternative ways of accommodating extended time horizon, synergism and new "calculus" for accounting for noncommensurables.

3. A good strategy at this point is to concentrate on case studies in order to illustrate current challenges, on-going practices and how pragmatic questions are answered in the field. In the context of realistic problems, it may be easier -- inductively -- to arrive at agreed upon procedures. Operational models need to be developed through interdisciplinary and interagency planning and funding. The cumulative issue is too large for one agency to efficiently and effectively manage.

4. It must be recognized that the search for cumulative impacts cannot really be a categorical process of explicit lists and measurable indicators. Instead it is an interactive process, requiring calibration mechanisms, feedback sensors, and a perspective of dynamic evolution. What is called for is an institutional process which legitimizes this evolution. The form of this structure is currently unclear but possibly an interagency vehicle could be used as an interim step. (Horak, et.al., p. 85)

The search for more adequate cumulative impacts methodologies is clearly not a simple linear or mechanistic task. It is part of a larger

process of comprehensive, future-oriented planning and a broader quest for accounting for a wide gamut of direct, indirect, secondary and aggregative effects of a multitude of interacting actions on our surrounding environment. If such a task is achievable at all, it is certainly not possible in the near future.

On this note of reality, we now turn to recommending options which the State of Virginia can consider as a way of advancing cumulative impact assessment and management in the Commonwealth.

VI. FINDINGS AND OPTIONS

Examining the ways that Virginia environmental agencies are managing cumulative impacts and looking for places where there are opportunities for improvements is a little like describing whether the glass of water is half empty or half full. Virginia's agencies are implementing a number of programs and permitting requirements-- from air quality to water quality to wetlands management--which are aimed at managing impacts on the natural environment and which work to minimize environmental degradation. In this sense the existing regulatory and management framework is managing cumulative impacts to a significant degree. Furthermore, there have been a number of initiatives in recent years - some of which were discussed above - which clearly have substantial potential for further minimizing cumulative impacts in the future. The provisions of the Chesapeake Bay Preservation Act, for example, represent one such program. We have found that Virginia agencies already have many of the basic tools and mechanisms for managing cumulative impacts.

However, we also conclude from our overall analysis that while cumulative impacts are not going unaddressed, there are significant opportunities for improvement in how Virginia's environmental management framework addresses cumulative impacts. While we have identified a variety of types of cumulative impacts, concern seems to be greatest over additive cumulative effects (e.g., "the nibbling phenomenon") and cross-media or trans-media impacts involving more than one agency. The difficulties in managing these types of cumulative impacts are numerous and not hard to understand. In large part these deficiencies can be attributed to the highly unconsolidated, agency-by-agency orientation of the environmental management system where states reflect the pattern set by federal legislation. It is important to reiterate that Virginia is not alone in this predicament, and our study has discovered few states that are addressing cumulative impacts in an effective fashion.

The reader is also reminded that assessing the actual extent and nature of environmental change that is due to cumulative impacts was not part of the scope of this study. Rather, the study proceeded on the basis that if a policy decision were made that Virginia should do more to manage cumulative impacts, what management approaches might be available, what advantages might they hold over current practice and might they be feasible in Virginia given our current management institutions.

The analysis of programs and initiatives, primarily in other states, does suggest that there are things which Virginia's agencies and departments should consider doing to strengthen their ability to manage cumulative impacts. Some of these changes are modest in scope and could be implemented within the existing framework. Others are more fundamental in nature, and longer in timeframe, and more detailed study may be appropriate before actions are taken.

OPTIONS FOR IMPROVING THE EXISTING FRAMEWORK

Improving Coordination and Interaction Between Regulatory Agencies

Our review of the state environmental management framework in Virginia suggests that its unconsolidated character may work against the consideration of cumulative impacts. Particularly with respect to cross-media cumulative impacts, the state should explore additional ways to coordinate and integrate the missions and permitting procedures of the different regulatory agencies, building on existing procedures for promoting coordination. Some states, such as Illinois, have instituted special project review procedures which allow a more efficient and comprehensive review of development proposals which may have multi-media impacts. The State of Virginia already has a version of such a procedure on the books, but it has never been utilized. Efforts should be made to explore how this existing authority/framework could be modified to provide a more effective integrated multi-permit review process. The Virginia Council on the Environment occupies a unique role in the state environmental management framework and would appear to be in the best position, at least in the short term, to coordinate and integrate such multi-media reviews. The office of the Secretary of Natural Resources might explore ways that the several agencies under that secretariat might function more in unison.

In the longer term the state may wish to consider a major agency reorganization which might promote better integration (see below). In the short term, however, a number of options are possible. An interagency permitting committee could be established to consider on a regular basis larger projects and permit requests that span more than one type of resource or issue or that are located in especially sensitive areas of the state.

Some type of institutional mechanism should also be explored for integrating the various plans and standards of different regulatory departments into a single and coherent environmental management program for Virginia. There presently exist a variety of different state agency plans and very little coordination or integration among them. There exists, or will soon exist, for example, a state floodplain management plan, state air quality plan, open space and recreation plan, biodiversity conservation plan, etc. The state should consider the preparation of a Strategic Plan for the Environment. The development of such a plan could be spearheaded and coordinated by the Secretariat of Natural Resources with the involvement and input of all of the other environmental agencies.

Expanding State Environmental Impact Review Requirements

Virginia environmental impact review requirements are currently quite limited in scope. The existing law does, however, represent a significant first step in the direction of more effective management of cumulative impacts and should be viewed as an important foundation upon which to build. We can see a number of ways that the existing law could be substantially strengthened.

Among other changes, the current law could be amended to specifically require the assessment and consideration of cumulative impacts. Models for such language are found in several of the states discussed above. Such language should mandate a specific finding with respect to cumulative impacts, as well as a discussion of the actions to be taken to minimize or mitigate these impacts. Incorporation of such language would have both practical and symbolic implications.

The state should also consider amending the law so that it applies to a larger set of state projects and actions. The recent memorandum of agreement expanding state environmental impact review to highway projects is a very positive step and efforts should be made to build on this foundation. Additional "memoranda of understanding" may be appropriate. Consideration should be given to expanding the environmental review requirements to apply to certain types of state permits (permits for activities of a certain size or magnitude) or permits for activities in particular regions of the state.

Consideration in the future should also be given to expanding the environmental review requirements to cover significant local land use

actions, including planning and zoning decisions, as well as other state plans, policies and regulations.

Incorporating Cumulative Impacts Language Into Existing Environmental Programs and Regulations

There is general agreement that lack of explicit statutory authority for Virginia agencies to consider cumulative impacts represents a significant legal obstacle. Virginia should consider following the lead of other states in adding cumulative impacts language to key permitting programs. Among those where such language would seem to be the most important: the wetlands program, VPDES, and the Air Board's PSD provisions.

While additional statutory language alone will not necessarily ensure that cumulative impacts are better managed, it should be helpful in several respects. Among other things, such explicit language will tend to elevate the importance of cumulative impacts in the permit review process and may substantially enhance the legal defensibility of decisions based on cumulative impacts.

Modifying Permitting Procedures to Promote Facility-wide, Cross-media Management

Our analysis suggests that there is substantial merit in establishing permit review procedures which consider the entire pollutant impact of a project or facility. Such a facility-wide, cross-media approach has been utilized effectively in other states and at least one such pilot project is underway in Virginia (the Amoco project described in Section IV). The advantages of such a permitting approach are substantial and include efficiencies in inspection and a greater ability to identify source-reduction opportunities.

Facility-wide, cross-media permitting approaches will require Virginia regulatory agencies to establish new inter-departmental procedures, utilizing interdisciplinary teams in the review and evaluation of polluting facilities. Such an approach will also require additional training for agency personnel. Such training should focus on cross-media thinking, cumulative impacts assessment and team building. The Interagency Multimedia Pollution Prevention Project recently initiated is a positive development and such efforts should be supported and further

expanded in the future. Permit review schedules could also be modified to better consider cumulative basin-wide effects.

Importance of Baseline Data and Enhanced Monitoring Capability

Any effective attempt to address the problem of cumulative impacts in Virginia will require a credible database and monitoring system from which to judge the conditions of the environment, its constituent parts, and changes over time to these resources. The state should be working in both the short term and long term to develop a comprehensive data base and monitoring system. At a minimum this data base should bring together smaller and more isolated baseline and trends data generated by each separate management agency. At a minimum this data base should contain information on: water quality of streams, rivers, groundwater, estuaries; condition of wildlife and habitat; air quality; tidal and non-tidal wetlands; conditions of farmlands and forestlands; and land use changes; among other information. Where possible this information should be incorporated into the statewide geographic information system. Together these baseline data should provide a comprehensive picture of the status and condition of Virginia's natural environment.

Data collection and monitoring systems will need to be established for certain resources and for certain geographical regions of the state before the real extent of the cumulative impacts problem can be assessed. Stream monitoring stations in the western part of the state, for example, which could provide important information on the incremental effects of sulphur dioxide and other pollutants are presently few in number. In this era of fiscal austerity other non-governmental ways of establishing monitoring systems might be productively explored, such as, for example, the volunteer initiative currently underway in the Northern Virginia Soil and Water Conservation District.

Each state environmental agency should identify baseline data and assessment models necessary for taking into account multiple projects and wider geographical areas of impact. Each agency should prioritize these technical needs and identify steps to be taken to address them.

Increasing Resources and Funding for Cumulative Impacts Analysis and Management

A consistent comment of individuals interviewed for this study was that state agencies did not have the level of resources and personnel necessary to effectively address cumulative impacts. The general perception is that state environmental agencies are underfunded and understaffed and existing personnel are heavily committed to dealing with day-to-day operations. Earmarking and setting aside additional resources specifically for cumulative impacts analysis and management in each agency could be very helpful. Perhaps one or more individuals in each agency or department could be assigned the responsibility of thinking about and bringing-up in programmatic discussions and in specific project reviews the issue of cumulative impacts. Such "cumulative impacts officers" might inject a certain broader more integrated cross-media perspective to the decisionmaking and mission of their respective agencies.

Additional resources will also be necessary to develop the capability in many cases to assess (e.g, through modelling, carrying capacity studies, etc.) the likely cumulative impacts of certain actions or activities. Developing this kind of technical assessment capability can be expensive, and will often depend in turn on adequate support for scientific research and monitoring activities as identified above. Each state agency or department should begin to assess its scientific and technical needs with respect to cumulative impacts analyses and management, and additional resources should be allocated accordingly.

Plugging Existing Loopholes

In reviewing the existing management and regulatory framework in Virginia it is apparent that the state does have a number of programs and permit requirements that are useful in managing and controlling cumulative impacts. However, for virtually any specific program there are usually a host of exemptions or grandfather clauses which reduce the actual degree of state control. Several mentioned earlier in this report include: exemptions for agricultural and silvicultural activities under the Bay Act and other environmental programs, withdrawal limitations for groundwater management areas, exemptions under stormwater management provisions, and so on.

One important element of a state strategy for enhancing cumulative impacts management may be to carefully examine the existing exemptions in these different regulatory programs and to eliminate or modify them, or phase them out, where they appear to be resulting in extensive cumulative impacts. A subsequent study should more thoroughly and comprehensively examine the range of exemptions and grandfather provisions and make specific recommendations about appropriate changes. This type of more detailed programmatic analysis is beyond the means of the current study.

In addition, as we have noted in our review of the existing regulatory framework there are some laws already on the books which could be extremely useful in managing cumulative impacts but have not yet been adequately utilized. One example is the state's expanded authority over surface water withdrawals. While a potentially effective tool for managing certain types of cumulative impacts, no implementing regulations have been issued and no surface water management areas have been designated.

In the course of reviewing the existing regulatory and management framework in Virginia we have also identified certain activities and resource lands currently not covered by state legislation. These include, for instance, activities affecting non-tidal wetlands (although, as has been noted, there are current control mechanisms through 401 certifications), and sensitive wildlife habitat areas, among others. An effective long term cumulative impacts strategy may require expanding the scope of environmental management to include these additional activities or habitats. This may be another appropriate subject for additional study.

OPTIONS FOR MODIFYING VIRGINIA'S FRAMEWORK

Reorganization and Consolidation of Environmental Management Functions

Our review of other states suggests that there has been widespread interest in and expression of need to establish new types of organizational arrangements. State organizational structures can be categorized as one of four types, with progressively greater levels of consolidation and integration: unconsolidated model, health department model, EPA model, and superagency model. Generally, the experience of other states suggests that there are many advantages to a more consolidated approach. These include certain economies of scale, better

communication and coordination in permit review, and greater effectiveness at dealing with trans-media environmental effects.

Virginia's system is perhaps closest to the unconsolidated model. Notwithstanding the advantages which may be found in the existing structure, more effective cumulative impacts management may require that serious consideration be given to reorganizing and restructuring the system so that regulatory and management functions are better integrated and consolidated.

Virginia should also explore other potential organizational changes which would facilitate more effective management of cumulative impacts. Among other organizational options, the state should consider: reorganizing at least some of its activities along functional lines (e.g., inspections); centralizing permit processing in headquarters offices; consolidating field offices across agencies; and instituting a long-term system of training for state environmental personnel which focuses on cross-media thinking, cumulative impacts assessment and team building.

Greater Emphasis on Basin-wide and Regional Approaches

Where possible Virginia regulatory agencies should attempt to take larger regional and basin-wide approaches. Examination of experiences in other states (e.g., North Carolina and Michigan) suggests that basin-wide approaches to permitting are particularly appropriate for water quality, for example, where the geographical level of analysis allows a better consideration of the cumulative effects on the hydrological system. Such a basin-wide approach facilitates the development of more unified and integrated plans for managing activities in a watershed--allowing the development of basin-wide strategies with a much greater chance of achieving desired results. Where possible, then, Virginia regulatory agencies should organize and coordinate their permitting systems on a basin-wide or regional level. Agencies should continue to look for ways to utilize natural carrying capacity and waste-load allocation concepts in their permitting systems, building on regional and basin-wide levels of analysis.

Taking a more regional approach to evaluating development and other proposals better also ensures that cross-jurisdictional impacts will be adequately considered. Regional permitting systems for facilities and other proposals of a certain size has worked well in Florida and elsewhere (e.g., Florida's Developments of Regional Impact program). While Virginia

has a history of reliance on local governments in the land use arena it does have a system of regional planning district commissions which could serve as the foundation for a more substantive review of larger development projects and proposals. In addition, in recent months several regional planning processes have been initiated in the state (e.g., the Thomas Jefferson Study to Preserve and Assess the Regional Environment and the Lower Rappahannock River Basin Project) and the state should make every every effort to encourage the development of these locally initiated regional planning approaches. The preparation of special area management plans, already mentioned, is another avenue for basin-wide and watershed-based planning.

Strengthening the System of Land Use Planning and Growth Management

Many of the cumulative impacts identified in this report are the direct result of patterns of land use and urban growth. Successful management and control of cumulative impacts in Virginia, then, may require a substantial strengthening of the existing system of land use planning and management. These initiatives may be directed at both state and local levels as well as the regional level as suggested above.

At the state level a plan for managing growth and development is now being called for by many groups. Such a plan would ideally involve consideration of the underlying carrying capacity of the state's natural systems and would identify appropriate statewide policies and programs for managing growth in order to sustain and protect these resources. Such statewide growth management plans have proven to be successful in many other states and would provide essential guidance for subsequent land use decisions at both state and local levels.

This statewide growth management plan should also identify the necessary elements of an effective implementation strategy, including possibly additional state agency authorities and institutions. For instance, if the state truly wishes to address the problem of gradual loss of habitat and natural areas it may need to embark on a major state land acquisition program (as many other states have done, including major land acquisition systems in Maryland and Florida, for example). Sources of funding that have been discussed include a land transfer tax.

Where appropriate, special area management plans should also be prepared for particular regions or sub-regions of the state, ideally

corresponding to the physical and biological boundaries of important state resource areas. Special area management plans have proven very useful in other states and have provided opportunities to craft unique regional management programs. A pilot effort could be started in Virginia in order to gain first hand experience with this approach.

Efforts may need to be undertaken in the long run to expand the land use and growth management capabilities of local governments. Presently, local governments in Virginia are constrained in the land use management tools and techniques they have available to them as a result of the Dillons rule. We are not in a position in this study to identify the specific tools and techniques needed to more effectively control cumulative land-based impacts, but subsequent analysis should examine this question. Transferable development rights, for instance, might be a very useful tool for managing cumulative impacts, but is not authorized for local use at the present time.

Integration between state, regional (special area management plans) and local growth management is essential. Each local plan should be required to be consistent with the state plan and any regional/special area management plans that may have been prepared. Regional or special area management plans should be required to be consistent with the state plan. A variety of mechanisms exist for achieving consistency and addressing the concerns of local governments over what can be perceived as a loss of control.

It should be noted that many of these issues are currently being considered by the Population and Growth Commission. The findings and recommendations of this study should be coordinated with, and where possible build upon, the forthcoming recommendations of the Growth Commission.

Greater Emphasis on Waste Reduction and Pollution Prevention

States as well as the federal government are beginning to look for ways to reduce the generation of wastes in the first place, and not rely as heavily on managing and regulating the flow and impacts of industrial and other waste. Experience suggests that source-reduction strategies may be much more cost-effective in the long term and more successful in ensuring that long term cumulative environmental and ecological impacts are minimized. Virginia should consider strategies that contain pollution reduction as an important component. The recent controversy over co-

generation plants in the western portion of the state suggests the benefits of developing strategies which reduce the need for polluting activities from the start. A state energy plan might be one way to identify and fund initiatives which reduce the need for polluting activities such as electric plants. This same principle of pollution avoidance applies equally to all environmental areas.

Implementing facility-wide, cross-media permitting procedures should help in identifying source reduction opportunities. The Interagency Multimedia Pollution Prevention Project recently initiated by the Department of Waste Management, is also a positive start, as is the pollution prevention policy statement recently approved by the Department of Waste Management and Air Pollution Control and the State Water Control Board.

Exploring Interstate Management Initiatives

Even if the state of Virginia were to assign cumulative impacts management its highest priority, because of the basic cross-boundary nature of air, water and other forms of pollution, such efforts could only be marginally effective. This is particularly evident, for example, in the area of air quality where large amounts of pollutants float in from other states to the west and south of Virginia. These realities suggest the continued need for a strong national system for managing environmental wastes and the need for Virginia to be actively involved in other productive interstate initiatives. For instance, the newly reauthorized federal Clean Air Act contains a potentially useful mechanism for creating interstate acid deposition commissions. Virginia should explore and participate in these potentially useful initiatives. The positive experience with multi-state cooperation through the Chesapeake Bay Agreements is another example of the benefits of these types of initiatives.

The interstate nature of many of Virginia's environmental problems also suggests the importance of considering the impacts of actions here that may affect others in other states. In time, and with greater sensitivity given to cumulative impacts nationally, we can expect agencies and political officials in other states to consider in turn the implications of their actions on Virginia.

Addressing Equity Issues in Allocating Limited Assimilative Capacity

Decisions based on greater concern about cumulative impacts will undoubtedly bump up against questions of fairness and how to equitably allocate the limited assimilative capacities of the finite natural environment. If there is greater reliance on the carrying capacity of the natural system (whether an airshed, groundwater aquifer, etc.) and determining thresholds beyond which further degradation will not be permitted, some inequity will be perceived by those communities, regions (or individual property owners) whose options are constrained as a result. If it is determined that standards require that no additional point source emissions can be tolerated will this mean that certain communities will not have opportunities to expand their economic bases? And if so, is this an equitable result, when compared with the history of allowing similar point sources in other similarly-situated communities?

Is a first-in-time, first-in-right standard the most equitable one, or ought the state to examine alternative arrangements for more equitably distributing the benefits and burdens of the state's limited environmental capacity. One possible approach might be to determine whether there are ways of "sharing the benefits" derived from the many actions which degrade a regional or state environmental resource, such as an airshed or estuary. Some types of tax-base sharing for these types of large facilities might be appropriate, for instance. An effort should be made in the future to identify and examine the potential range of policies or institutions available to address the equity question. Policy roundtables have been a useful mechanism in the past for identifying and resolving these types of equity issues. The state might consider convening a cumulative impacts roundtable which could help to define potential areas of consensus among stakeholder groups.

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VIII. TECHNICAL APPENDIX

This appendix contains selected items which were collected as part of conducting this study. They can be useful to the reader who wants to examine these primary sources for a fuller understanding of a particular program or law.

A copy of this Technical Appendix volume is on file at the Virginia Council on the Environment for reference use. Copies also have been placed in the libraries at the University of Virginia and the Virginia Institute of Marine Science.

The following items are included:

Item Number	Description
1	Virginia: Letter from Attorney Geneal's Office to Council on the Environment regarding coordinated permitting (March 25, 1977)
2	Virginia's Amoco - US EPA Pollution Prevention Project; Yorktown, Virginia (September 1990)
3	North Carolina: Coastal Area Management Act (CAMA) (1989)
4	Mississippi: Rules, Regulations, Guidelines and Procedures of the Mississippi Coastal Program, Chapter 8, Section II, Part E (1988)
5	Louisiana: State and Local Coastal Resource Management Act, Coastal Use Guidelines. Title 43, Part I, Chapter 7, Section 701 (1980).
6	Wisconsin: Department of Natural Resources Policy Statement on Wetlands Preservation, Protection, and Management (NR1.95), (1989).
7	Oregon: Administrative Rules for Oregon's Removal - Fill Permit Program. Fill Permit Policy 141-85-050 (1986).
8	Maryland: Non-tidal Wetlands Protection Act, Annotated Code of Maryland, Section 8-1201 (1990) and Code of Maryland Regulations 08.05.04.01 (1991).
9	North Carolina: Water Control Law, Section 143-215.1.
10	Massachusetts: Toxic Use Reduction Act (July 24, 1989)

11 Wisconsin: Environmental Analysis and Review Procedures (January 1987)

12 California: Guidelines for Implementation of the California Environmental Quality Act (1990)

13 Connecticut: Environmental Policy Act

14 Washington: Growth Strategies Act (March 11, 1991)

15 Michigan: Recommended Environmental Review Procedures (June 4, 1990)

16 Massachusetts: Environmental Policy Act Regulations: Areas of Critical Environmental Concern (December 21, 1990)

17 New York: Environmental Conservation Law (June 1, 1987)

18 New Jersey: Executive Order No. 215, Environmental Assessment (September 11, 1989)

19 Oregon: Statewide Planning Goals (1990)

20 Vermont: House Bill 295 (cumulative impact and master plan review) (1985)

21 North Carolina: Whole Basin Approach to Water Quality Management: Program Description (no date)

22 Oregon: Wetland Inventory and Wetland Conservation Plans (September 1989)

23 Maryland: Guide for Developing Non-tidal Wetlands Watershed Management Plans (January 2, 1991)

24 Colorado: Basinwide Phosphoros Management (July 1987)

25 Colorado: Application of Innovative Pollutant Trading for Reservoir Water Quality Management (no date)

26 New Jersey: Assembly Bill 988, Pollution Prevention Act (June 13, 1991)

27 New Jersey: Pre-Pilot Facility - Wide Permit Program (no date)

28 Massachusetts: Blackstone Project Executive Summary (July 23, 1990)

29 Michigan: Basin-wide Permitting (February 9, 1988)

30 Illinois: Procedures for Coordinated Permit Review (1979)