CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

LOCAL ASSISTANCE MANUAL

A guide for the development of local programs in order to comply with the Chesapeake Bay Preservation Act.

NOVEMBER 1989

PREFACE

The Chesapeake Bay Local Assistance Department has prepared this Local Assistance Manual for use by local governments in the development of local programs under the Chesapeake Bay Preservation Act.

The first installment of this Manual (Chapters I, II, and III) focuses upon methods and techniques for inventory, mapping, and designating Chesapeake Bay Preservation Areas for the protection of water quality in the Bay region. It is based upon the use of existing, readily available data resources.

Recognizing that the local jurisdictions under this program have different levels of available mapping resources and planning capabilities, the Manual provides basic guidance for beginning an analysis of sensitive lands and program development. For some local governments with highly advanced inventories and planning capabilities, this installment of the Manual may prove more useful as a discussion of regulatory intent than as an organizational guidebook.

This Manual is intended to be a dynamic document, responsive to the changing knowledge, techniques, and needs of local governments. It can and will be updated and supplemented over time. This work has been prepared as a tool for the end-users, local governments and the Chesapeake Bay Local Assistance Department invites suggestions for improving its utility.

Certain terms used throughout this document have desired and distinctive meanings. "Board" means the "Chesapeake Bay Local Assistance Board", "Department" means the "Chesapeake Bay Local Assistance Department", and "Criteria Regulations" or "Regulations" may be used interchangeably and refer to the "Chesapeake Bay Preservation Area Designation and Management Regulations."

TIDEWATER VIRGINIA

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INTRODUCTION

INTRODUCTION

The Virginia General Assembly has enacted a number of initiatives to protect and restore state waters, ranging from incentive programs to specific delegation of authority to local governments. The most significant of these is the Chesapeake Bay Preservation Act, which serves to greatly expand local police powers and provide a means of better utilizing state resources in that effort.

Title 15.1 of the Code of Virginia contains a number of delegated authorities to local governments. In Section 15.1-446.1, the General Assembly called for comprehensive plans to guide and accomplish "coordinated, adjusted and harmonious development" for the general welfare of the area's residents, including the designation of areas for conservation, floodplain and drainage, sewage disposal, and groundwater protection measures.

Section 15.1-466 also requires subdivision ordinances to provide regulations for drainage and flood control and the installation of sewerage.

Section 15.1-489, relating to zoning ordinances, is even more explicit, authorizing zoning ordinances to "include reasonable provisions ... to protect surface water and groundwater." The following section (15.1-490) provides further that conservation of natural resources shall be a consideration in the drawing and application of zoning ordinances and districts.

The Chesapeake Bay Preservation Act establishes a more specific relationship between water quality protection and local land use authority, stating in Section 10.1-2108: "[c]ounties, cities, and towns are authorized to exercise their police and zoning powers to protect the quality of state waters consistent with the provisions of this chapter." The Criteria Regulations adopted pursuant to the Act draw heavily upon the powers conferred to local governments and seek to build on the foundation of other state water quality protection initiatives.

Thus the General Assembly has encouraged local governments to make full use of the significant expansion of authority and responsibility conferred by the Act and Title 15.1. Water quality protection is to be more closely considered in land use decisions, policy, and ordinances.

CHAPTER I

LOCAL PROGRAM DEVELOPMENT

CHAPTER I

INTRODUCTION

The state-local cooperation envisioned by the Chesapeake Bay Preservation Act hinges on timely local implementation of the Criteria Regulations promulgated by the Chesapeake Bay Local Assistance Board. This chapter outlines the implementation schedule which takes into consideration the planning needs and abilities of Tidewater localities. The various tasks to be accomplished during the implementation period are explained. Taken together, the schedules and guidelines establish the framework for a cooperative state-local effort to protect the water quality of the Chesapeake Bay and its tributaries. While the Act and the Board's Regulations give much discretion to local governments, general adherence to these procedures will greatly strengthen the efficiency of program development and ensure compliance with the requirements of the Act and the Board's Regulations.

The guidelines presented in this chapter are intended to be of assistance to all counties, cities, and towns comprising "Tidewater Virginia" as defined in the Act. "Tidewater Virginia," by definition, includes 17 cities and 29 counties, many of which encompass independent towns possessing their own land use policies, plans, and ordinances. Unless included in the county programs, towns will be required to prepare local implementation programs independently. Thus, early in the designation process, town officials should contact the county administration to determine an appropriate process for designating and managing Preservation Areas within their jurisdictions.

PROGRAM OVERVIEW AND SCHEDULES

Section 10.1-2109 of the Chesapeake Bay Preservation Act allows localities one year after the adoption date of the Regulations (**September 20, 1989**) to designate Chesapeake Bay Preservation Areas within their jurisdictions. Localities are further required by the Act to "employ measures" necessary to implement the Board's performance criteria.

For many localities, one year may not be sufficient to fully incorporate the performance criteria into local plans and land use ordinances. These localities may, as an option, adopt the performance criteria as a separate ordinance, thus ensuring that performance criteria are "employed" within the one year period specified for designating Chesapeake Bay Preservation Areas. The second program year could then be devoted to further refining the performance criteria and revising plans and ordinances as necessary. By the end of the two years, every locality will develop and fully implement a local program which accomplishes the Act's specific objectives.

NOTE: In a forthcoming chapter of the local assistance manual, the Department will provide a model ordinance for employing the Board's performance criteria. The form of the ordinance will likely be a model overlay district which embodies the specific criteria of the Board's Regulations.

The Department will provide local governments with technical assistance during the implementation period. A Department staff member will serve as a liaison between the Department and each local government. The liaison will provide both office and field assistance with the designation and management phases of implementation. Local governments should plan to meet with their liaison as early in the implementation period as possible.

First Year Program

The First Year Program will accomplish the local designation of Chesapeake Bay Preservation Areas and the adoption of performance criteria to apply in these areas. In a general sense, this will involve data collection and analysis, consideration of alternatives, and implementation of the most suitable alternative. More specifically, this effort will involve inventorying sensitive land features of the shoreline and upland areas, determining the geographic extent of those features to be included as Preservation Areas (see Chapter II, Local Assistance Manual), and officially adopting the Preservation Area designations and accompanying performance criteria.

The schedule for local program development and review established by the Chesapeake Bay Local Assistance Board is designed to facilitate interaction between the Board, the Department, and local governments. The sequence of local submittals and Board review allows local governments assurance that they are proceeding in a satisfactory manner that complies with the intent of the Act and the Criteria Regulations. This process will also permit the assessment of more specific needs of individual localities and help prioritize assistance efforts in the first program years.

To allow for the maximum amount of time for the preparation of the local program,

In developing the Work Plan, the planning district staff should be consulted so that opportunities for sharing resources, achieving economies of scale, and enhancing regional cooperation can be identified. When the Work Plan itself has been prepared, it should be submitted to the planning district for comment. From a regional perspective, the planning district staff may be able to provide suggestions about mapping resources and allocations of resources that will be necessary to accomplish the First Year Program.

Following comment from the planning district staff, the completed Work Plan should be submitted to the Department for review. The Department will complete a review of the Work Plan within 30 days. If the local Work Plan appears consistent with the Act and the Regulations, the Department will schedule a conference to determine what assistance may be needed and can be supplied. If the Work Plan does not appear consistent, the Department will recommend specific changes. In such a case, the Work Plan should be revised and resubmitted to the Department.

The First Year Program Proposal

After the Work Plan has been completed, the actual designation process should be initiated. The recommended process for designating Chesapeake Bay Preservation Areas is summarized below:

- First, collect various data and mapping resources in order to create an inventory of environmental features.

- Next, analyze the data. Research and undertake field reconnaissance to fill in data gaps. After further analysis, determine the boundaries of Resource Protection Areas on a series of working maps.

- Similarly, determine the boundaries of Resource Management Areas using the guidelines presented in Chapter 3 of this manual.

- Finally, prepare a working map or map series delineating the proposed Chesapeake Bay Preservation Areas.

NOTE: Experience has shown that the formulation of a citizen advisory committee can be very useful in achieving early and meaningful public involvement in potentially controversial processes such as these.

Early in the development of the First Year Program, alternatives for implementing the performance criteria should be evaluated. Local governments have discretion in determining the appropriate mechanism by which to employ the performance criteria of the Regulations. Some local governments may opt to develop a separate ordinance within the local code that embodies the criteria and which is referenced in the local zoning and subdivision ordinances or other ordinances that address land use. The determination of the appropriate means to employ the performance criteria should be based on an evaluation of reasonable and available alternatives. More specifically, alternatives should be evaluated based upon: the "fit" of each alternative with the specific character of each locality's land use management program; the program effectiveness of each alternative; and the degree of administrative burden on staff resources.

SECOND YEAR PROGRAM

THE WORK PLAN

Like the First Year Program, the second year of implementation should be preceded by a Work Plan which describes the year's implementation activities and the assistance that will be required. The Work Plan for the Second Year Program should be submitted to the Department by **June 20, 1990.** As with the first work plan, the Second Year Work Plan should identify program elements, set tentative dates and estimate needs for technical and financial assistance. The program elements to be discussed in the Work Plan should include at least the following:

- Review of existing plans and ordinances;
- Consideration of alternatives for revising plans and ordinances;
- Drafting necessary plan and ordinance revisions;
- Preparation and submittal of a Second Year Program Proposal;
- Presentation of the Proposal at one or more local public hearings;
- Adoption of the Second Year Program Proposal.

The Department will review the Work Plan within 30 days after submission. The Department will review the Second Year Program Work Plan for consistency with the Act and schedule a conference to discuss local needs for technical and financial assistance.

THE SECOND YEAR PROGRAM PROPOSAL

After the formal designation of Chesapeake Bay Preservation Areas and the adoption of the performance criteria, the full implementation of the Act and the Board's Criteria Regulations should be undertaken. The process for developing a Second Year Program consistent with the Act and the Regulations is outlined below:

- First, review all existing plans and ordinances for consistency with the Regulations. Carefully examine specific regulations, guidelines, plans, and policies to determine whether there is functional equivalency with the Regulations. Identify areas where existing plans and ordinances do not incorporate provisions equivalent to the Regulations;
- Next, using the chapters of this manual and the technical assistance provided by the Department, develop alternatives for revising and amending plans and ordinances;
- Finally, determine the revisions and amendments which render plans and ordinances consistent with the Act.

Once the specific revisions and amendments have been determined, a Second Year Program Proposal should be prepared. The Proposal should contain the proposed revisions in an official form suitable for comprehensive plans and local ordinances as well as a written explanation of each proposed revision. The alternatives and the technical issues considered should be thoroughly discussed.

CHAPTER II

CHESAPEAKE BAY PRESERVATION AREAS

DEFINITIONS AND VALUES

INTRODUCTION

The purpose of this chapter is to assist local officials in the identification of the components of Chesapeake Bay Preservation Areas through an understanding of the role these features play in the protection of water quality. Dealing with the effects of nonpoint source pollution is especially challenging because the origins of these pollutants are so diverse that they cannot be easily measured or regulated. An understanding of natural processes enhances the ability of local officials to better address water quality problems and develop effective solutions.

The chapter is divided into two sections. The first section presents the components of Chesapeake Bay Preservation Areas and how these features are defined in the Criteria Regulations. The second section provides basic information about the natural processes that are important to water quality protection. It further describes the functional role the components of Chesapeake Bay Preservation Areas have in protecting the quality of the Bay and its tributaries.

CHESAPEAKE BAY PRESERVATION AREAS

Section 10.1-2109 of the Act requires each local government to designate Chesapeake Bay Preservation Areas encompassing those land features which, if improperly developed, would contribute to the significant degradation of the water quality of the Bay and its tributaries. Some land features within the shoreline environment, such as wetlands, serve an important and direct water quality function in their own right by removing excess sediment, nutrients and potentially harmful or toxic substances from the runoff entering the Bay and its tributaries. Other features, such as floodplains, have a great potential to degrade water quality if they are improperly disturbed or developed. Thus, in developing the Regulations the Board recognized the functional difference between two types of lands.

On the one hand, lands which have intrinsic water quality benefit will be designated Resource Protection Areas (RPAs). Those lands which have the potential of degrading water quality or diminishing the functional values of the Resource Protection Area, if not properly managed, are to be designated Resource Management Areas (RMAs).

All tidal wetlands, tidal shores and non-tidal wetlands hydrologically connected by surface flow and bordering on tidal wetlands or tributary streams, as well as a 100-foot buffer area landward of wetlands, shores and tributary streams must be designated as Resource Protection Areas. These lands perform important water quality protection functions by absorbing wind and wave energy, stabilizing soils, and filtering sediment and nutrients running off the land. The RPA constitutes the last barrier to the overland flow of runoff before it reaches surface waters. Because of their vital ecological importance, RPAs will be the most stringently regulated portion of Chesapeake Bay Preservation Areas.

Land features which should be considered for inclusion in the designation of Resource Management Areas include isolated non-tidal wetlands, floodplains, highly erodible soils and highly permeable soils. A Resource Management Area must be designated contiguous to the entire inland boundary of the Resource Protection Area. General performance criteria will apply in the RMA to ensure that land use and development will not impair water quality.

The lands to be considered for designating RMAs are not likely to be evenly distributed in each locality, nor will they necessarily have the same water quality impacts. It is for this reason that the RMA boundary should be based on an inventory of these features, as well as an analysis of their connection and proximity to the stream network and RPA features.

Inappropriate land use and development practices in the RMA may have an adverse impact on the water quality protection function of the RPA. It is therefore critical that the RMA encompass an area large enough to provide significant water quality protection through the employment of the performance criteria. Options for determining the geographic extent of the RMA are discussed in greater detail in the next chapter.

Resource Management Areas shall include land types that, if improperly used or developed, have a potential for causing significant water quality degradation or for diminishing the functional value of the Resource Protection Area. A Resource Management Area shall be provided contiguous to the entire inland boundary of the Resource Protection Area.

Floodplains

"...all lands that would be inundated by flood water as a result of a storm event of a 100-year return interval."

Highly Erodible Soils

"...soils (excluding vegetation) with an erodibility index (EI) from sheet and rill erosion equal to or greater than eight. The erodibility index for any soil is defined as the product of the formula RKLS/T, as defined by the "Food Security Act (F.S.A.) Manual" of August, 1988 in the "Field Office Technical Guide" of the U.S. Department of Agriculture Soil Conservation Service, where K is the soil susceptibility to water erosion in the surface layer; R is the rainfall and runoff; LS is the combined effects of slope, length and steepness; and T is the soil loss tolerance."

Highly Permeable Soils

"...soils with a given potential to transmit water through the soil profile. Highly permeable soils are identified as any soil having a permeability equal to or greater than six inches of water movement per hour in any part of the soil profile to a depth of 72 inches (permeability groups "rapid" and "very rapid") as found in the "National Soils Handbook" of July, 1983 in the "Field Office Technical Guide" of the U.S. Department of Agriculture Soil Conservation Service."

Nontidal wetlands

"...those wetlands other than tidal wetlands that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, as defined by the U.S. Environmental Protection Agency pursuant to Section 404 of the federal Clean Water Act, in 33 C.F.R. 328.3b dated November 13, 1986, as amended."

Other lands

"...such other lands...necessary to protect the quality of state waters."

tion, undrained hydric soils, and wetland hydrology—must be satisfied in order to classify an area as nontidal wetlands. Unfortunately, there has often been the mistaken conclusion that hydric soils alone constitute nontidal wetlands and that large expanses of such soils in certain Tidewater localities would mean that land development in these areas would effectively cease. Since the Regulations' definition is the same as that used by the U.S. Army Corps of Engineers, most of the wetlands included within Chesapeake Bay Preservation Areas are likely to be regulated by the federal government anyway.

Floodplains

The 100-year storm return interval is used to define floodplains in the Regulations since this is the return interval used in the federal flood insurance program in which most local governments participate. Further, 100-year floodplain maps are relatively common as a result of that program. It should be noted that floodplains are land areas that are inundated by the overflow of streams and rivers, not drainage ditches. A regulatory floodplain is frequently defined by state and local regulations to include all land within reach of a 100-year flood, that is, a flood with a one percent probability of occurring in any given year.

Highly Erodible Soils

The Regulations define highly erodible soils by the incorporation of a formula that accounts for most of the characteristics that actually result in excessive soil erosion including, the effects of the interaction of rainfall, the erodibility factor, slope gradient, and slope length. This formula is familiar to soil scientists and soil conservationists. Using this definition will also permit areas of highly erodible soils to be easily mapped from digital soil data. Also important is the fact that the definition is consistent with the definition used in Virginia to identify highly erodible agricultural soils for determining compliance with requirements of the 1985 federal Food Security Act (Farm Bill).

Highly Permeable Soils

The definition of highly permeable soils is based upon recommendations by the U.S. Department of Agriculture - Soil Conservation Service and is consistent with SCS's classification system. Again, the use of this definition will allow highly permeable soils to be easily mapped from digital soil data.

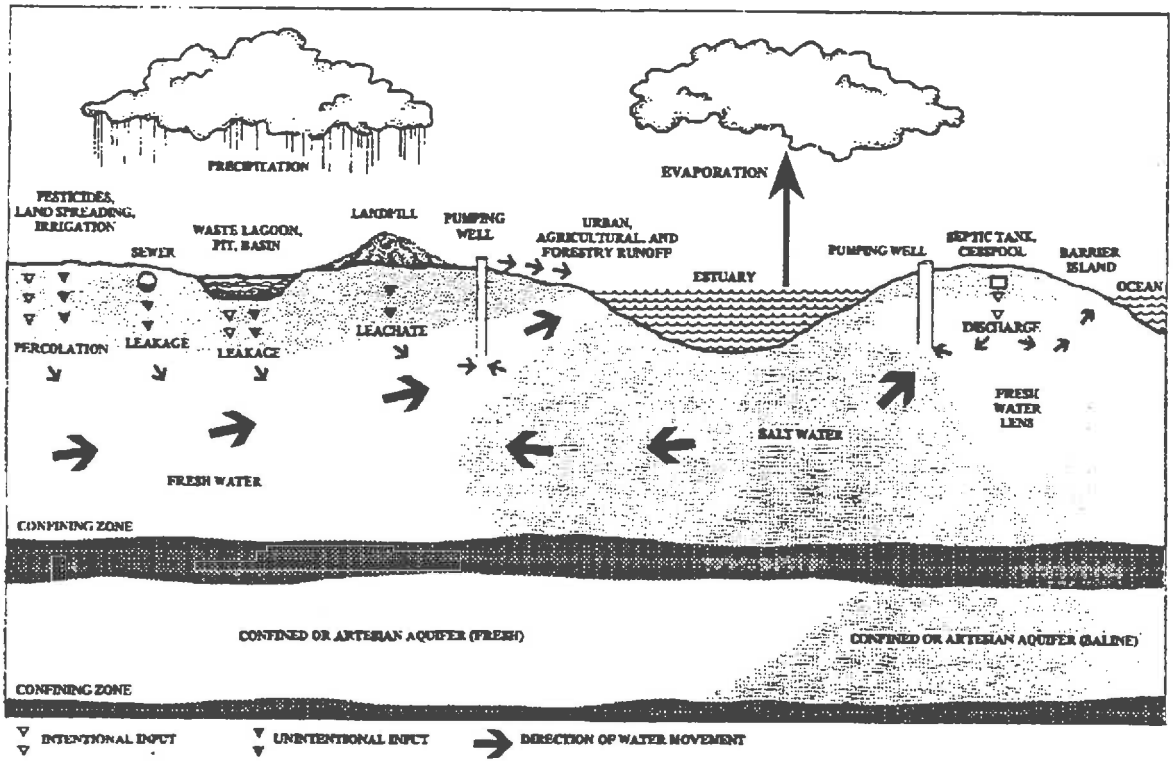
The SCS estimates that this definition (six inches per hour) describes approximately 30 percent of coastal plain soils, whereas, the next lower mapping break-point – moderately rapid (two inches per hour) – describes approximately 75-80 percent of the land in Tidewater Virginia.

Resource Protection Areas perform natural pollution control functions. Biological activities in these areas are specially adapted for controlling runoff, trapping sediment, and recycling nutrients and pollutants. By virtue of their proximity to water courses, Resource Protection Areas provide the last line of defense before pollutants enter the Bay and its tributaries.

The second class of lands, Resource Management Areas, are prone to amplifying the impacts of pollutants. Highly erodible soils, steep slopes, highly permeable areas, floodplains, and certain wetlands accelerate the process of pollutants reaching groundwater and surface water. Their characteristics cause them to have a greater potential for pollution as a result of improper development practices.

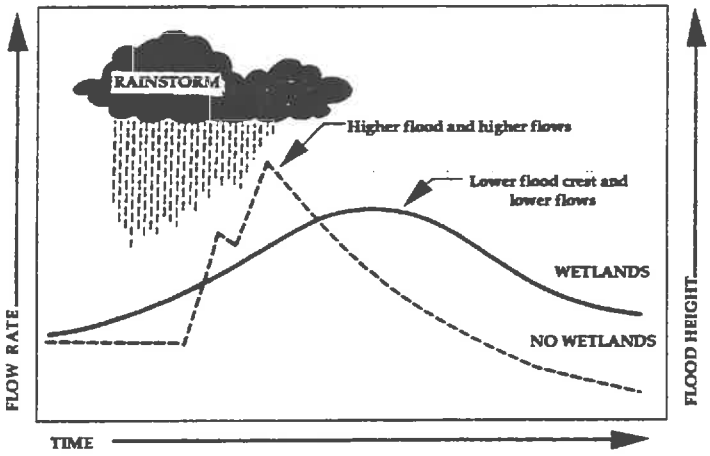
The types of lands which have been identified as Chesapeake Bay Preservation Areas are important features in the hydrologic cycle and, as such, have direct and substantial links to water quality. The Regulations have been designed to recognize this relationship as a means to achieving enhanced water quality in the Bay.

HYDROLOGIC CYCLE *FIGURE 2-1*



Source: Adapted from North Carolina Department of Natural Resources and Community Development, Division of Coastal Management, ***A Guide to Protecting Coastal Waters Through Local Planning***, 1986

FLOOD REDUCTION VALUE OF WETLANDS *FIGURE 2-3*



Wetland value in reducing flood crests and flow rates after rainstorms.

Source: Adapted from Burke, et al., ***Protecting Nontidal Wetlands***, 1988

WETLANDS' ROLE AS A SPONGE

Wetlands also act as a sponge by slowing down fast-moving erosive water, absorbing the energy of it for flood control and storm-damage protection, and acting as a buffer against coastal erosion from wave action. (See Figure 2-3.) Water is stored in the highly absorptive soils of wetlands, which serve as reservoirs from which groundwater can be replenished during dry seasons.[3]

SENSITIVITY TO POLLUTION

Wetlands are more sensitive than deeper water to pollution because the exposure of their larger relative surface area to wind movement and the sun's warmth speeds up the chemical processes taking place in the water. Development overloads and degrades the natural filtering system by accelerating the natural process of silting, often adding pollutants as well. Wetlands have a threshold of tolerance for what they can effectively assimilate; beyond that threshold, they will no longer have the same filtering and water-storing capacity. Wetlands cannot function as bottomless settling basins and must be protected from pollution and sediment flow in order to maintain their value. The ecology of wetlands is also disturbed by exaggerated high and low water levels caused by increased stormwater runoff and pumping for irrigation and water supplies.[4]

Wetlands are either tidal or nontidal depending on their proximity to tidal waters, such as bays and oceans. Tidal wetlands include marshes and salt ponds, and nontidal wetlands are generally inland areas such as forested swamps.

Tidal wetlands, which include vegetated marshes and nonvegetated sandflats or mudflats, are the most easily recognized of the wetlands in the coastal area. They are dominated by tidal action which regularly floods them. Typically, these wetlands are found along the coast but they may also be found along creeks and rivers which are influenced by tides although they are distant from the coast. Thus, tidal wetlands may be either salty or fresh depending on their proximity to the coast and the amount of freshwater entering them.[5]

Both vegetated marshes and non-vegetated mudflats protect the shoreline and adja-

Buffer Areas

Buffer areas

"...an area of natural or established vegetation managed to protect other components of a Resource Protection Area and state waters from significant degradation due to land disturbances."

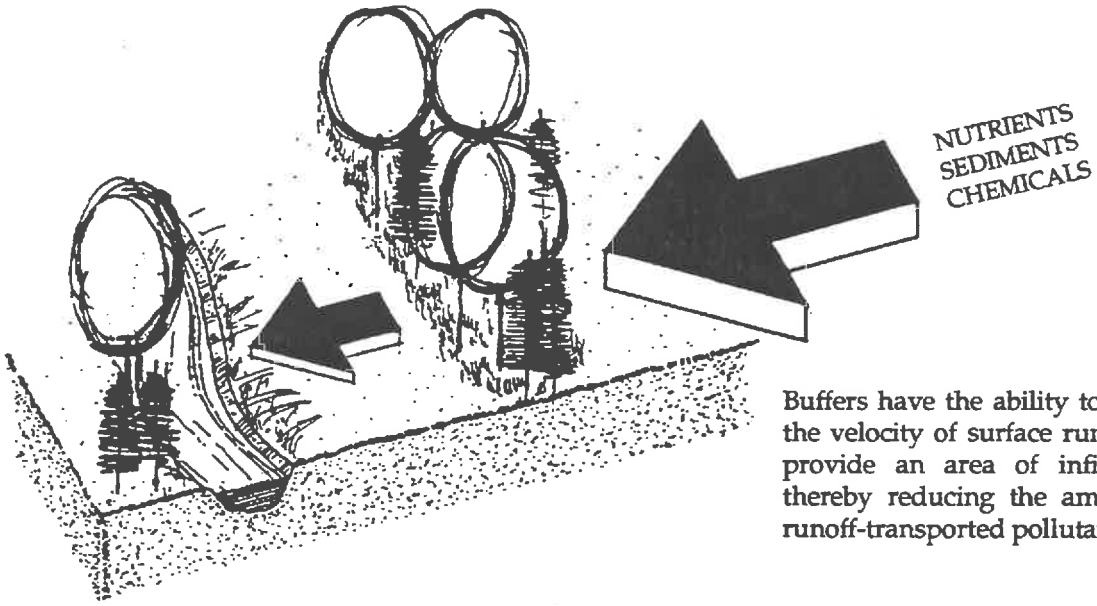
Recent developments in land use planning techniques have recognized the benefits that arise from the use of vegetative buffers in screening or separating incompatible land uses. Such buffers are most commonly associated with screening wind, noise or unsightly views, but buffers can be particularly effective as well, in filtering stormwater runoff from disturbed sites.

Buffer areas are zones of undeveloped, vegetated land that are managed to reduce the impact on water quality of land disturbing operations in adjacent areas. The buffer area can either be spatially arranged as a linear strip or as a free-form mass of vegetation, depending upon the desired use for which the buffer is intended. Similarly, buffer areas can be naturally existing zones of vegetation or planted zones of vegetation, depending upon the character of the site and the extent of site disturbance.

Vegetated buffer areas provide a wide variety of environmental, aesthetic, and recreational benefits. Benefits that can be derived from the implementation of buffer areas include the following:

- **Sediment control**
- **Nutrient assimilation**
- **Streambank stabilization**
- **In-stream temperature maintenance**
- **Outdoor recreation**
- **Flood control/protection**
- **Groundwater recharge area protection**
- **Aesthetics protection**
- **Runoff volume reduction**

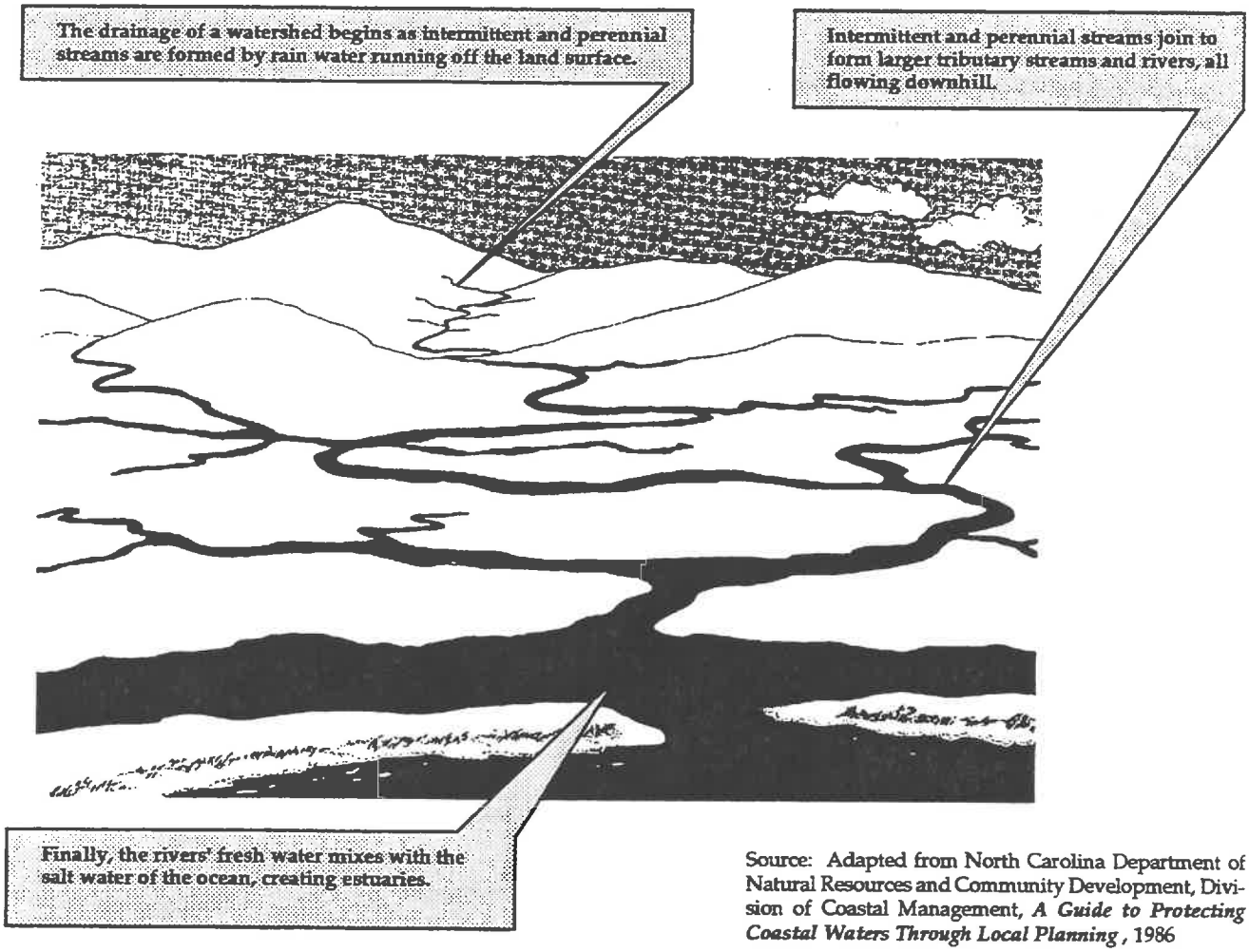
RUNOFF REDUCTION ASSOCIATED WITH BUFFER AREAS *FIGURE 2-4*



Buffers have the ability to reduce the velocity of surface runoff and provide an area of infiltration, thereby reducing the amount of runoff-transported pollutants.

WATER SYSTEM

FIGURE 2-5



Source: Adapted from North Carolina Department of Natural Resources and Community Development, Division of Coastal Management, ***A Guide to Protecting Coastal Waters Through Local Planning***, 1986

Other Lands

Other lands

"...such other lands...necessary to protect the quaity of state waters."

There are a number of other natural features that may have the potential to impact water quality if not afforded special protection and may be considered worthy of inclusion in RPA's.

These include:

- **Drainage swales and basins**
- **Reservoirs**
- **Intermittent streams**
- **Groundwater recharge areas**
- **Floodplains for storms less frequent than the 100 - year storm**
- **Canals under tidal influence**

Sensitive Soils

Highly Erodible Soils

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The information generally found in soil surveys can be broadly applied in the initial planning phase to indicate certain areas that may need special attention in relation to potential soil problems. This information can be used in determining: soil drainage properties; wetland potential; suitability for basements, foundations, roadways, septic systems, etc; flood hazard potential; suitability for specific crops and vegetation along with probable yields that may be expected; and soil erosion potential. Such information, along with other factors such as percent of slope, length of slope, infiltration rate, and the depth to groundwater, can identify the potential for the soil itself to become a pollutant to surface waters, as well as its potential to transmit pollutants through the soil into groundwater.

The proper application of soil information is especially important in planning in order to ensure that the use or development of land does not add to the pollution of water resources. The significance of this information becomes more apparent in view of the fact that different uses or activities on the land generate vastly different sediment loads.

In addition, it is important to understand that other pollutants generated from human-induced activities, such as phosphorous, adsorb or attach themselves to sediment particles and are transported into water resources through overland runoff and subsurface leaching.

Soil erosion is the process by which the land surface is worn away by the action of water, wind, ice, and gravity. Water generated erosion or runoff is unquestionably the most damaging problem, particularly in areas under development. The erosive action of water has both a vertical component, the energy developed by rain as it falls, and a horizontal component, the energy derived from its motion as it runs off the land. Both of these components are equally important when viewed in terms of water quality protection.

Infiltration

As rain strikes the surface of the soil, or as snow melts, a certain amount infiltrates or moves down through the soil, a certain amount runs off the land, and the remaining portion is absorbed by vegetation. The amount of water that infiltrates the soil varies de-

Vegetative cover plays an extremely important role in controlling erosion by shielding the soil surface from the impact of falling rain, holding soil particles in place, maintaining the soil's capacity to absorb water, slowing the velocity of runoff, and removing subsurface water between rainfalls through the process of evapotranspiration. Soil erosion can be significantly reduced through the careful control and phasing of the removal of existing vegetation, as well as by limiting the area and duration of raw soil exposure.

The topography of a drainage area--its size, shape and slope--exerts a great amount of influence on the volume and rate of runoff. As both slope length and gradient increase, the rate of runoff increases and the potential for erosion is magnified. Theoretically, a doubling of the rate or velocity of runoff enables water to move particles 64 times larger, allows it to carry 32 times more material in suspension and makes the erosive power four times greater.[15]

Slope orientation can also be a factor in determining erosion potential in relation to potential heat gain and associated soil heating. For example, a south-facing slope containing droughty soils may exhibit poor growing conditions that would inhibit the reestablishment of vegetative cover.

Climatic factors, including frequency, intensity and duration of rainfall, are fundamental factors in determining the volume of runoff produced in a given area. As both the volume and velocity of runoff increase, the capacity of runoff to detach and transport soil particles increases. Correspondingly, where storms are frequent, intense, or of long duration, erosion potential is high.

SEDIMENTATION/SILTATION

Sedimentation typically occurs following the time when runoff reaches its peak velocity. Excessive quantities of runoff generated by erosion during periods of high velocities are deposited downstream during periods of lower velocities, only to be picked up and carried further downstream by later peak flows. In this manner, sediments are progressively carried further downstream or downslope from their source or point of origin.

Sediments alter the existing aquatic environment by screening out sunlight, thereby changing the rate and amount of heat radiation within the water. Particles of finer silt that settle to the bottom of water bodies create an adverse environment for the organisms that inhabit such areas by essentially smothering the organisms and their eggs. Coarser-grained sediments also suppress bottom-dwelling aquatic life and, where currents are sufficiently strong, exhibit abrasive qualities that accelerate channel scour, thereby, exerting an even more damaging effect upon aquatic life.

The principle effect land development activites have on the soil erosion process consists of exposing disturbed soils to precipitation that leads to surface storm runoff and sedimentation. Uncontrolled erosion and sedimentation resulting from land disturbing activities often cause considerable economic damage to individual properties and society in general.

ally transports soil particles lower in the strata until they potentially end up in the groundwater system.

The end result of this leaching process is significant for two major reasons. Minerals and nutrients important for plant and microorganism growth can be removed from the upper soil horizons where they are needed for plant growth and become deposited in a lower part of the horizon where they are essentially unavailable for root uptake. Additionally, pollutants discussed in the previous section can adhere to the soil particles and be leached lower into the soil horizon until they reach an area of groundwater storage. These pollution-charged particles can then be transported through the groundwater system into other water systems adding further to the problem of water resource pollution. Generally, in areas where percolation and infiltration are high, the potential for leaching is also high.

[13] Ibid.

[14] Ibid.

[15] Nyle C. Brady, ***The Nature and Properties of Soils*** (New York, NY: MacMillan Publishing Company, 1974).

CHAPTER III

CHESAPEAKE BAY PRESERVATION AREAS

GUIDELINES FOR DELINEATION

CHAPTER III

INTRODUCTION

The purpose of this chapter is to assist local officials in the designation of Chesapeake Bay Preservation Areas, outlining appropriate methodologies for conducting environmental inventories, mapping natural features, analyzing resource relationships to local water quality, and delineating Chesapeake Bay Preservation Areas.

Each section provides technical guidance for determining the ecological and geographic extent of these areas. Graphics are provided to facilitate the use of existing mapping products and to illustrate possible spatial relationships of the Preservation Areas.

PREPARATION OF THE ENVIRONMENTAL INVENTORY

INTRODUCTION

The Criteria Regulations require an inventory of certain key features that must or may be components of Chesapeake Bay Preservation Areas. Local governments are provided discretion in the preparation of the inventory; the guidelines provided below are designed to assist local governments in their development of the environmental inventory in order to designate Preservation Areas within their jurisdictions. More and more communities are recognizing the importance of an inventory and analysis of natural and physical resources in order to make informed short and long term land use decisions. The inventory and analysis serves as a foundation for the preparation of a sound plan for the community and any measures for the plan's implementation.

An environmental inventory usually consists of information collected and presented in map form. A set of maps is prepared delineating the location of resources and problem areas. Maps are prepared for such basic natural conditions within a community as:

- Topography
- Soils
- Wildlife and Marine Life Resources
- Geologic Resources
  - Bedrock
  - Surface Material
- Hydrology
  - Drainage/Watersheds
  - Flood-prone Areas
  - Groundwater Characteristics
- Land Cover
  - Vegetative Types
  - Density of Cover

Generally, an analysis of the information collected for the inventory will identify natural and living resources in the community and help local officials and citizens in understanding their uniqueness. It will also indicate how these resources may constrain future development and, in turn, what impact development may have on their long term viability. The analysis will further delineate areas with features of special planning interest. Finally, the environmental inventory provides information critical to the community in its struggle to balance the value of anticipated growth and economic development with the value of natural features and environmental resources.

Environmental inventories are time-consuming and can be expensive, and may involve the expertise of specialists not normally associated with local government staffs. The Regulations, however, require all Tidewater local governments to prepare an environmental inventory **based on existing data and mapping resources.** This will establish, within every community, a baseline of information necessary to make informed land use decisions which protect water quality.

METHODOLOGY

By recording the inventory of the environmental features on base maps, these key environmental features can be assimilated into the overall planning process. There are two different methods of combining the base maps in the preparation of the environmental inventory. The "linear method" entails examining the various environmental features independently of one another in the initial analysis stage. The information is then

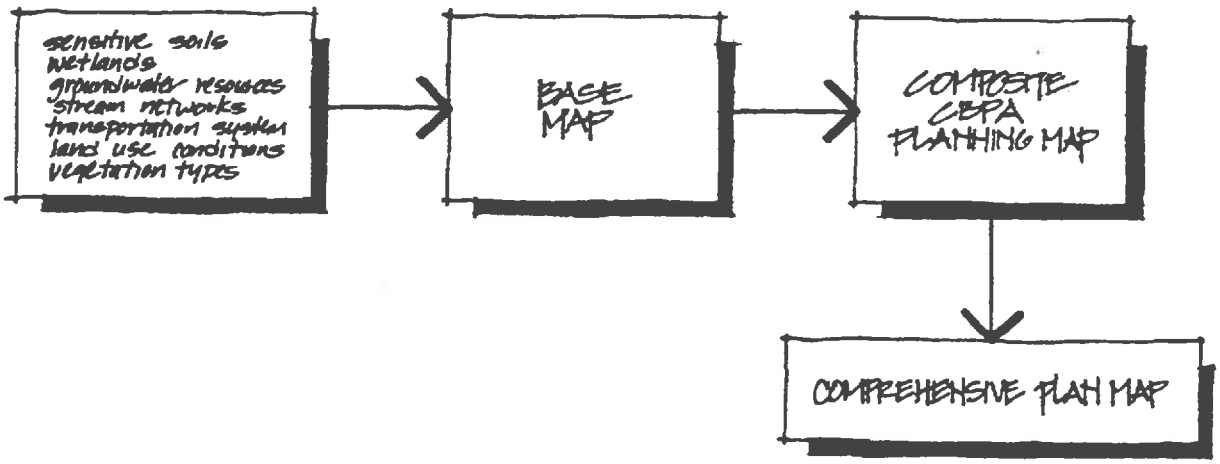
As required by the Criteria Regulations, local governments will assess the nature, location, and condition of the following land forms within the local jurisdiction:

- Tidal shores
- Tidal wetlands
- Tributary streams
- Non-tidal wetlands
- Floodplains
- Highly erodible soils
- Highly permeable soils
- Other lands at local discretion

Although these are features which must be inventoried, it is recommended that local governments take this opportunity to inventory a more comprehensive scope of environmental and cultural resources. Other features could include vegetation types, other soils with constraints to development, underground water resources, existing land use or land cover, mineral resources, and important terrestial and aquatic habitat areas.

After the features are identified and values are assigned to them, the actual physical inventory will be conducted for each feature. For example, the wetlands feature will be mapped after an analysis of the various types of wetlands. The resulting map will delineate the boundaries of (1) tidal wetlands, (2) nontidal wetlands that are connected by surface flow and contiguous to tidal wetlands or tributary streams, and (3) isolated nontidal wetlands. Since tidal wetlands and contiguous nontidal wetlands are components of Resource Protection Areas and the most important wetlands in protecting water quality, they should be depicted as being distinct from isolated nontidal wetlands. This distinction can be achieved by color or by different shades.

Once the categories of features have been individually mapped, the combined maps, one upon another, form the final environmental inventory. The inventory of features will be further analyzed using guide-



lines introduced later in this chapter to determine the boundaries for, first, Resource Protection Areas and, second, Resource Management Areas.

With the preparation of the inventory and the introduction of improved information as it becomes available, local governments will have a comprehensive environmental information base to use in all of their land use planning efforts. As time and staff resources permit, additional analyses can be undertaken which, in turn, enhance this important information resource.

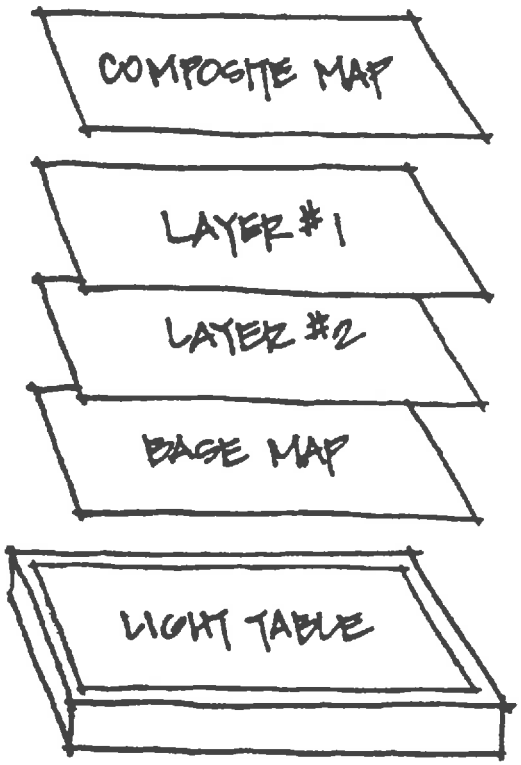
Existing Mapping Resources

As noted earlier, the designation of Chesapeake Bay Preservation Areas is based on **existing** data and mapping resources readily available to Tidewater local governments. There are certain limitations in the accuracy of these resources due to scale and methodology. Nevertheless, these resources provide an important tool for local land use planning and, as such, are appropriate for the designation of Preservation Areas.

The majority of these mapping resources are available at a scale of 1:24,000 (1"=2000'), which facilitates the preparation of overlays of environmental features. Some of the available mapping products, like the USGS topographic maps, are widely used by most, if not all, local governments. Other available mapping resources may be less familiar, or they may present a new resource to localities. Local governments should use these available resources (identified in Table 3-1) in conjunction with other locally-derived data sets and maps, many of which address the problems associated with scale and accuracy.

Although the Criteria Regulations do not dictate a map scale for the designation of Chesapeake Bay Preservation Areas, local governments should prepare their designation maps at a scale that will provide the best fit with their comprehensive plan, zoning map, tax maps, or local topographic mapping. For many rural local governments, the 1: 24,000-scale will generally be adequate. For urban and rapidly developing suburban localities, more detailed mapping of Preservation Areas may be desirable.

The scale of the final map or maps designating Chesapeake Bay Preservation Areas will in large part depend upon the mechanism local governments choose to implement the performance criteria at the



MAPPING NATURAL RESOURCES

The following section provides specific guidelines on the mapping of individual features that must or may be components of Chesapeake Bay Preservation Areas. The guidelines address the use of existing mapping resources available for this effort. The USGS topographic maps are the most fundamental and practical maps to be used, and they are available for every part of Tidewater Virginia. USGS topographic maps generally use contour lines at 2-foot, 5-foot, or 10-foot intervals to show the shape and elevation of the terrain.

The standard series of USGS maps are the 7-1/2 minute format quadrangles ("quads"), which use a map scale of 1:24,000, that is, 1 inch on the map equals 2000 feet on the land. In Virginia, each map represents an area approximately 7 miles from east to west and 8 miles north to south. This scale combines an appropriate amount of detail with a relatively large amount of land portrayed on each map, thus minimizing the number of maps necessary to cover an area. (See Figure 3-2.)

Recent mapping techniques, such as aerial reconnaissance for map revisions, have enabled the accuracy of these maps to be standardized so that not more than 10% of the points shown on a map will be in error by more than 1/30th of an inch. It is important for localities to note that different quad maps have different base years, pertaining to when they were published or last updated. The base year number appears in the lower right portion of the map, below the quad name. Localities should be aware that updated quad maps generally show more detail than older quad maps. Areas shown in purple on quad maps represent features that have been added from aerial photographs during the map revision process, and indicate that the quad map has been revised. All efforts should be made to obtain the most recent quad maps to facilitate the analysis of accurate information in the planning process.

The brochure entitled "Topographic Map Symbols", published by USGS, provides additional information on the USGS mapping process, as well as a list of symbols and accompanying explanations that aid in the understanding of USGS maps. Additional information on USGS maps can be obtained from the U.S. Geological Survey at the location listed in the Appendix, "Government Resources".

Tributary Streams

Tributary streams are a reasonable place to begin the mapping process, as they provide the "skeleton" for Resource Protection Area boundaries and they provide linkage to the other elements of a regional watershed network. Where other RPA features don't exist, the RPA may only consist of the 100-foot buffer area along both sides of a tributary stream.

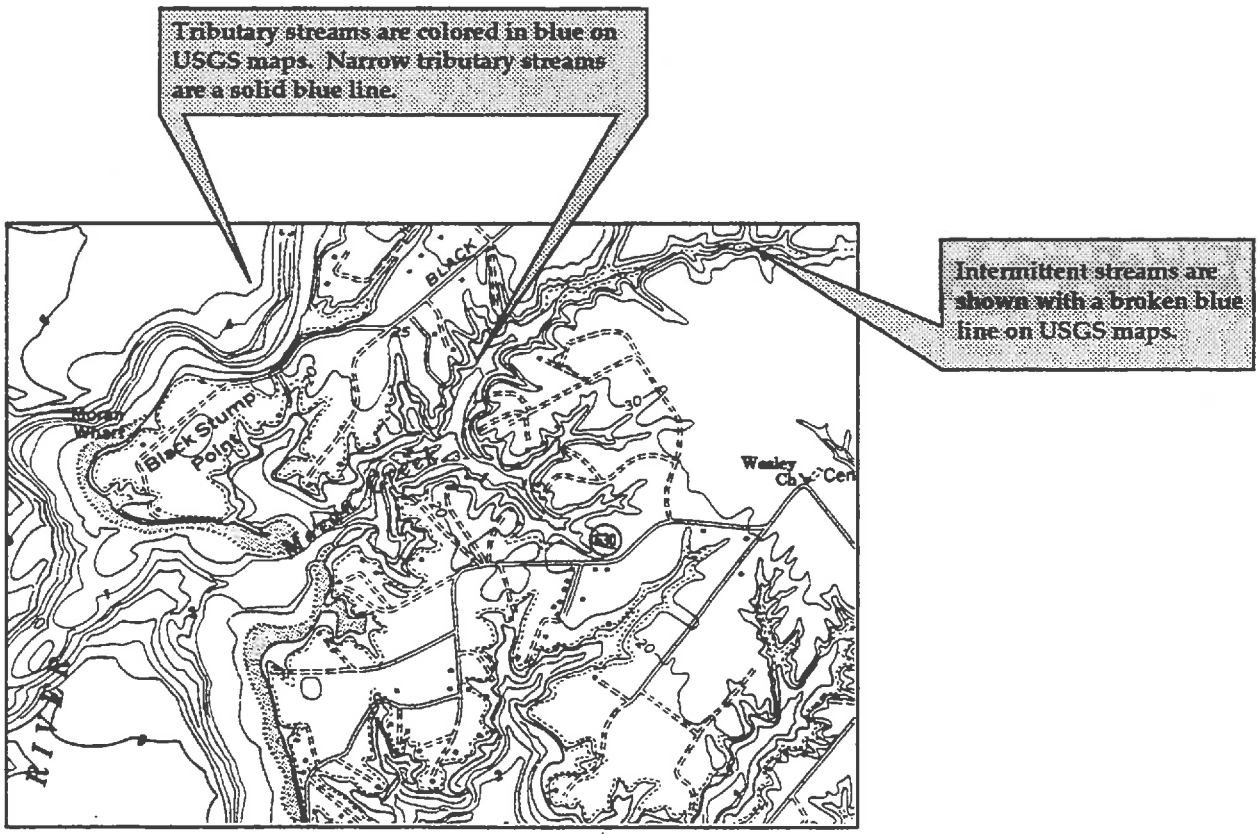
Identifying and mapping tributary streams is not a complicated process, since they are clearly marked on USGS topographic quadrangle maps. On USGS maps, the Bay and its tributaries are shown in blue. Perennial streams, which are portrayed on these maps with solid blue lines, must also be included in mapping tributary streams because their flow of water is constantly connected to the larger rivers. Intermittent streams, which

are shown as broken blue lines, are only sporadically connected by water flow to tributary streams, so they are not truly tributaries.

In mapping tributary streams, local governments should also consider the presence of drainage and navigation canals that may be linked to the regional watershed system. Typically, such canals are indicated on USGS maps in the same manner that tributary streams are indicated. However, drainage and navigation canals are generally the results of human intervention into the drainage system and tend to follow rather obvious straight or angular paths.

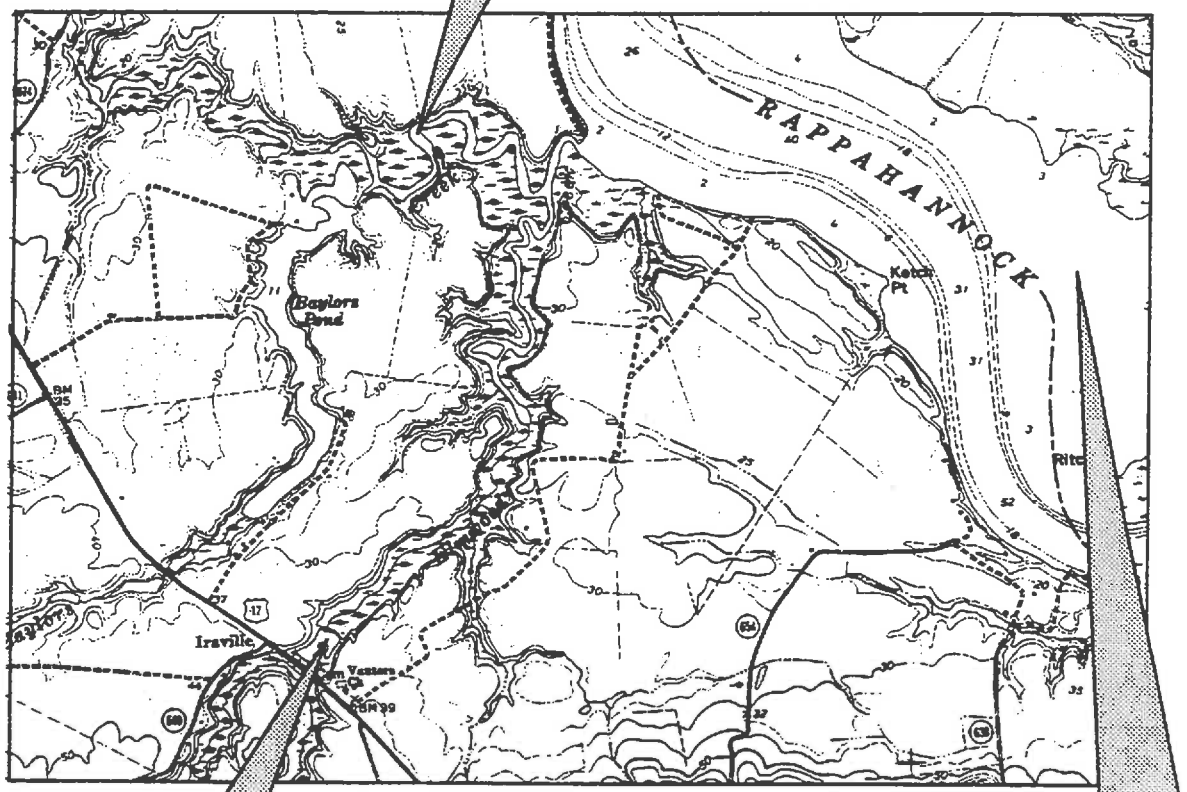
In addition, it is important to note that tributary streams and drainage/navigation canals may be shown on USGS maps in purple, rather than the standard blue color. As discussed earlier, the purple color indicates features that have been added or revised on more recent quad maps. Therefore, these purple water features should be mapped, along with the more prevalent blue water features, during the environmental inventory process.

DELINEATION OF TRIBUTARY STREAMS USING USGS MAPS *FIGURE 3-3*



TIDAL SHORES

FIGURE 3-5

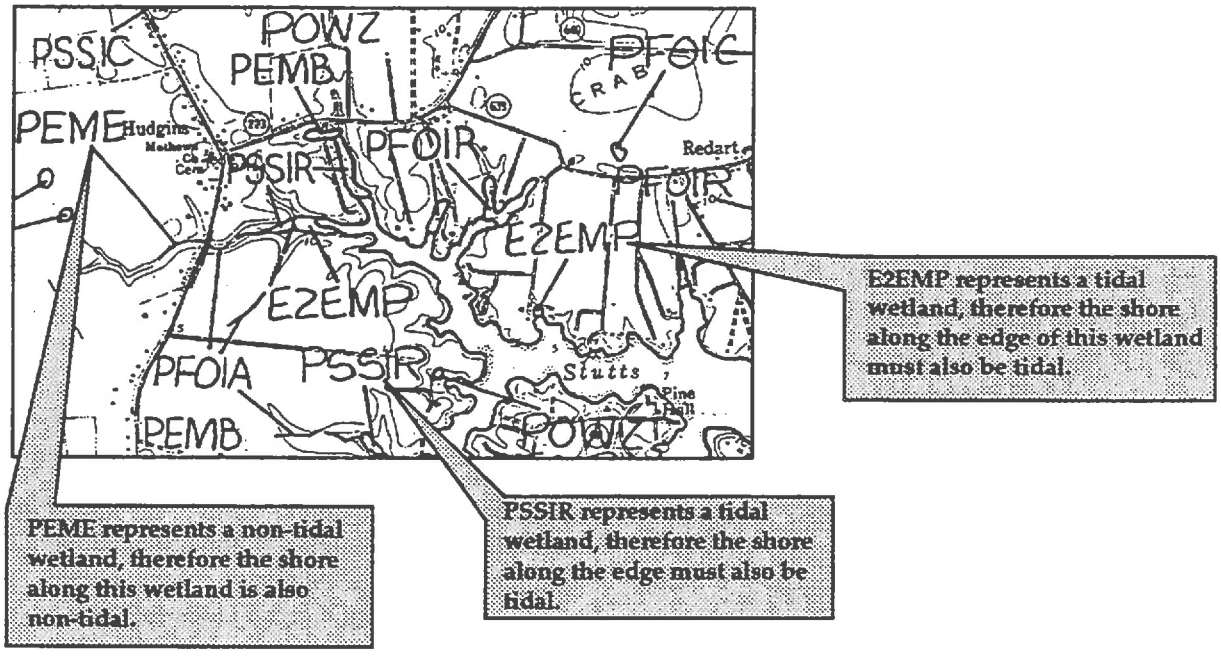


In some parts of Tidewater Virginia, USGS topographic/bathymetric quadrangle maps are also available. These maps depict depth contours (isobaths) at 1-meter intervals to show the land beneath bodies of water. The increased level of shoreline detail shown on these maps may be useful in the delineation of tidal shores.

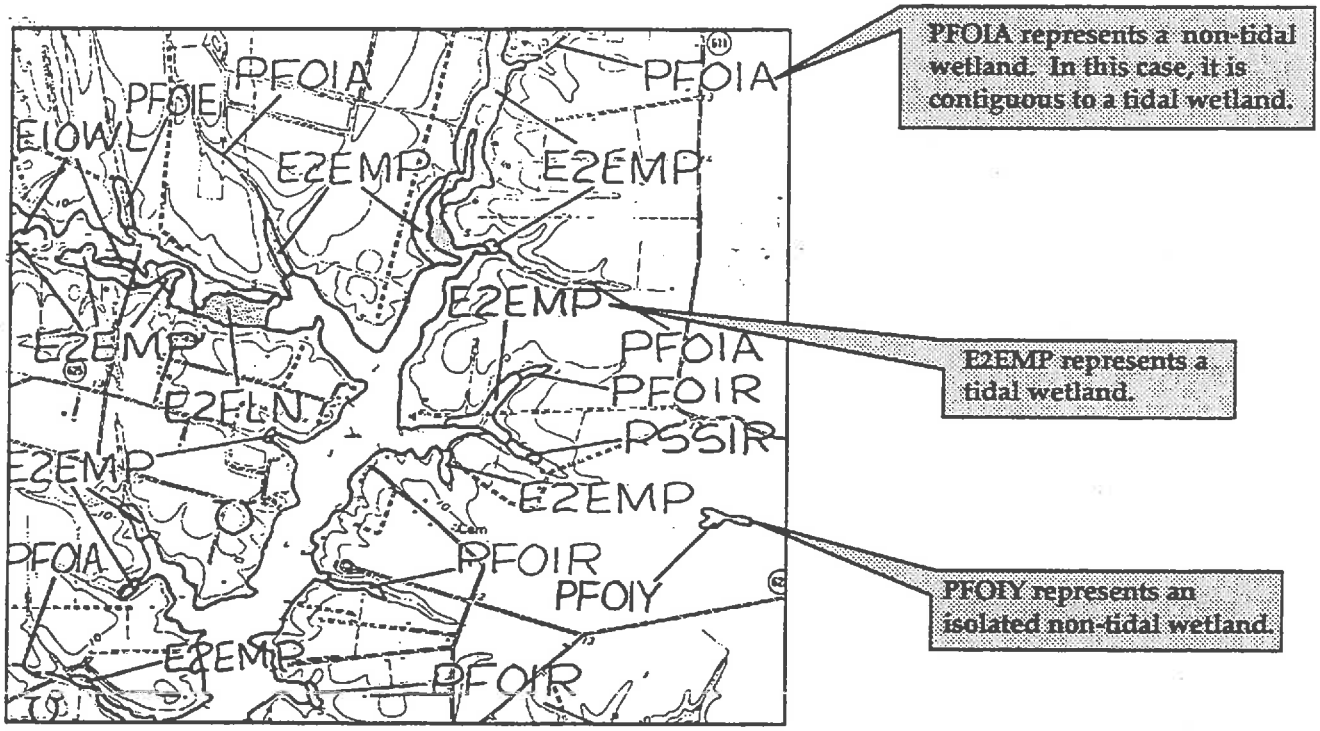
Since the upper reaches of tributary streams may become nontidal, these areas will need to be examined in more detail. Useful information can be obtained from National Wetland Inventory maps, which are published by the U.S. Fish and Wildlife Service. (See Figure 3-7.) The presence of tidal wetlands along a tributary stream is a strong indicator of the probable existence of tidal flows. (The codes used in the National Wetland Inventory maps are explained in the following section on mapping wetlands.) Local navigational data and related data on tidal ranges can also be used to determine tidal influence.

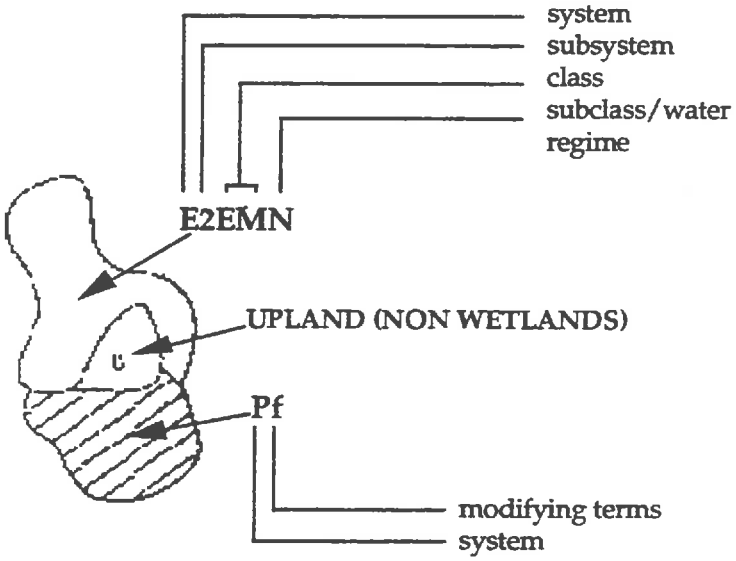
Additional information on the extent of tidal flows necessary for tidal shore designation is available from the Virginia Institute of Marine Science (VIMS), the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service, as well as from other public and private maritime organizations and clubs.

DELINEATION OF TIDAL SHORES USING NWI MAPS *FIGURE 3-7*



DELINEATION OF WETLANDS USING NWI MAPS *FIGURE 3-8*





The hierarchical classification scheme used by the Fish and Wildlife Service divides wetlands into five major systems which reflect the location of the wetlands: marine, estuarine, riverine, lacustrine, and palustrine. These systems, with their subsystems, are further divided into classes which reflect both the types of vegetation and the types of soils or substrates found in the wetlands.

All NWI maps are on the same scale as USGS topographic maps (1" = 2,000') and use the same quadrangle system. The wetlands are noted on NWI maps using an alpha-numeric code. That code is based on the hierarchical classification scheme used by the

NWI CODES FOR WETLAND WATER REGIMES — *TABLE 3-2*

NONTIDAL	TIDAL
A = Temporarily Flooded	L = Subtidal (submerged)
C = Seasonally Flooded	M = Irregularly Exposed
E = Seasonally Flooded/ Saturated	N = Regularly Flooded
F = Semipermanently Flooded	P = Irregularly Flooded
H = Permanently Flooded	R = Seasonally Flooded
K = Artificially Flooded	V = Permanently Flooded/Tidal
Z = Permanently Flooded/ Intermittently Exposed	

Source: Adapted from Fish and Wildlife Service, *Classification of Wetlands*, 1979

Wetlands Delineation

The procedure for identifying and mapping wetlands is described in detail in the ***Federal Manual for Identifying and Delineating Jurisdictional Wetlands***. This manual was published in 1989 as a cooperative effort by several federal agencies: the U.S. Army Corps of Engineers, The U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S.D.A. Soil Conservation Service. The federal manual serves as the technical basis for recognizing and defining wetlands which are jurisdictional, that is, regulated by federal law.

Note: Copies of the federal manual will be supplied to local governments in coming months by the Department.

The federal manual identifies three mandatory technical criteria which must be identified before an area is considered to be a jurisdictional wetland. These criteria are hydrophytic vegetation, hydric soils, and wetland hydrology.

Hydrophytic, or "water-loving," plants are those which require water or wet soils to live, or which tolerate wet conditions that are often deficient in oxygen. Hydric soils are saturated, flooded, or ponded long enough during the growing season to develop anaerobic (no oxygen) conditions in the upper layers. Wetland hydrology is, as the Federal manual says, the "driving force" which creates wetlands, because it is directly responsible for evidence of the other two criteria. Hydrology describes the distribution and circulation of water; in wetlands, hydrology is characterized by flooding or saturation which is either permanent or which recurs for significant periods of time (usually a week or more during the growing season, which is between March and October in Virginia). The Federal manual gives specific parameters for each of these technical criteria, and also de-

Some localities in Tidewater Virginia may have Tidal Marsh Inventory studies available from the Virginia Institute of Marine Science. These studies can be used to supplement the off-site identification procedure.

NOTE: The following section presents the Federal Manual's on-site procedure for wetlands identification. This is provided only as general information for local governments. It may be useful to local governments wishing to field check areas where existing data may be inconclusive. Local governments are not required, however, to field verify data in order to designate Chesapeake Bay Preservation Areas.

On-Site Procedure

On-site field inspection procedures are useful when there are areas which need additional information in order to make definite identification. Tidal wetlands generally are easy to identify, since water usually floods the area twice a day. (Some tidal wetlands may be irregularly tidal, or seasonally tidal. For instance, lagoons may be flooded only during major winter storms, while other areas may be affected only by early spring snow melt. Because of cases such as these, determination of questionable tidal wetland areas is best made during the late spring, summer and early fall.) Nontidal wetlands are often easy to identify as well, since water may stand in them for most of the year. Some areas, however, may not be so easily recognized. In these cases, the three major technical criteria mentioned earlier must be applied in making on-site inspections for wetlands identification.

Hydrophytic Vegetation

Plants that grow in wetlands are classified in two ways. One way is by their stratum, that is, whether they are trees, saplings, shrubs, vines, herbs or bryophytes (mosses and liverworts). The other way is according to their relative ability to live in either wetlands or uplands. If a plant is found only in wet areas, it is classified as "obligate" (OBL). If it is found in either wetlands or uplands, it is classified as "facultative" (FAC), and if it is facultative but is found more often in wetlands it is considered to be "facultative wet" (FACW). Other plants are found only in uplands (UPL) or more often in uplands than in wet areas (FACU). (Specific definitions for these classifications are provided in the Federal manual.)

If all of the plants in an area are obligate species, then that area is likely to be a wetland. If more than half of the plants in all of the strata are OBL, FACW or FAC, then hydrophytic vegetation is considered to be dominant in that area, and it is weighed as a consideration along with hydric soils and hydrology.

A photographic guide to prevalent plants in Virginia's wetlands will be included with forthcoming chapters of the Local Assistance Manual. These plants are listed in the following table. (Table 3-3.)

Hydric Soils

Soils are regarded as hydric if they are saturated, flooded, or ponded long enough to develop anaerobic (no oxygen) conditions in their upper layers. Chemical changes which result from prolonged saturation (at least one week during the growing season) are reflected in the soil color and other physical characteristics which are used to identify these soils. Indicators of these changes, which are explained in more detail in the Federal manual, are the soil's composition, its color, and, in some cases, its smell.

The composition of hydric soils is classified as either organic or mineral. Organic soils are of three types: muck (saprists), peat (fibrists), or a combination of the two which is either mucky peat or peaty muck (hemists). Mineral soils are characterized by mottles or gleying, which reflect chemical processes in the soil.

Hydric soils are also identified and classified by inspection of the soil colors, which are compared to a standardized soil color chart. In some cases, organic hydric soils may be recognized by their sulfurous smell, like rotten eggs, or by their greasy feel.

Determination of hydric soils is assisted by the use of county soil surveys. If hydric soils are found on the soil survey map for the area in question, an inspection in the field can be undertaken to compare the soil to its description in the soil survey report. If there is no information which is specific to a site, then the physical characteristics of the soils in that area can be investigated using the "field indicators" of soil composition, color and smell. These field indicators are described in detail in the Federal manual.

Wetland Hydrology

The occurrence of wetlands is dependent upon the hydrology of an area, which is affected by a number of factors such as the amount of precipitation, topographic variations, soil permeability, and plant cover. Recorded data on the frequency and duration of inundation, which is necessary to determine if an area is flooded or saturated for prolonged periods, is available from several sources. The U.S. Army Corps of Engineers' district offices have data for major waterbodies and other site-specific areas; the U.S. Geological Survey has stream and tidal gauge data; and the National Oceanic and Atmospheric Administration has tidal gauge data, as well. State, county and local agencies have flood data, Soil Conservation Service state offices have data on small watershed projects, and private landowners or developers often have site-specific data such as depths of water tables or groundwater wells.

Aerial photographs can be helpful in showing evidence of flooding and saturation, particularly those taken before trees leaf out completely in the spring. It is best to examine aerial photos from several consecutive years, to account for abnormally dry or wet seasons; the U.S. Weather Service maintains historical weather records for comparisons. The U.S. Department of Agriculture has been rephotographing the state of Virginia in 1989 to produce color infra-red aerial photographs. The state was previously photographed aerially in the early 1980's. These color infrared photographs can be produced at various scales and can be used in conjunction with USGS quadrangle maps, as well as with NWI maps. In addition, the Virginia Department of Transportation (VDOT) often takes color infrared photographs along proposed road align-

STEP 4

Determine whether a disturbed condition exists. If parts of the area's vegetation, soils or hydrology have been significantly altered, the limits of these disturbed areas should be identified in order to evaluate them separately after the undisturbed areas have been evaluated. Disturbed area determination procedures are explained in more detail in the federal manual.

STEP 5

Decide on the field determination method to be used.

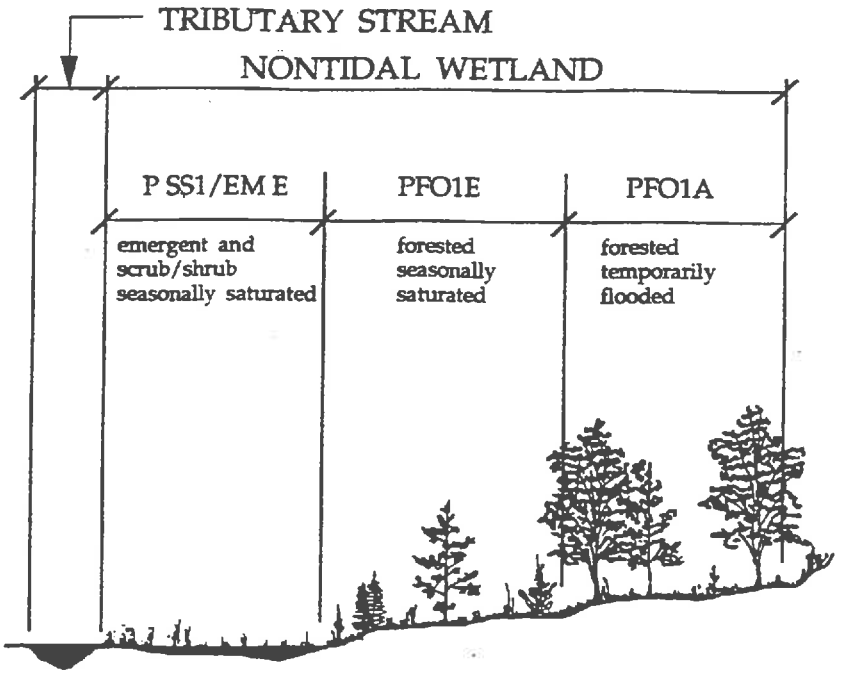
The designation of Resource Protection Areas (RPAs) requires the inclusion of tidal wetlands, as well as nontidal wetlands which are both contiguous and connected by surface flow to either tidal wetlands or tributary (perennial) streams. Figure 3-10 shows the conceptual relationship of various types of wetlands to Resource Protection Area and Resource Management Area (RMA) designations. Note that one of the illustrated noncontiguous nontidal wetlands is along an intermittent (nontributary) stream. This wetland is ultimately connected by surface flow to a perennial stream. Because this particular wetland satisfies only one of the two criteria necessitating designation as an RPA, localities may exercise their judgment and designate such a wetland as either an RPA or an RMA. Another wetland shown on the same illustration is lacustrine, that is, it is associated with a lake. Such a wetland is another type of area for which a locality may wish to exercise its judgment by designating the wetland as part of an RPA as an "other land" which functions to protect the quality of state waters.

As noted earlier, the three technical criteria which must be met for an area to be identified as a wetland are hydrophytic (water loving) vegetation, hydric (no oxygen) soils, and wetland hydrology. Of these three mandatory technical criteria, wetland hydrology is the most important because it causes hydric soils and a predominance of hydrophytic vegetation. The federal manual states that an area has wetland hydrology when saturated to the surface or inundated with water for usually one week or more during the growing season. The growing season for Tidewater Virginia runs, on the average, from March through October of each year.

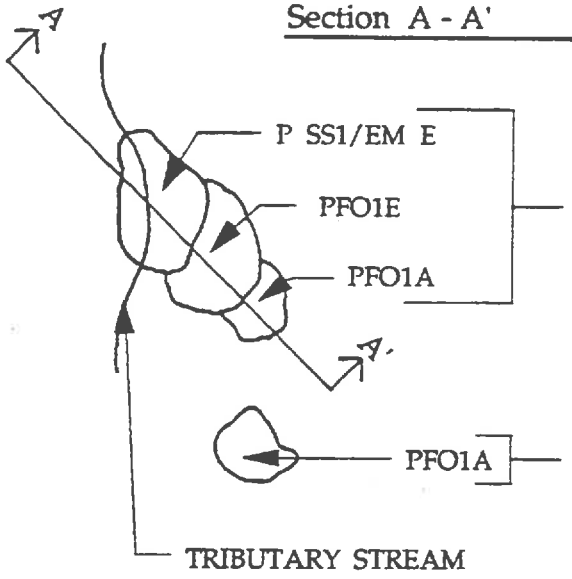
Figure 3-11 (Scenario A) illustrates how the technical criterion for wetland hydrology is related to designation of nontidal wetlands as RPAs and RMAs. A nontidal wetland system is shown in which part of the landscape is saturated throughout most of the growing season and part of it is not. The federal manual defines saturation as that which is within 18 inches of the surface dependent on the soil's permeability. "Surface flow" is to be interpreted literally as actual ground saturation or inundation when designating Resource Protection Areas. To be consistent with the technical criterion for wetland hydrology, designation of a nontidal wetland within a Resource Protection Area should include all nontidal wetlands which are both contiguous and satisfy a hydrological connection, either singularly or as a continuous unit, by surface flow to a tidal wetland or tributary stream **for a week or more during the growing season.**

Figure 3-12 (Scenario B) illustrates some examples of wetland designation based on NWI maps. Some wetlands on these maps are clearly associated with tributary streams.

NONTIDAL WETLAND CONNECTED TO A TRIBUTARY STREAM (SCENARIO A) *FIGURE 3-11*



Section A - A'



These nontidal wetlands must be mapped under the Resource Protection Area (RPA) designation since they are contiguous and connected by surface flow to a tributary stream.

This nontidal wetland will likely be mapped under the Resource Management Area (RMA) designation since it is an isolated wetland not connected by surface flow to a tributary stream.

Where stream channels are narrow, wetlands may show up on NWI maps as heavy dashed lines. Changes in the predominant vegetative stratum or water regime are indicated by the same alpha-numeric code discussed earlier in this chapter. Heavy dashed lines perpendicular to stream channels are also used on NWI maps to mark distinct changes in vegetation along a given stream segment. When using NWI maps, a comparison with USGS maps is useful in order to distinguish perennial from intermittent streams and to locate flatter areas along stream channels where wetlands are likely to occur.

Cross-checking NWI maps with USGS maps may reveal that nearly continuous wetlands occur even where stream flow changes from perennial to intermittent. In such cases these nontidal wetlands are contiguous to perennial waters, and hydrological connection by surface flow (again, for a week or more during the growing season) is virtually certain during any year of average rainfall. These nontidal wetlands should be designated as RPAs. Conversely, as is also shown in Figure 3-12 (Scenario B), a wetland with a given classification on an NWI map might in fact be spatially separated by an intermittent stream from the same type of nontidal wetland. In such instances a locality could designate a wetland as either an RPA (other lands) or as an RMA (noncontiguous).

The 1989 Virginia Outdoors Plan identifies Virginia wetlands that have priority for protection; these wetlands are unique or particularly representative of a certain community type. Table 3-4 lists wetlands in Tidewater Virginia which have been identified as priorities for protection by the Virginia Outdoors Plan, following the U.S. Fish and Wildlife Service's ***Wetlands Priority Protection Plan.***[6] Local governments may find this list useful, generally for planning purposes and in their environmental inventories.

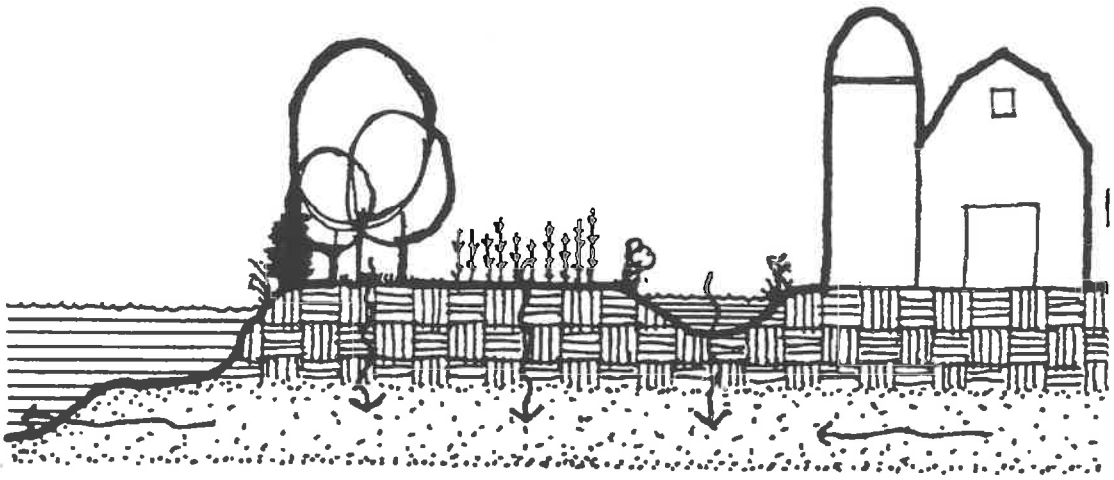


TABLE 3-4 CONT.

Lancaster County

Mosquito Island
North Point Marsh
Belle Island
Belle Isle

Mathews County

Lilleys Neck
Mathews County Interior Wetlands

Middlesex County

Dragon Run

New Kent County

Lilly Point Marsh Complex
West Island
Cousiac Marsh
Hill Marsh
Ware Creek & Terrapin Point
Chickahominy River Marshes
Chickahominy Swamp
Lanexa Marsh
Cumberland Thoroughfare
Matton Creek
Whites Landing
Holts Creek
North Anna River Wetlands
Big Creek

Newport News

Mulberry Island
Warwick River

Northampton County

Butlers Bluff
Fishermans Island
Greens Creek
Plantation Creek
Wreck & Bone Islands
Savage Neck Dunes
Eastern Shore of Virginia NWR
Mockhorn Island WMA
Hog Island
Cobb Island
Godwin Island
Ship Shoal Island
Mink Island
Myrtle Island
Smith Island
Rogue Island
Magothy Bay
Fringing Bottomlands

Northumberland County

Hack Creek
Bluff Point Marsh
Bell Swamp/Owens Point
Dameron Mars

Prince George County

Powell Creek Marsh
Kennon Marsh
Ward's Creek
Dutch Gap Fault
Upper Chippokes Creek
Appomattox River Wetlands
Appomattox River Marshes

Prince William County

Neabsco Creek Marsh
Powell's Creek
Quantico Creek
Chopawamsic Creek
Featherstone NWR
Marumsco NWR

Richmond County

Broad Creek
Cat Point Creek
Little Carter Creek Marsh
Totuskey Creek
Downing Bridge Marsh
Jones Creek Wetlands

Spotsylvania County

Alexander Berger Memorial Sanctuary
Ware Creek
Hazel Run Fault

Stafford County

Aquia Creek
Accakeek Creek
Potomac Creek
Chopawamsic Creek
Tank Creek Fault
Crows Nest

Suffolk

Nansemond River/Bennett Creek Marshes
Hoffler Creek Marsh
South Quay Pine Barrens
Blackwater River
Great Dismal Swamp NWR

Surry County

Upper Chippokes Creek
Sunken Meadow Pond
Crouch Creek & Timber Neck Creek
Lower Chippokes Creek Marsh
Hog Island
Lawnes Neck Creek Marsh
Blackwater River Swamp
Surry Site
Swann's Point
Mt. Pleasant

Virginia Beach

North Landing River Wetlands
Pocaty Creek Swamp
Seashore State Park
Blackwater Creek
Pungo Causeway
False Cape State Park
Gum Swamp
Stumpy Lake
Back Bay Wetlands
Back Bay NWR
Pocohontas WMA
Trojan WMA
Barbour's Hill WMA

Westmoreland County

Drake's Marsh
Otterburn Marsh
Nomini Cliffs
Currioman Bay
Hollis Marsh Island
Bridges Creek

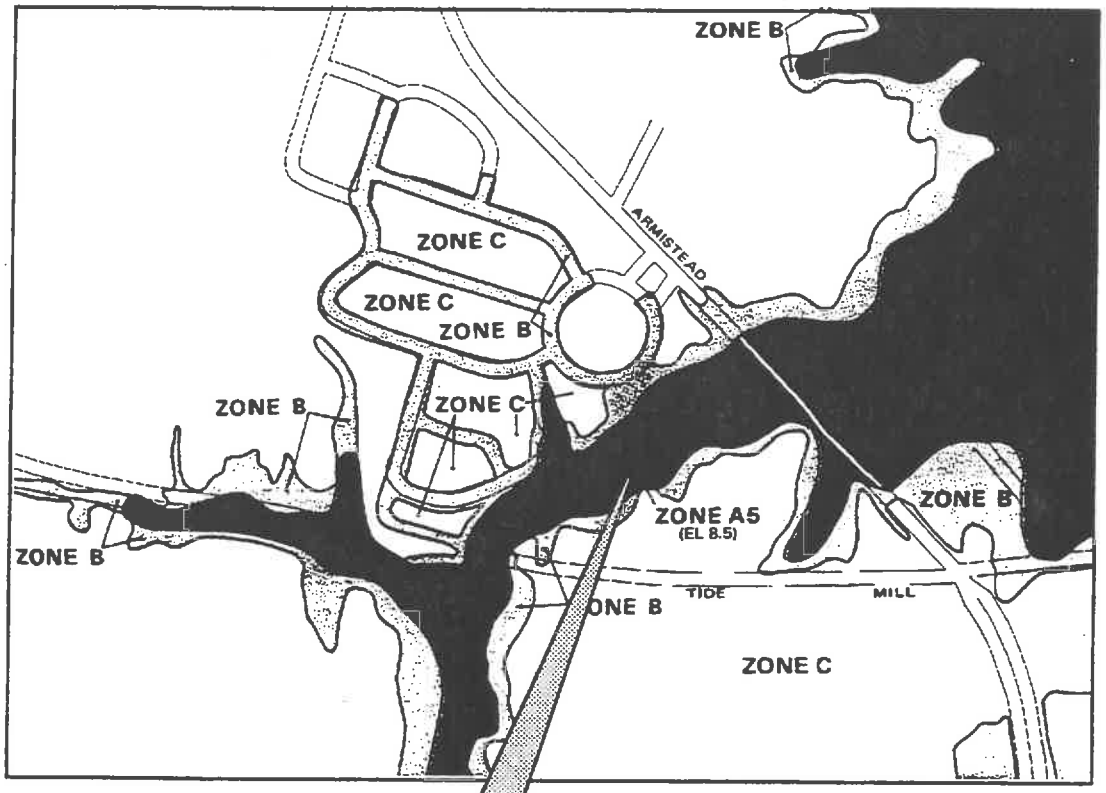
York County

College Woods
Grafton Ponds

Source: Virginia Department of Conservation and Recreation, ***The 1989 Virginia Outdoors Plan.***

Delineation of Floodplains Using FEMA Maps

Figure 3-13



100 year flood zone is designated on FEMA maps as Zone A, and shown with dark shading.

KEY TO MAP

500-Year Flood Boundary	
100-Year Flood Boundary	ZONE B
Zone Designations*	
100-Year Flood Boundary	
500-Year Flood Boundary	ZONE B
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

Alternative soil mapping resources that may be useful are the Erodibility Index (EI) maps developed by the U.S. Department of Agriculture, Soil Conservation Service for determining compliance with the 1985 federal Food Security Act (FSA or Farm Bill). The erodibility index for those maps was determined by the same formula applied in these Regulations, but the maps apply only to agricultural lands. Those maps should be available in the local SCS or Soil and Water Conservation District offices.

Another alternative way of mapping highly erodible soils if EI information is unavailable is to use erodibility (K) factors and slope information to determine highly erodible soils. That is, soils depicted in the local Soil Survey having K factors equal to or exceeding .35 should be considered highly erodible. In addition, any soil with a slope exceeding 15% should be considered highly erodible. There are no effective alternatives to the soil survey for providing comprehensive soil permeability information.

The Department does not encourage local governments whose soil surveys have not yet been included in the VirGIS data base to try to calculate the erodibility indices for their soil types, since the process is quite cumbersome to perform manually. It necessitates determining from topography maps slope gradients and lengths for each soil mapping unit, overlaying that data with the soil erodibity and replacement rate information, calculating all those findings with a rainfall factor, and delineating the resulting polygons on a map. However, that process is set forth below for those who might still be interested.

Highly Erodible Soils

Highly erodible soils have a high potential for erosion and sedimentation problems. This potential is due, in part, to excessive steepness and length of slope, which act to increase precipitation runoff velocity. Higher velocities act to loosen and remove certain soil particles. The extent to which these soil particles are moved is related to their structure, texture, percentage of organic content, the infiltration rate and the soil's permeability.

The soil characteristics of erodible soil are discussed in soil surveys with reference to soil mapping units. A thorough discussion of soil mapping units in terms of their relationship to soil classification and land management is provided in each soil survey document.

The calculation of the erodibility index (EI) for a given area is required to delineate "highly erodible soils" as a potential component of Resource Management Areas. The erodibility index for any soil is determined from the following formula:

EI = RKLS/T, where
R = the rainfall and runoff factor
K = the soil susceptibility to water erosion
LS = the combined effects of slope length and steepness
T = the soil loss tolerance

In general terms, the erodibility index (EI) is the measure of the ratio at which soil is being eroded in relation to the rate at which it is being replaced. The index of eight (8) is the generally accepted threshold at which the rate of soil loss becomes critical in relation to soil replacement, resulting in severe soil erosion.

tion through the vertical transportation of pollution-charged particles. The amount of water that moves down through the soil varies depending upon the water holding capacity of the particular soil type. That capacity is largely determined by the soil structure, texture, percentage of organic matter and permeability. Soil permeability is especially important in relation to the design of soil drainage systems, septic tank absorption fields, and construction projects where the rate of water movement under saturated conditions affects pollutant behavior. Excessive seepage or infiltration from septic tank absorption fields caused by soils with rapid permeability rates can cause serious health problems through pollution of underground sources of domestic drinking water. Shallow groundwater resources are also a source of water for all streams which flow into larger rivers and the Bay.

Other pollutants such as pesticides, heavy metals, organic wastes, road salts, and nuclear wastes also can adhere to soil particles and be leached lower into the soil horizon until they reach groundwater storage areas. The combined effects of septic tank and chemical pollutants leaching into groundwater storage systems adds significantly to the problem of water resource pollution.

The determination of "highly permeable soils" can be accomplished by using the local SCS soil survey in a three-step process:

Step 1

Find the soil mapping unit in the "Index to Mapping Units" located in the front of the soil survey.

Step 2

Go to the page number listed in the "Index to Mapping Units"; from this listing, the soil series for that mapping unit can be identified.

Step 3

Refer to the soil survey's table of contents for the location of the information on capability units, as well as the tables "Estimated Soil Properties Significant in Engineering" and/or "Physical and Chemical Properties of Soils" in more recent soil surveys. Information pertaining to permeability is presented in these tables and in the soil survey's glossary in terms of seven permeability rate parameters:

- very slow (less than 0.06 inches/ hour)
- slow (0.06 to 0.20 inches/hour)
- moderately slow (0.20 to 0.60 inches/ hour)
- moderate (0.60 to 2.0 inches/hour)
- moderately rapid (2.0 to 6.0 inches/hour)
- **rapid (6.0 to 20 inches/hour)**
- **very rapid (more than 20 inches/hour)**

The Criteria Regulations state that the permeability groups to be included in the mapping of "highly permeable soils" are those soils that exhibit permeability rates equal to or greater than 6 inches/hour, the rapid and very rapid groups as outlined above. Therefore, all soil mapping units that are characterized by permeability rates in these two categories should be delineated as "highly permeable soils" in the mapping of Resource Management Areas.

LENGTH/SLOPE (LS) FACTORS

TABLE 3-6

% Slope	Slope Length In Feet													
	10	20	40	60	80	100	110	120	130	140	150	160	180	200
0.2	0.04	0.05	0.06	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10
0.3	0.04	0.05	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11
0.4	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11
0.5	0.05	0.06	0.08	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12
1.0	0.06	0.08	0.10	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.16
2.0	0.10	0.12	0.15	0.17	0.19	0.20	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.25
3.0	0.14	0.18	0.22	0.25	0.27	0.29	0.30	0.30	0.31	0.32	0.32	0.33	0.34	0.35
4.0	0.16	0.21	0.28	0.33	0.37	0.40	0.42	0.43	0.44	0.46	0.47	0.48	0.51	0.53
5.0	0.17	0.24	0.34	0.41	0.48	0.54	0.56	0.59	0.61	0.63	0.66	0.68	0.72	0.76
6.0	0.21	0.30	0.43	0.52	0.60	0.67	0.71	0.74	0.77	0.80	0.82	0.85	0.90	0.95
8.0	0.31	0.44	0.63	0.77	0.89	0.99	1.04	1.09	1.13	1.17	1.21	1.25	1.33	1.40
10.0	0.43	0.61	0.87	1.06	1.23	1.37	1.44	1.50	1.56	1.62	1.68	1.73	1.84	1.94
12.0	0.57	0.81	1.14	1.40	1.61	1.80	1.89	1.98	2.06	2.14	2.21	2.28	2.42	2.55
14.0	0.73	1.03	1.45	1.78	2.05	2.29	2.41	2.51	2.62	2.72	2.81	2.90	3.08	3.25
16.0	0.90	1.27	1.80	2.20	2.54	2.84	2.98	3.11	3.24	3.36	3.48	3.59	3.81	4.01
18.0	1.09	1.54	2.17	2.66	3.07	3.43	3.60	3.76	3.92	4.06	4.21	4.34	4.61	4.86
20.0	1.29	1.82	2.58	3.16	3.65	4.08	4.28	4.47	4.65	4.83	5.00	5.16	5.47	5.77
25.0	1.86	2.63	3.73	4.56	5.27	5.89	6.18	6.45	6.72	6.97	7.22	7.45	7.90	8.33
30.0	2.52	3.56	5.03	6.16	7.11	7.95	8.34	8.71	9.07	9.41	9.74	10.06	10.67	11.25
40.0	4.00	5.66	8.00	9.80	11.31	12.65	13.27	13.86	14.43	14.97	15.50	16.01	16.98	17.90
50.0	5.64	7.97	11.27	13.81	15.94	17.82	18.69	19.53	20.32	21.09	21.83	22.55	23.91	25.21
60.0	7.32	10.35	14.64	17.93	20.71	23.15	24.28	25.36	26.40	27.39	28.36	29.29	31.06	32.74

% Slope	Slope Length In Feet													
	300	400	500	600	700	800	900	1000	1100	1200	1300	1500	1700	2000
0.2	0.11	0.12	0.13	0.14	0.15	0.15	0.16	0.16	0.17	0.17	0.18	0.19	0.19	0.20
0.3	0.12	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.18	0.18	0.19	0.20	0.21	0.22
0.4	0.13	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.19	0.20	0.20	0.21	0.22	0.23
0.5	0.14	0.15	0.16	0.17	0.18	0.18	0.19	0.20	0.20	0.21	0.21	0.22	0.23	0.24
1.0	0.18	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.27	0.28	0.29	0.30	0.32
2.0	0.28	0.31	0.33	0.34	0.36	0.38	0.39	0.40	0.41	0.42	0.43	0.45	0.47	0.49
3.0	0.40	0.44	0.47	0.49	0.52	0.54	0.56	0.57	0.59	0.61	0.62	0.65	0.67	0.71
4.0	0.62	0.70	0.76	0.82	0.87	0.92	0.96	1.01	1.04	1.08	1.12	1.18	1.24	1.33
5.0	0.93	1.07	1.20	1.31	1.42	1.52	1.61	1.69	1.78	1.86	1.93	2.07	2.21	2.40
6.0	1.17	1.35	1.50	1.65	1.78	1.90	2.02	2.13	2.23	2.33	2.43	2.61	2.77	3.01
8.0	1.72	1.98	2.22	2.43	2.62	2.81	2.98	3.14	3.29	3.44	3.58	3.84	4.09	4.44
10.0	2.37	2.74	3.06	3.36	3.62	3.87	4.11	4.33	4.54	4.74	4.94	5.30	5.65	6.13
12.0	3.13	3.61	4.04	4.42	4.77	5.10	5.41	5.71	5.99	6.25	6.51	6.99	7.44	8.07
14.0	3.98	4.59	5.13	5.62	6.07	6.49	6.88	7.26	7.61	7.95	8.27	8.89	9.46	10.26
16.0	4.92	5.68	6.35	6.95	7.51	8.03	8.52	8.98	9.42	9.83	10.24	11.00	11.71	12.70
18.0	5.95	6.87	7.68	8.41	9.09	9.71	10.30	10.86	11.39	11.90	12.38	13.30	14.16	15.36
20.0	7.07	8.16	9.12	9.99	10.79	11.54	12.24	12.90	13.53	14.13	14.71	15.80	16.82	18.24
25.0	10.20	11.78	13.17	14.43	15.59	16.66	17.67	18.63	19.54	20.41	21.24	22.82	24.29	26.35
30.0	13.78	15.91	17.79	19.48	21.04	22.50	23.86	25.15	26.38	27.55	28.68	30.81	32.80	
40.0	21.92	25.31	28.30	31.00	33.48									
50.0	30.87													
60.0														

Source: Virginia Dept. of Conservation and Historic Resources, Division of Soil and Water Conservation. *Training Notebook: Urban Erosion and Sediment Control in Virginia.*

Significant Wildlife Habitat

The relationship between wildlife habitat and water quality is reciprocal by nature. Many wildlife species depend upon habitats (such as forested wetlands) which provide essential water quality protection functions. At the same time, many species (such as marine fish and shellfish) play an essential role in the ecological processes which support features critical for water quality protection (such as tidal wetlands).

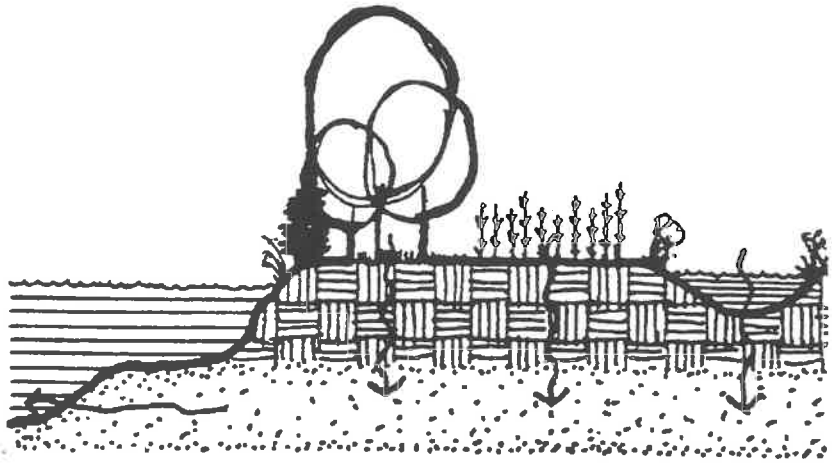
The location and function of significant wildlife habitat areas may be derived from a variety of sources. The Virginia Department of Game and Inland Fisheries' BOVA (Biota of Virginia)[9] and Endangered Species programs, as well as the Department of Conservation's Natural Heritage Program[10], are able to provide useful information for this purpose.

In designating RPAs under the "such other lands" provision, localities should use the RPA criteria in the Regulations.

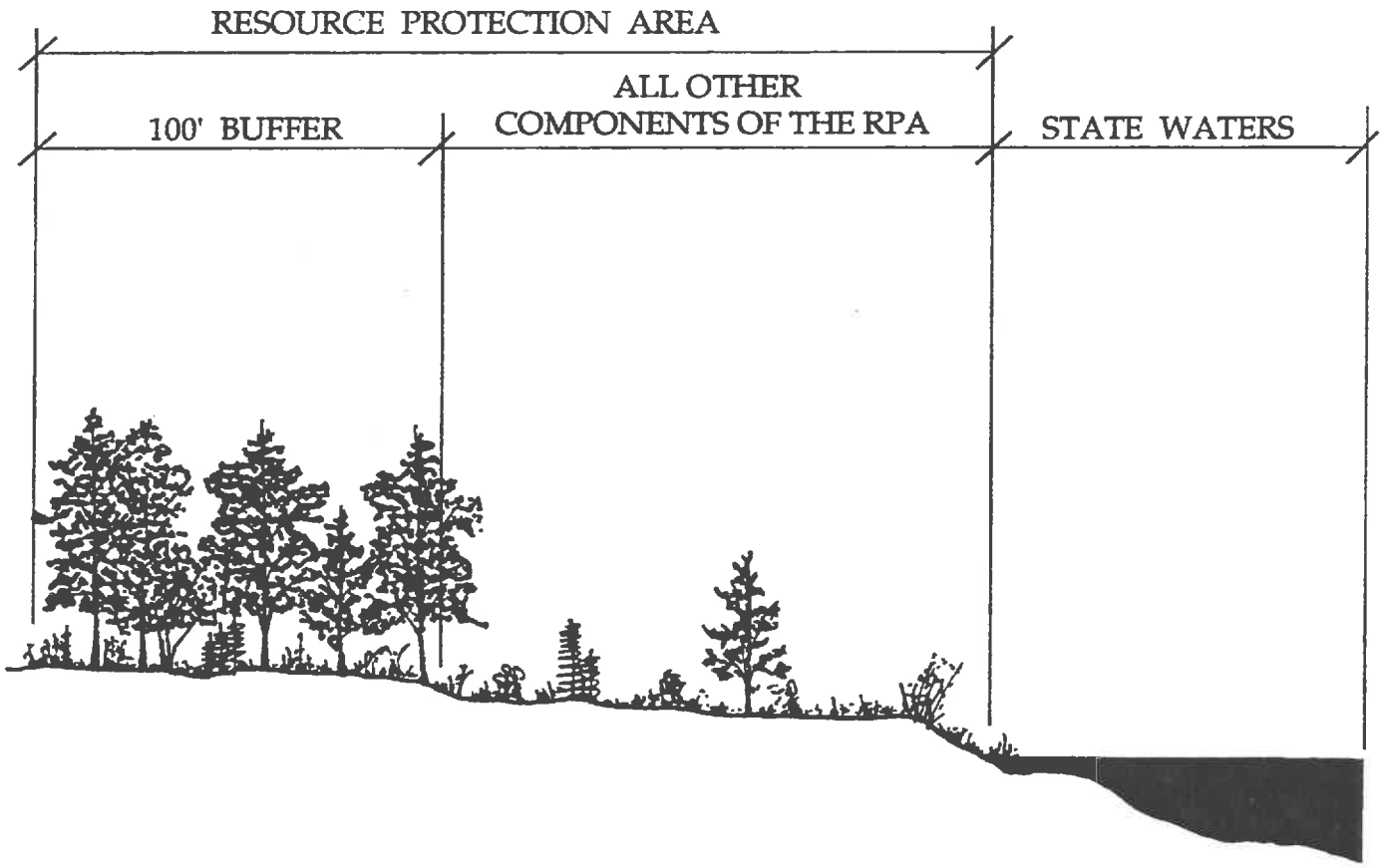
The lands must:

- Be located at or near the shoreline;
- Exhibit intrinsic water quality value due to the ecological or biological processes they perform, or, be sensitive to impacts which may cause significant degradation to the quality of state waters;
- In their natural condition, provide for the removal, reduction, or assimilation of sediments, nutrients, and potentially harmful or toxic substances in runoff entering the Bay and its tributaries;
- Minimize the adverse effects of human activities on state waters and aquatic resources.

Lands which meet some of the above criteria but do not meet the full definition should be considered for designation as Resource Management Areas.



BUFFER AREA CROSS-SECTION *FIGURE 3-15*



The Resource Protection Area designation criteria, coupled with readily available data and mapping resources for most of those components, should provide a rather direct, logical method for designating RPAs. These components will tend to be adjacent to each other, following the dendritic (stream) pattern. Figure 3-16 shows how the components listed in the Regulations might be combined to create a Resource Protection Area, in a hypothetical case.

Resource Management Areas

The Criteria Regulations establish the Resource Management Area (RMA) as the landward component of Chesapeake Bay Preservation Areas. Lands to be considered for designation as Resource Management Areas include the following:

- Non-tidal wetlands
- Floodplains
- Highly erodible soils
- Highly permeable soils
- Other lands at local discretion

Resource Management Areas are important in terms of water quality primarily because, if improperly used or developed, they could release significant amounts of nonpoint source pollutants into the surface and ground water systems. The Regulations do not limit the types of land use and development that may occur within the RMA. Instead, a variety of performance criteria will be applied to any use or development within RMAs to ensure that those land disturbances that do occur will minimize the adverse impact on water quality.

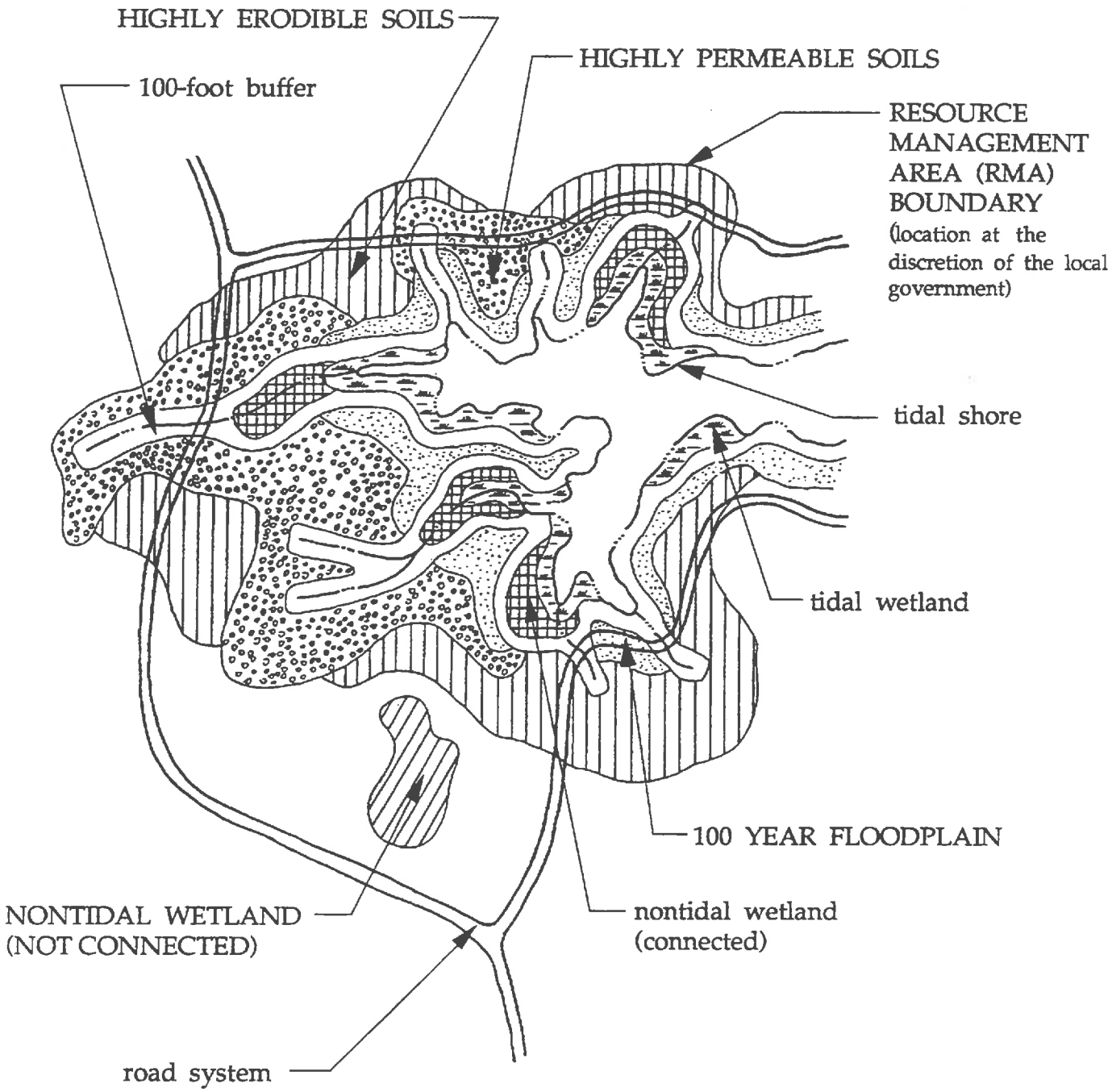
Unlike the delineation of RPAs, the designation of RMAs will be left in large part to local discretion. That is, the delineation of RPAs must follow the natural boundaries of the land features themselves. By contrast, the geographic extent of RMAs is to be determined by each local government according to the analysis of components of RMAs and an examination of local conditions. The features mentioned earlier are land forms which must be **considered** for inclusion within the RMA boundary. For example, a locality may choose not to designate certain isolated non-tidal wetlands which may not have a direct impact on the water quality of the Bay and its tributaries. At the same time, the lands that may be designated as part of the RMA are not limited to those components mentioned here. A locality may choose to include, as part of the RMA, certain other lands which, for example, serve as groundwater recharge areas.

Determining the Geographic Extent of the RMA

While localities have broad authority in the designation of Resource Management Areas and may choose among several options, it is essential to utilize the environmental inventory as a basis for that determination. In the final analysis, the designation must be legally defensible and based upon water quality protection, consistent with the Act, the Criteria Regulations, and other police powers specifically granted under Title 15.1 of the Code of Virginia.

The environmental inventory advances this purpose by clearly establishing priority areas and enabling local governments to make reasonable decisions. Where the suggested RMA components are clustered or predominant in the landscape, the area should be prioritized for inclusion. Human-made boundaries or natural features (roads, ridgelines, etc.) may have utility as easily administered RMA boundaries, if they roughly follow the outlines of the suggested components. The use of a specified linear distance should be avoided unless the distance is based upon a general grouping of features evidenced by the inventory. Without such a basis, this linear approach may be subject to challenge for being without an adequate technical basis. Designation of watersheds as RMAs may

HYPOTHETICAL RMA COMPONENTS *FIGURE 3-17*



NOTE: items in lower case letters indicate the feature that the symbol depicts. ITEMS IN UPPER CASE LETTERS INDICATE THE FEATURE SHOULD BE MAPPED AS AN RMA FEATURE

The Regulations establish two basic conditions which must characterize any area to be designated as an IDA. Section 3.4 of the Regulations states:

Areas of existing development and infill sites where little of the natural environment remains may be designated as Intensely Developed Areas.

This condition is the over-riding test before any area within the local jurisdiction can be delineated as an Intensely Developed Area. In addition to this central requirement, IDA designation is further contingent upon the characteristics of an area meeting any one of the following three conditions:

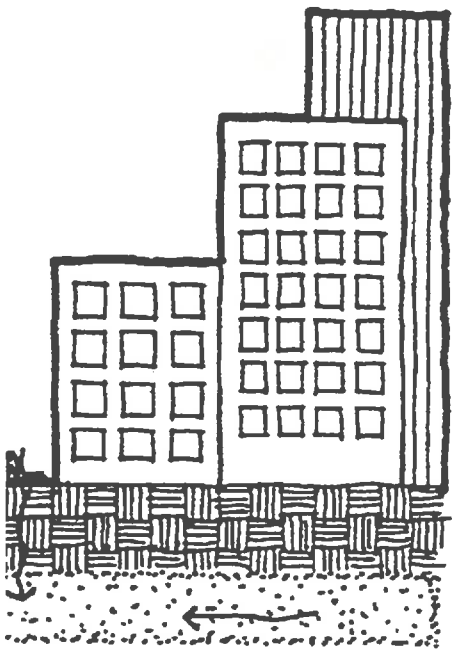
1. Development has severely altered the natural state of the area such that it has more than 50% impervious surface;

2. Public sewer and water is constructed and currently serves the area by the effective date of the Regulations (October 1, 1989). This condition does not include areas planned for public sewer and water;

3. Housing density is greater than or equal to four dwelling units per acre.

Delineating the boundaries of the IDA will entail examining the land use pattern within Chesapeake Bay Preservation Areas to determine where the above conditions are present. Local officials should begin by locating concentrations of high density development. Potential IDAs should be reviewed in relation to the comprehensive plan, particularly where the plan identifies redevelopment areas. The criteria outlined above should then be applied to determine eligibility for IDA status. The IDA boundaries should be drawn so as to bypass larger, naturally vegetated areas. At the same time, the designation process should not isolate small, individual sites as IDAs; rather, IDAs are intended to serve as areas where future redevelopment activity is focused.

NOTE: Although the Regulations do not specify a minimum size criterion for IDAs, it is recommended that local governments use a 20 acre minimum as a guide in delineating these areas.



ENDNOTES

[1] Ian McHarg, ***Design With Nature*** (Garden City, New York: The Natural History Press, 1969)

[2] Inaccuracies in the National Wetlands Inventory are also the result of variations in the resolution of the aerial photo imagery. It should be noted, however, that NWI maps usually underestimate the extent of jurisdictional wetlands, as determined using the new federal manual.

[3] See David G. Burke, Erik J. Meyers, Ralph W. Tiner, Jr., and Hazel Groman, ***Protecting Nontidal Wetlands,*** Planning Advisory Service Report Number 412/413 (Chicago: American Planning Association, 1988), 32-35. Although maps are helpful in identifying wetlands boundaries and often presenting other information about the characteristics of a particular wetland, maps typically provide only a portion of the data necessary for evaluating permit applications.

[4] The National Wetlands Inventory for the Chesapeake Bay region was prepared over a number of years (1979-1984.) U.S. Department of the Interior, Fish and Wildlife Service, ***Atlas of National Wetlands Inventory Maps of Chesapeake Bay,*** vol. 1, 1986.

[5] Burke, et al., ***Protecting Nontidal Wetlands.***

[6] Commonwealth of Virginia Department of Conservation and Recreation, ***The 1989 Virginia Outdoors Plan*** (Richmond, Va.: Division of Planning and Recreation Resources, 1989), 162-166.

[7] The Virginia Geographic Information System (VirGIS) has been developed by the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, with assistance from the Agricultural Engineering Department at Virginia Polytechnic Institute and State University. Local governments interested in additional VirGIS products other than those provided by the Department should make their inquiries to the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, (804) 786-2064.

[8] DRASTIC is another form of suitability analysis used to aid in planning for the protection of groundwater resources. DRASTIC is an acronym which stands for: D - Depth to water; R - (Net) Recharge; A - Aquifer Media; S - Soil Media; T - Topography (Slope); I - Impact (on zone of saturation between the surface and groundwater; and C - Conductivity (Hydraulic) of the aquifer. These variables represent important factors affecting the relative groundwater pollution potential of an area. A numerical DRASTIC index is calculated from available information and mapped to assess the relative groundwater pollution potential of areas in the jurisdiction. Demonstration projects have been undertaken in three Tidewater localities: Prince William, Henrico, and Middlesex County. Information assessing these projects is available from the Virginia State Water Control Board.

CHAPTER IV

PERFORMANCE CRITERIA

INTRODUCTION

The purpose of this chapter is to provide local officials with a framework of interpretation, explanation and guidance regarding the Land Use and Development Performance Criteria found in Part IV of the Regulations. These performance criteria are the second set of criteria referred to in § 10.1-2107A of the Act,

". . . for use by local governments in granting, denying, or modifying requests to rezone, subdivide, or to use and develop land in these areas."

This chapter provides clarification and guidance in implementing the performance criteria. The chapter first discusses basic principles inherent in the performance standards. The chapter next discusses the General Performance Criteria, which apply to all lands within Chesapeake Bay Preservation Areas (both RPAs and RMAs). The following sections of the chapter discuss more specific performance criteria addressing Erosion and Sediment Control, Septic Systems, Stormwater Management, Agriculture, Forestry, Wetlands and Buffer Areas.

Local Adoption Of Performance Criteria

These criteria become mandatory upon the local program adoption date. They are supplemental to the various planning and zoning concepts employed by local governments in granting, denying, or modifying requests to rezone, subdivide, or to use and develop land in Chesapeake Bay Preservation Areas. (§ 4.1.A)

This subsection of the Regulations means the requirements do not apply to individual property owners, renters or developers until the local government has officially adopted a local implementation program through ordinance, regulations or other legally acceptable mechanism. As noted in Chapter I of this Manual, localities in Tidewater Virginia have twelve months from the adoption date of the Regulations to designate their Preservation Areas **and employ** (by local adoption) the performance criteria.

Furthermore, the criteria are considered supplemental to existing planning and zoning authority and development regulations. To the extent that a locality already requires any of the performance criteria, the locality would simply continue, with whatever implementation modifications necessary to fully comply. Generally, the locality will make adjustments as necessary to incorporate the performance criteria into the existing local land use management system. Suggestions of ways to effectively implement each of the criteria are made in this chapter and in the model ordinances. (Chapter V.)

Rebuttable Presumption

Local governments may exercise judgement in determining site-specific boundaries of Chesapeake Bay Preservation Area components and in making determinations of the application of these Regulations, based on more reliable or specific information gathered from actual field evaluations of the parcel, in accordance with plan of development requirements in Part V. (§ 4.1.B)

This subsection establishes the concept of "rebuttable presumption" as applicable to the Regulations. Procedures and determinations included in a local program may be based on certain generally defensible assumptions. However, with data that is more specific to actual site conditions these assumptions may be refined.

For instance, a locality with Preservation Areas on a planning-scale map (e.g., 1:24,000 or 1:12,000 scale) will be able to assert that the types of sensitive lands listed in the Regulations can **generally** be assumed to exist within the designated boundaries. A developer will delineate site-specific boundaries of RPA features as part of the water quality impact assessment or plan of development process. Site-specific delineations may show there is less RPA land on the development site than is indicated on the planning-scale map and appropriate adjustment may be approved by the local government. Such site-specific delineations can also be useful to localities in more precisely locating and mapping their wetlands.

to requirements in § 208 of the Clean Water Act, the State Water Control Board published Virginia's first set of BMP Handbooks in 1979. These Handbooks were developed largely through the cooperative efforts of a number of state and federal conservation and environmental protection agencies. At that time, a greater number of BMPs were listed for each land use than are considered effective with current knowledge. In addition, BMP descriptions were more conceptual, since some of the recommended practices were in their infancy and had not been subjected to extensive research and the test of time.

Over the last ten years considerable research on BMPs has proven certain practices to be less effective than originally assumed. As a result, a more specific list of practices has been developed for each type of land use. Design, construction and maintenance guidelines and criteria have also been refined through experience. Virginia's BMP Handbooks are currently being revised under leadership from the Department of Conservation and Recreation, Division of Soil and Water Conservation. However, other sources providing updated guidance can be used until those revisions are completed. For urban development applications, two resources in particular provide excellent guidance:

1. ***Controlling Urban Runoff: A Practical Manual For Planning and Designing Urban BMPs,*** Metropolitan Washington Council of Governments, 1987.

2. ***BMP Handbook for the Occoquan Watershed,*** Northern Virginia Planning District Commission, 1987. [1]

Both of these resources provide information on BMP design, construction, and maintenance. (See Figure 4-1.)

For agricultural applications, information should be sought from the U.S. Department of Agriculture - Soil Conservation Service; local Soil and Water Conservation Districts; the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation; and local Virginia Cooperative Extension Service offices. All of these agencies cooperate in implementing combined agricultural conservation programs aimed at reducing agricultural NPS pollution. (See Appendix A: Government Resources.)

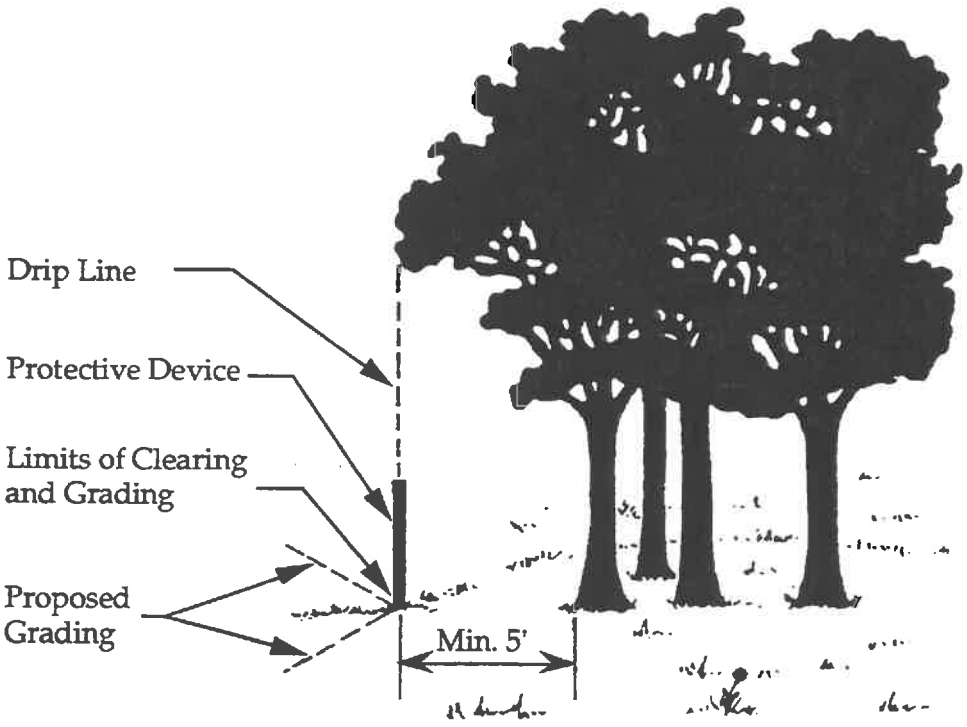
The Board agreed to allow the silvicultural industry and the Virginia Department of Forestry an opportunity to demonstrate the effectiveness of their non-regulatory forestry BMP program prior to determining whether forestry needs to be addressed by the Regulations. Therefore, there are no specific criteria applicable to silvicultural activities in the Regulations at present. However, anyone interested in forestry BMP guidance can obtain information from local offices of the Virginia Department of Forestry.[2]

The best current stormwater runoff control BMPs can remove only **60 to 65 percent** of the pollutants in runoff.[5] As the Regulations require site runoff to contain or contribute no more pollution after development than before development, there must be a balance between the amount and type of development and the amount of vegetation preserved. This is true even with the use of pollutant loading factors based on average watershed conditions. Generally, the more existing woody vegetation on-site before development, the more difficult it will be to satisfy the runoff loading control requirement if this vegetation is replaced by impervious surfaces.

Greater pollution removal efficiencies can be obtained by using a connected system of BMPs. However, such systems increase project costs and require more land area, reducing the area left for development in a manner comparable to preserving existing vegetation at little or no cost. In view of these factors, careful consideration should be given in the planning stage of a project to preserving vegetation on the site in balance with the desired development and runoff control requirements.

Local governments should consider adding provisions to their local Erosion and Sediment Control (ESC) Programs that require all ESC plans to show the limits of clearing and grading and contractors to physically mark those limits on the site. The latter should be done not only at the site's perimeter, but also around tree groupings to be preserved within the site. This can prevent damage to tree trunks and compaction over the root zones that might otherwise result in the eventual loss of the vegetation.

CONSTRUCTION TECHNIQUES TO PROTECT TREES *FIGURE 4-2*



Source: Adapted from *Virginia Erosion & Sediment Control Handbook*, 2nd Edition, 1980

ensure that the applicable performance criteria of the Regulations are satisfied.

That review process can be an expansion of a plan of development or other procedures for project review currently being implemented by a locality, such as site plan review, subdivision plan review, or stormwater management plan review. A locality may decide to initiate a new or separate review process for this program. However, a comprehensive, integrated review process for all locally required plans benefits all participants in the process.

The Board included this requirement because numerous Tidewater localities conduct little or no review of actual project plans prior to issuing building permits. A project may change considerably both in concept and in potential for impact on the environment from the time it receives zoning or subdivision plat approvals to the time the construction permits are sought.

Impervious Cover

Land development shall minimize impervious cover consistent with the use or development allowed. (§ 4.2.5)

This criterion is to be interpreted the same as §§ 4.2.1 and 4.2.2. The intent is to ensure that any use or development proposed for a property -- regardless of the zoning classification or how extensive or sparse the coverage -- is accomplished in a manner that results in the minimum impervious cover necessary to accommodate the proposed development. The intent is not necessarily to restrict developers to only those building types or concepts that result in minimal impervious cover. However, greater impervious cover results in greater runoff pollution and developers who limit the amount of impervious surface will reduce their site development costs.

Local governments may choose to adopt impervious cover performance standard thresholds. In a large sense, impervious surface is dictated by conventional setback and other bulk requirements for development. However, such building coverage restrictions have little relationship to the natural characteristics of a site or the site's capacity for the proposed use or development. Open space or natural area ratios can be used to define the limits of impervious cover based on the site's physical character. Open space ratios alone may not protect sensitive lands or minimize land disturbance unless open space is carefully qualified. For this reason, some localities have required a "natural area" ratio which limits clearing and grading to a proportion of a site and restricts impervious cover to the remaining "footprint."[6] Importantly, the restrictions of impervious surface to a certain percentage of a site need not limit the scale or intensity of the desired development.

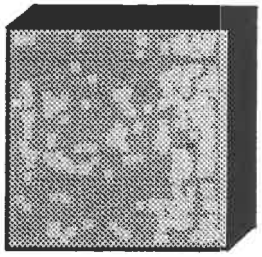
Careful site design and layout are very important in satisfying this criterion of the Regulations. Use of grass drainage ditches instead of curb and gutter, efficient layout of parking areas, minimizing the size of driveways, and minimizing site coverage by using multi-story structures where they are permitted all can be effective design techniques. Land planning and design professionals involved early in the site design phase of a project can assist a developer in enhancing the integration of the built environment with the natural environment.

Many local erosion and sediment control ordinances use the standard definition of "land disturbing activity" from §15.1-560, Code of Virginia. The language in the definition can be revised to comply with the Regulations by striking out the septic tank exemption, clarifying the single family exemption, and changing the 10,000 square foot limit as shown on the following page.

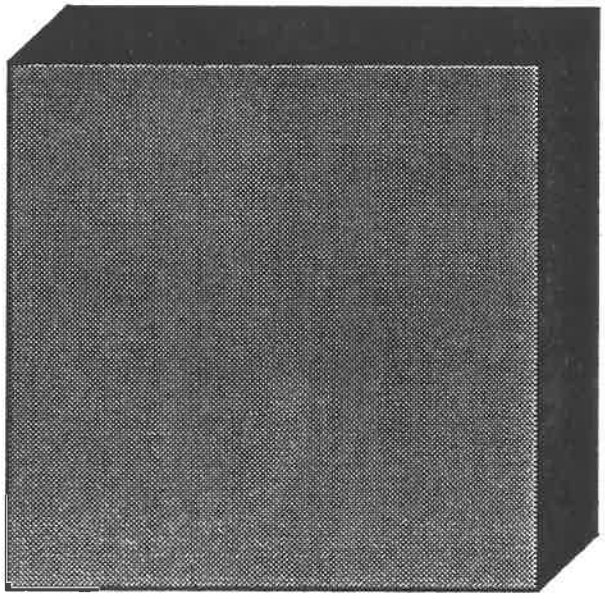
SEDIMENT VOLUME LOSS *FIGURE IV-3*

Forest: 24 tons /acre/year

Grassland: 240 tons/acre/year



Cropland: 4,800 tons/acre/year



Construction: 48,000 tons/acre/year

Source: Based on Virginia Department of Conservation and Historic Resources, ***Urban Erosion and Sediment Control in Virginia, Training Notebook,*** 1985

SEPTIC SYSTEMS

On-site sewage treatment systems serve a significant percentage of residents throughout the Tidewater region of Virginia. Some rural localities have 100 percent of their population served by on-site sewage treatment systems. Even some rapidly growing localities may have 25 percent or more of their residents served by on-site sewage treatment systems, which include: septic systems, low-pressure distribution systems, elevated sand mounds, package treatment plants, as well as other types of systems.

Package treatment plants (package plants) operate under a Virginia Pollutant Discharge Elimination System permit (VPDES) which regulates their discharge. This permit is currently issued and enforced by the Virginia State Water Control Board (SWCB.) The SWCB must first obtain a General Permit from the Environmental Protection Agency. The 1990 General Assembly gave the Virginia Department of Health (VDH) the authority to develop regulations for single family package plants with a discharge of 1000 gallons/day or less. Package plants and other systems which operate under a VPDES permit are not subject to the Regulations.

Septic systems in particular have been identified by EPA as the most frequently reported sources of groundwater contamination in the United States.[7] A properly designed, installed, maintained, and utilized septic system, however, should function well for many years.[8] Bulky wastes should not be disposed of in septic systems nor should such items as plastics, grease, liquid fats, oils, disposable diapers, other sanitary items, or toxic and hazardous chemicals. Conservation of water is also very important for the efficient function of septic-type systems.[9] A list of principles for best use of septic systems is reproduced as Table 4-1. Because septic systems have a potential to degrade water quality through surface leaching and groundwater mixing, the Regulations include performance criteria for periodic pump-out and 100 percent reserve drainfields.

PERIODIC PUMP-OUT

On-site sewage treatment systems not requiring a Virginia Pollution Discharge Elimination (VPDES) permit shall:

a. Have pump-out accomplished for all such systems at least once every five years; (§ 4.2.7)

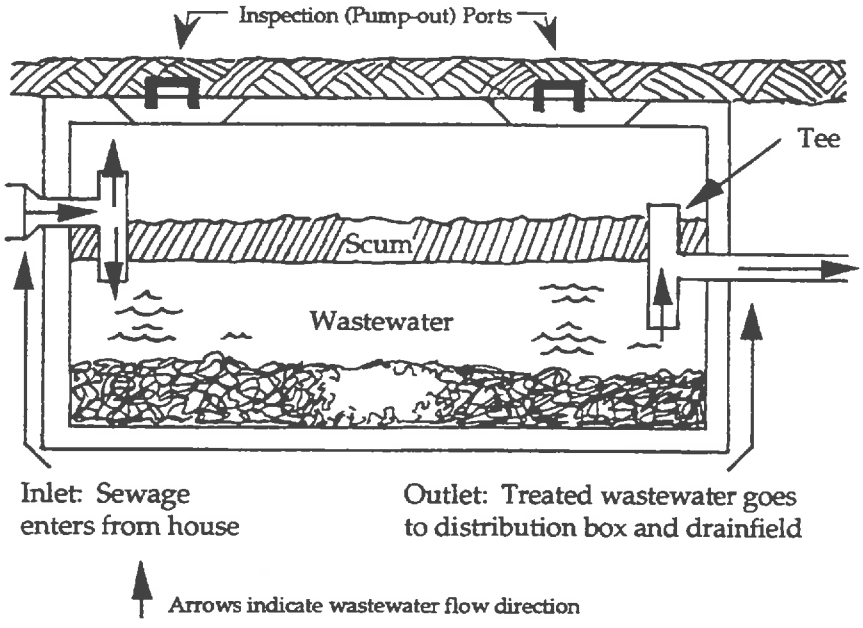
Septic systems function by providing both anaerobic (without oxygen) and aerobic (with oxygen) treatment of biological wastes. This treatment is provided by micro-organisms. Solids are transferred from commodes to the septic tank via household plumbing. Within the septic tank the solids are combined with all other household wastewater from the kitchen, bath and laundry. The solids are partially liquified and digested within the anaerobic environment of the septic tank. (See Figure 4-4.) Lighter materials float on top of the liquid in the tank and form a scum layer. Each time the septic tank fills up the overflow goes first into a distribution box and then into parallel lines of perforated pipe or open-jointed tile. These "lines" are placed in trenches partially filled with gravel and completely surrounded by soil. These trenches make up the drainfield of a conventional septic system.

Aerobic treatment of the wastewater takes place in the soil of the drainfield. If the septic tank is not pumped out, it will eventually fill up with solids. Solids will begin to be transported into the trenches and, over time, will clog the soil pores. Septic system "failure" will occur when sufficient solids have infiltrated into the soil pores to cause sewage to leach out onto the surface or back up into the residence that the system serves. Rehabilitation of a drainfield which has failed due to solids infiltration is often either impossible or ineffective, and is extremely expensive even where it can be done. In addition, long before this type of failure occurs, inefficient treatment of the wastewater may have occurred for a number of years.

In order to ensure the efficient operation of on-site sewage treatment systems, the Regulations include the provision for pump-out of all **(both new and existing)** on-site sewage treatment systems not requiring a VPDES permit and located within Chesapeake Bay Preservation Areas at least once every five years. Research by EPA and others, recommends an average pump out frequency of three to five years for conventional septic systems in order to maintain efficient effluent treatment.[10]

Additional research at Pennsylvania State University's College of Agriculture, Cooperative Extension Service resulted in the publication of an agricultural engineering fact sheet on septic tank pump-out. This paper recommends pump-out of a 750 gallon septic tank, serving a two-person household, every 4.2 years. The paper further recommends a 2.6 year pump-out frequency for use of a 750 gallon septic tank by three persons.[11] The minimum size septic tank currently allowed in Virginia for one and two bedroom homes is 750 gallons. Virginia state code currently requires a minimum septic tank capacity of 900 gallons for three bedroom homes. The Penn State recommendation for pump-out frequency of a 900 gallon septic tank with a two-person household was 5.2 years. The fact sheet is reproduced in Appendix B.

TYPICAL SEPTIC TANK *FIGURE 4-4*



Source: Virginia Water Resources Research Center, VPI&SU, *A Homeowners Guide to Septic Systems*, 1986

SEPTIC SYSTEM MANAGEMENT — TABLE 4-2

*For further information contact: **National Small Flows Clearinghouse** at 1 (800) 624-8301.*

1. CONTRACTING BY COMMUNITY
   a. ***Westboro, Wisconsin ($36/quarter)***
      - inspections and pump-out as necessary
      - accepts bids for contracts to keep costs down.

   b. ***Somers, Connecticut ($128.47/year, new $112.96/year, rehabilitated)***
      - inspection every 2 years and pump out if necessary
      - accepts bids for contracts to keep costs down.

2. MONITORING
   Stinson Beach, California ($36/quarter)
   - issues wastewater permits for two years or less
   - inspects all systems every two years

3. MANAGEMENT CORPORATIONS
   Larimar County, Colorado ($100/year)
   - fee for lot owners in rural subdivision
   - up to 2000 gallons of water delivered and up to 2000 gallons of sewage picked up annually

4. REGIONAL SEPTAGE DISPOSAL
   Towns of Wayland and Sudsbury, Massachusetts
   - built a regional facility for treatment
   - private pumpers dispose of septage free of charge
   - towns charge homeowners per gallon treatment costs
   - unpaid fees added to homeowners' taxes

5. LOCAL UTILITY MANAGEMENT
   a. ***Anne Arundel County, Maryland ($53/quarter)***
      - Mayo Peninsula residents guaranteed service
      - maintenance and replacement are county responsibilities
      - reserve fund for replacement of failed systems

   b. ***Glide, Oregon ($16/month)***
      - Septic Tank Effluent Pumps (STEP)
      - county inspects and pumps tanks every 12 years

   c. ***Otter Trail Lakes in Battle Lake, Minnesota***
      - 1,350 residences and businesses
      - one full-time operator
      - resorts and businesses inspected once a year
      - individual homes inpsected once every three years
      - private pumpers contracted
      - septage used as fertilizer

6. PUBLIC/PRIVATE AGREEMENTS
   Chesterfield County, Virginia ($10/year)
   - private pumpers submit standardized form to county
   - county maintains data base to record dates individual systems are pumped out
   - once per cycle (5 years) county notifies residents by mail with no record of pump-out
   - county contracts to have system pumped if owner does not comply (back charges and fines)
   - fees pay for staff (one inspector, two clerical), and maintenance of data base

requirements. Those VDH septic permits issued after October 1, 1989, but prior to local program adoption will undergo a second site evaluation and will be required to comply with both the 100% reserve sewage disposal site and be located outside of Resource Protection Areas to the maximum extent possible. VDH permits issued after local program adoption must comply fully with the Regulations.

Redevelopment And Expansion Of Existing Structures

The Regulations state in § 4.2.7.b that a 100% reserve sewage disposal area shall be set aside for "new construction." All redevelopment in Chesapeake Bay Preservation Areas constitutes new construction and would require a 100% reserve sewage disposal area. For lots or parcels recorded prior to October 1, 1989, however, this requirement would apply only to the extent that there is sufficient area on that lot or parcel for the 100% reserve area.

Expansion of existing structures within Chesapeake Bay Preservation Areas could require a 100% reserve sewage disposal area depending on the size of the expansion. The Regulations define 2,500 square feet as the threshold for substantial alterations within Resource Management Areas (RMAs). Any alteration within Resource Protection Areas (RPAs) may be considered substantial. If an expansion of existing structures will require a new on-site sewage treatment system permit from the Health Department, then a 100% reserve sewage disposal area will also be required unless the lot or parcel was recorded prior to October 1, 1989 and there is insufficient room for the 100% reserve area. A local government could, therefore, by reasonable interpretation of § 15.1-492 of the Code of Virginia, require a 100% reserve area for any substantial alteration of existing structures within Chesapeake Bay Preservation Areas even where the nature of the expansion would not otherwise require a new sewage disposal permit from the Health Department.

Alternating Drainfields

There is another method to prolong the useable life of a conventional drainfield. Fairfax County has required a diversion valve, as illustrated in Figure 4-6, since June 1984. Citizens are notified by the county to turn their diversion valve once a year. By so doing, half of each drainfield is taken out of use every year. This action prevents excess buildup of a biological mat and allows sufficient time for breakdown of a mat which has developed. Such a technique could be employed between two full-size drainfields if initial failure occurs due to biological mat buildup alone. In addition to alternating between each half of the drainfields, Fairfax County achieves more sidewall storage of effluent within the drainfield trenches by requiring more gravel between the lines and the gravel/soil interfaces.

The 100% reserve drainfield requirement can be met by alternating between halves of one drainfield annually if an additional 50% reserve is maintained and alternation between the two halves of a drainfield is assured. The spirit of the requirement is met given this circumstance because the 50% reserve of the total drainfield area equals 100% of the drainfield capacity in use at any given time.

STORMWATER MANAGEMENT

INTRODUCTION

Most routine and human activities introduce contaminants into the earth's environment. Just driving a car to work, letting the dog outside, or applying an extra bag of fertilizer in the fall hoping to make the spring lawn a *little* bit greener can take a toll on our waterways. Natural processes also release contaminants from volcanic eruptions, forest fires and hurricane battered shorelines. Contaminants introduced into state waters from such diffuse activities and locations are collectively called "nonpoint source" (NPS) pollution. Rarely can we control the forces of nature. However, we can modify both individual and collective practices to improve, enhance, and protect water quality. This section discusses the ways stormwater management (SWM) practices can be applied toward the goals of the Act by explaining the SWM criteria in § 4.2.8 of the Regulations and describing ways to improve and reduce the runoff from the places where we live and work.

As development occurs, existing local stormwater management programs have handled the increased rate and volume, velocity and flow rate of runoff by requiring developers to construct on-site ponds and drainage systems that control one or more of those runoff characteristics. In some cases, localities have conducted regional stormwater management studies and publicly funded stormwater improvements including elaborate drainage systems, channelized watercourses, dams, and reservoirs. However, very few localities have required developers to control increased loads of pollutants in runoff resulting from their development projects.

The Chesapeake Bay Preservation Act recognizes NPS pollution as having a significant and detrimental effect on the Chesapeake Bay. Passage of this legislation demonstrates that the General Assembly values the Chesapeake Bay enough to protect *and improve* its water quality. In order to protect the Bay's resources, localities at large are charged to:

"... encourage and promote [the] ... prevention of any increase in pollution [and the] reduction of existing pollution ..." (§ 10.1-2107)

These provisions of the Act are reflected in regulatory criteria that require **no net increase** in NPS loads resulting from **new development** projects and a **10 percent reduction** in NPS loads resulting from **redevelopment** projects.

In 1989, the General Assembly passed the State Stormwater Management Act (§ 10.1-603.1 et seq., Code of Virginia) that provides localities optional authority to adopt local stormwater management ordinances consistent with minimum state regulations. Most localities have required stormwater management for years to control flow volume and velocity through erosion and sediment control ordinances and floodplain regulations. However, until passage of the SWM Act and previously noted amendments to § 15.1-489 of the state zoning code, no **clear** authority for localities to protect water quality existed. The SWM Act integrates all of these objectives into one piece of comprehensive enabling legislation.

Although the Chesapeake Bay Preservation Act preceded the SWM Act, the objectives for NPS pollution control are consistent. As well, the Department participated in the Department of Conservation and Recreation's regulatory development advisory committee to ensure that the SWM criteria in the Regulations would be consistent with regulations adopted pursuant to the SWM Act (proposed VR 215-02-00.)

If localities have a stormwater management ordinance, the SWM criteria of the Regulations should be **integrated into** the local program. However, the Regulations must be implemented within Chesapeake Bay Preservation Areas even if a locality chooses **not** to adopt a local SWM ordinance.

New Development

Stormwater runoff is a principal transporter of NPS pollution. Chapter II describes how pollutants enter and are transported by the water system.

*For development, the post-development nonpoint source pollution runoff load **shall not exceed the pre-development load based upon average land cover conditions**... (§ 4.2.8)* [emphasis added]

The Manual includes a guidance calculation procedure that outlines the technical standards to meet this performance criterion. The guidance calculation procedure has been designed to be easy to use, even for those localities without an engineer or technically trained employees. The guidance calculation procedure will not produce the design of a BMP structure. The procedure will merely indicate what level of performance is required of a BMP. The Department will provide training in use of the calculation procedure to local government staff.

NOTE: The guidance calculation procedure is provided in Appendix C and is formatted as a pull-out leaflet for immediate distribution.

Because NPS pollution encompasses many different contaminants (such as sediment, nutrients, metals and toxic substances), the procedure is based on the concept of **keystone pollutants**. A keystone pollutant shares the general characteristics of most other urban pollutants.[12] Although the Act and Regulations refer to sustaining no net increase in "nonpoint source pollution" collectively, accurate modelling, monitoring, and control of <u>all</u> pollutants would be cost-prohibitive. Properly identified, keystone pollutants can be realistic indicators of total nonpoint source pollution loads. Both pre- and post-development loadings should be determined by the same procedure to ensure consistent methodology.

The guidance calculation procedure also provides guidelines for localities in order to designate "average land cover conditions." The Board included a default average land cover condition clause in the Regulations to

For New Development

$$NPS_{\text{POST-DEVELOPMENT}} \leq NPS_{\text{PRE-DEVELOPMENT}}$$

ment sites, the following provision(s) must be satisfied to constitute "being served by water quality best management practices":

(1) **In general, runoff pollution loads must have been calculated and the BMP selected for the expressed purpose of controlling NPS pollution.** However, if existing facilities can be shown to achieve the current standard of NPS pollution control, local authorities *may* consider the site as being served by water quality BMPs.

(2) **If BMPs are structural, facilities must currently be in good working order, performing at the design levels of service.** The local authority may require a review of both the original structural design and maintenance plans to verify this provision. A new maintenance agreement may be required to ensure consistency with the locality's SWM requirements.

As with the performance criterion for development, the post-development loads for a redevelopment site should be calculated. However, in the case of redevelopment, **default loads (e.g. average land cover loads for a watershed) may not be used to establish a pre-development load.** The pre-development load for a redevelopment site must be determined based upon the existing conditions on the site. In cases where existing development is served by BMPs and the original design data is still available, the original post-development NPS loadings may be substituted for the "existing" development NPS loadings.

For redevelopment sites not served by BMPs, modern techniques for NPS pollution control must be employed to achieve a minimum 10 percent reduction from existing pollutant loadings.[13]

Where sites are small or coverage is proposed to be extensive, underground BMPs such as cisterns with detention features may be necessary if sufficient open space cannot be provided.

FOR SITES SERVED BY BMPS:

Before the Regulations:

$NPS_{\text{EXISTING DEVELOPMENT}} \leq NPS_{\text{PRE-DEVELOPMENT}}$

After the Regulations:

$NPS_{\text{REDEVELOPMENT}} \leq NPS_{\text{PRE-DEVELOPMENT}}$

NOTE: A future installment of the Manual will generally describe selection, design, construction, and maintenance of BMPs appropriate for use in Tidewater Virginia.

If, however, the site is located in an area served by an adopted regional SWM plan which satisfies this criterion as a whole, participation in that regional plan will be considered as complying with this section under option #2. Localities must demonstrate that their program achieves water quality protection standards equivalent to the goals of the Regulations. In addition, all locally adopted SWM programs should be consistent with state laws and regulations covering SWM and erosion and sediment control.

Another means of satisfying the Regulations, option #3, allows developer participation in SWM programs necessitated by the federal Clean Water Act's storm sewer discharge permit requirements, after such a program is implented by a local government. The federal program will consist of two tiers with separate timeframes. Localities with populations exceeding 250,000 are in the first tier and localities with populations between 100,000 and 250,000 are in the second. By including option #3, the Board assumes the EPA program will achieve water quality protection at least equivalent to the Regulations. Even if programs have standards different from the Regulations, EPA approval of such programs will classify them as equivalent under this provision.

Some redevelopment sites, particularly those proposing a high proportion of impervious cover, may have significant difficulties complying with the 10% NPS pollution reduction requirements. Impervious areas increase both runoff and pollutant loadings.

In general, maintaining or restoring areas of natural vegetation plays a major role in effective stormwater management and NPS pollution control by infiltrating and filtering more of rainwater. Vegetated areas:

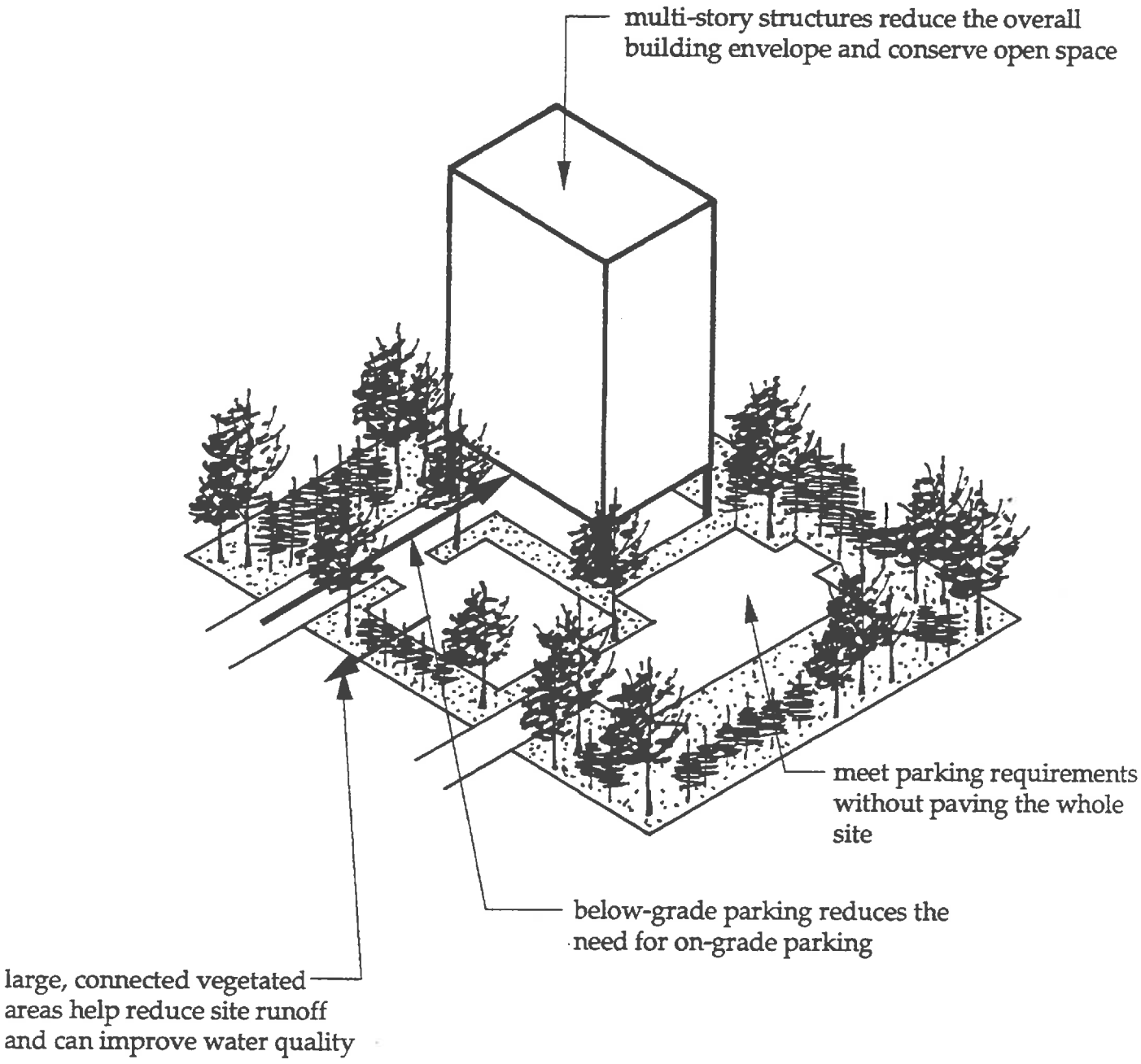
1. Reduce runoff volumes;
2. Generally provide for greater infiltration, further reducing runoff;
3. If on-grade and properly placed can intercept, filter, and infiltrate runoff generated on other impervious areas;
4. Have aesthetic value; and
5. Generally need less maintenance to remain effective.

For all these reasons, converting impervious areas to vegetated areas under option #4 is one way to reduce NPS pollution runoff -- a BMP in its own right. Experience with SWM programs shows a 1% reduction in NPS pollution can be achieved for every 1-2% of the land restored to vegetation.[14]

To achieve these goals and to comply with the provisions of option #4, **the entire 20% of the vegetated area should be continuous, permanent, and on existing grades.** If possible, areas should be placed so non-erosive sheet flow runoff from impervious areas can pass across and through the vegetated area. Vegetation suggested in the section addressing buffer areas (see pages IV-45-60) would most likely have appropriate mitigating qualities.

The Board specifically included this reference to clarify its intent **not** to treat minor expansions as redevelopment. While any expansion *can* degrade water quality by creating more impervious surface, local authorities will be expected to make reasonable judgments concerning "maintenance, alteration, use or improvement(s)." Localities are encouraged to use existing expansion classification policies or establish guidelines to address such cases. Consistency should be a goal.

PROPOSED TYPICAL DEVELOPMENT *FIGURE 4-11*



Conservation Plans

Conservation plans as a voluntary practice have been part of the agricultural management programs of both SCS and local SWCDs since the 1930s. Conservation plans are based on the principle of "land capability" – every acre of land has its own specific potential and constraints. To achieve the most productive long-term use of the land while protecting it from erosion and water quality degradation, land capability must be the foundation of any plan for agricultural management. Conservation plans take into account the particulars of local soils and climate conditions, as well as the specific type of agricultural operation. They may include a single BMP or a combination of BMPs.

Agricultural conservation plans are developed by a technical expert in coordination with a land operator, who may be either the farm owner or a farmer who leases the land. They examine the land, study the local soil survey covering that farm, and discuss the land use objectives and priorities of the farmer. The resulting plan is a record of decisions the land operator will carry out.

In recent years, regulations have made cost-share benefits contingent on the development of conservation plans on certain agricultural lands. Since passage of the 1985 Food Security Act, farms with highly erodible lands have been required to develop conservation plans for those lands in order to receive USDA Farm Program benefits. In Virginia, DSWC has initiated a nutrient management program which offers farmers technical assistance and cost-share incentives for determining optimum use of chemical fertilizers and manure. Some conservation plans also include integrated pest management (IPM). The Extension Service promotes IPM techniques as an alternative to routine application of pesticides and herbicides in a preventive spray program. In addition, the Extension Service promotes the benefits of nutrient and conservation plans to the agricultural community.

Agricultural Requirements of the Regulations

Land upon which agricultural activities are being conducted, including but not limited to crop production, pasture, and dairy and feedlot operations, shall have a soil and water quality conservation plan. Such a plan shall . . . accomplish water quality protection consistent with the Act and these regulations. Such a plan will be approved by the local Soil and Water Conservation District by January 1, 1995. (§ 4.2.9)

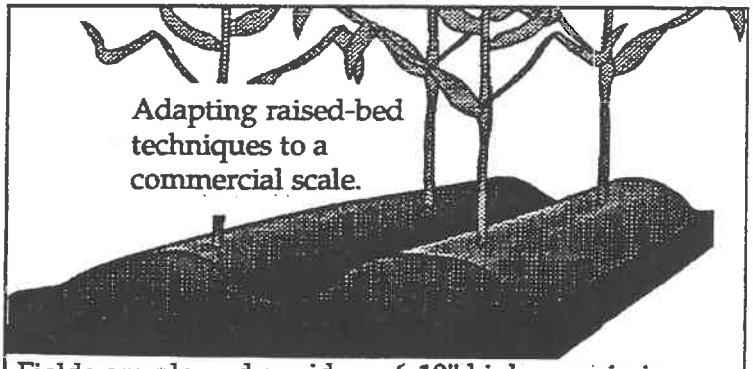
Chesapeake Bay monitoring efforts carried out by the Environmental Protection Agency (EPA) prior to the Chesapeake Bay Agreement identified agricultural lands as a significant contributor of sediment and nutrient pollution. EPA's 1983 Chesapeake Bay Study estimated that runoff and soil erosion from agricultural lands contributed about 37% of the nutrients entering the Bay from the James River basin.[15] During the same period, cropland was estimated to contribute an average of 60% of the nitrogen and phosphorus found in the York River.[16] Figure 4-12 (on the next page) shows that, although there are many sources of nonpoint source pollution in the nation's rivers, agricultural lands contribute a large share.

Because of the adverse impact of pollutants from agricultural lands on water quality, the Regulations require the development of soil and water quality conservation plans for all agricultural lands within Chesapeake Bay Preservation Areas (CBPAs). These plans, which must be approved by the

These levels are called Resource Management Systems and Acceptable Management Systems.

All such conservation systems address five major resource concerns - soil, water, air, plants, and animals - through the use of a combination of conservation practices and management. A Resource Management System will meet a defined minimum level of protection for all five concerns.

RIDGE-TILLAGE *FIGURE 4-14*

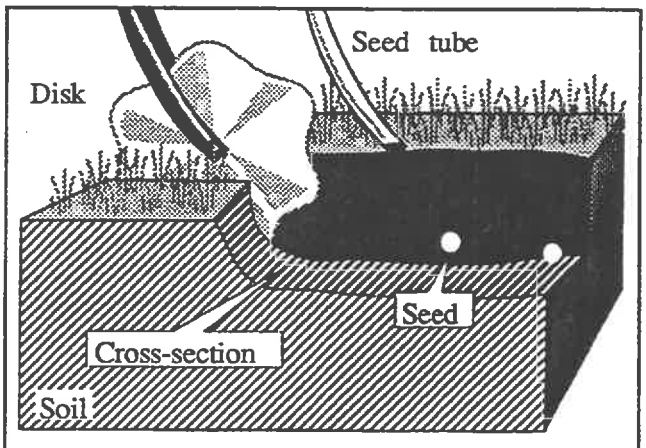


Fields are plowed so ridges, 6-10" high, remain in the same place. All wheeled traffic stays in valleys.

Source: The *Richmond Times-Dispatch*, April 10, 1990

Under certain situations, implementation of a total Resource Management System is not practicable due to the existence of social, cultural, or economic constraints identified for the resource area. Acceptable Management Systems can be developed for such situations. It is important to understand that Resource Management Systems and Acceptable Management Systems address issues beyond the scope of the Regulations, which focus on water quality protection. However, because they are so comprehensive Resource Management Systems and Acceptable Management Systems consistent with SCS policies will be considered in compliance with the Regulation's agricultural criteria provided that the issues of erosion control and nutrient and pesticide management are addressed.

NO-TILL CULTIVATION *FIGURE 4-13*



Minimal soil disturbance and residue from previous crop reduce runoff and erosion.

Source: *Richmond Times-Dispatch*, April 10, 1990

BEST MANAGEMENT PRACTICES

Some of the more prominent agricultural BMPs recommended by conservation plans in the Tidewater area are conservation tillage, streambank stabilization, grass waterways, cover crops, filter strips, critical area planting, nutrient and pest management, and erosion control structures.

The employment of BMPs on farmland or the development of a soil and water quality conservation plan will allow flexibility in the amount of buffer area required for that land as provided by the Regulations. As discussed in greater detail in the section on buffer areas, buffer areas for agricultural lands may be reduced to 50 feet when BMPs are in place on the adjoining land, and to 25 feet when a soil and water quality conservation plan has been implemented on that land. It is

ample, a farmer may reduce fertilizer costs while maintaining or, in some cases, boosting productivity by carefully controlling the rate of application and by applying fertilizer when it will be most efficiently taken up by crops. The farmer can also reduce costs by substituting manure produced on the farm for chemical fertilizers. Such principles are consistent with the concept of sustainable agriculture promoted in recent years by many segments of the agricultural community, including the land grant university system.[18]

Local Governments and Conservation Planning

In order to meet the requirements of the Regulations, local governments must establish an enforceable procedure to track the approval of conservation plans on agricultural lands within Chesapeake Bay Preservation Areas. Once the locality has designated its CBPAs, agricultural lands in those areas can be identified with the aid of the local soil and water conservation district. In local zoning ordinances or other regulations, a requirement could be included that an owner of agricultural lands must provide evidence of compliance with the requirements. The ordinances could specify what constitutes acceptable evidence. For example, the official minutes of the district board could stipulate that the required conservation plan has been approved or implemented.

The Department recommends that a locality develop a "Memorandum of Understanding" with its local Soil and Water Conservation District to take advantage of the technical resources available through the district programs. Such a memorandum could include the following agreements:

- The local government will provide the local district with a map of their designated Chesapeake Bay Preservation Areas;

- The local district will provide the local government with a list of landowners in these areas who already have an ap proved conservation plan which meets the intent of the Regulations, and up date the list of approved conservation plans on a routine basis;

- The local district will prioritize the development of soil and water quality conservation plans for the farms of landowners in CBPAs that do not already have them, and track compliance.

The results of district-conducted spot checks of installed BMPs should be made available to local governments, who could use that information to determine the need for more monitoring or enforcement measures. The spot-check procedure could be similar to the program conducted by districts to determine proper installation of cost-share practices. Before legal measures are implemented to secure compliance, a process of education should be used to motivate the noncomplier. Legal measures may include penalties typical of other zoning violations.

FORESTRY

Silvicultural activities in Chesapeake Bay Preservation Areas are exempt from these regulations provided that silvicultural operations adhere to water quality protection procedures prescribed by the Department of Forestry. (§ 4.2.10)

Silvicultural Best Management Practices for water quality have been carried out as a voluntary program by the Virginia Department of Forestry (DOF) for some years. In July of 1988, DOF resolved that water quality protection would be a priority. A goal was set to reduce sedimentation in the Chesapeake Bay from silvicultural sources by 40% by the year 2000, in accordance with the 1987 Chesapeake Bay Agreement.[19] In 1989, the Department of Forestry published a new handbook, ***Forestry Best Management Practices for Water Quality in Virginia***, which explains the purpose of and provides technical specifications for forestry BMPs.

The Department of Forestry's Best Management Practices program was developed through a cooperative process including organizations such as the Virginia Forestry Association, forest landowners, Virginia Tech, and others. These groups recognized that Best Management Practices are good forestry practices which not only protect water quality, but also save time and money for loggers by reducing maintenance and repair costs to their operations.

The Department of Forestry has held training meetings statewide to acquaint loggers and foresters with Best Management Practices. DOF has also developed a methodology for evaluation of BMP compliance and effectiveness which uses a central computerized database. The results of these BMP inspections will become part of a water quality assessment and monitoring program which will also include baseline data, direct water quality sampling, analysis of forest disturbance trends, and outside research.[20]

In developing management regulations for the Chesapeake Bay Preservation Act, the Local Assistance Board recognized the existence of on-going water quality protection efforts by the forestry industry. The Board believed that elective BMP procedures already in place should be given more time to prove their effectiveness before additional regulations on forestry are instituted; as a result, the Regulations do not **require** the implementation of forestry BMPs. However, a review of existing forestry BMP programs by July 1, 1991, will evaluate their effectiveness at protecting water quality to ensure that they achieving an equivalent level of performance, consistent with the Act and Regulations.

NOTE: The Department is developing a program for wetlands delineation training in coordination with the Corps and SWCB. Training workshops will be conducted for Tidewater local government staff at little or no cost.

Wetlands designated as Resource Protection Areas (RPAs) are generally only eligible for water-dependent development and redevelopment, whether or not a permit can be obtained for a project. The current wetlands permitting processes are different for tidal wetlands than for nontidal wetlands. Highlights of these permitting processes and the jurisdiction of federal, state, and local agencies over wetlands are examined in the following sections.

NONTIDAL WETLANDS

The principal federal agency which administers permits for impacts to wetlands (tidal or nontidal) is the U.S. Army Corps of Engineers. The Corps is currently the **only** permit-issuing agency for impacts to nontidal wetlands within Virginia. The **SWCB must issue or waive issuance of a 401 water quality certificate prior to a Corps permit issuance.** The Corps receives its authority to regulate wetlands under Section 404 of the Clean Water Act of 1977 (33 U.S.C. 1251, as amended). Corps regulations concerning wetlands are found in 33 CFR, Parts 320 through 330. The Corps may issue or deny permits for the discharge of dredged or fill materials into waters of the United States, including wetlands.

The Environmental Protection Agency (EPA), the Fish and Wildlife Service (FWS) under the Department of the Interior, and the National Marine Fisheries Service (NMF) under the National Oceanic and Atmospheric Administration (NOAA) act as federal advisory agencies to the Corps for the issuance and conditions of 404 permits. The Corps is required to solicit and consider the recommendations of these advisory agencies. Of these advisory agencies, EPA has the authority to veto a Corps permit.

Both the Corps and EPA have the authority to take enforcement action against violators of 404 permits. The other advisory agencies may report suspected permit violations. There are both criminal and civil penalties for violations of the conditions and requirements of a 404 permit, and for failure to obtain a permit when required by law.

Where other forms of wetland mitigation, including avoidance and minimization of impacts, have been attempted and the project is considered by the Corps to be in the public interest, compensation (replacement) may or may not be required. The Corps and EPA enacted a memorandum of agreement (MOA) on February 7, 1990. This MOA is "consistent with President Bush's goal of no overall net loss of wetlands and affirms the Corps existing policy of striving to avoid adverse impacts and offset unavoidable adverse impacts to aquatic resources...the MOA expressly recognizes that achieving no net loss of wetlands values and functions is not possible for every permit action. The President's Domestic Policy Council Interagency Working Group on Wetlands is currently developing policy on no overall net loss of wetlands."[22] The decision as to whether to require compensation and the ratio (1:1, 2:1, etc.) of replacement wetlands to impacted wetlands is made on a case by case basis.

- Construction or maintenance of farm or stock ponds, or irrigation ditches, or the maintenance of drainage ditches.

However, even the activities noted above **do** come under the jurisdiction of the Corps if, when conducted, they result in the conversion of a wetland or other waters of the United States to a use or condition to which it was not previously subject. In such cases, a 404 permit may still be required. The Corps should be consulted on a case by case basis when questions arise as to permit requirements for various activities.

Also, Virginia has a Coastal Resources Management Program (CRMP) funded by the federal government through NOAA. The Council on the Environment reviews applicable 404 permit proposals to determine consistency with the CRMP, which is commonly called Coastal Zone Management (see Appendix A). If a proposal is determined to be inconsistent with the goals of the CRMP, the state may object to issuance of a 404 permit. In such instances, NOAA acts as a mediator between the Corps and the Council but only the federal Secretary of Commerce can allow the Corps to issue a 404 permit over the state's objection, if the objection cannot otherwise be resolved.

Tidal Wetlands

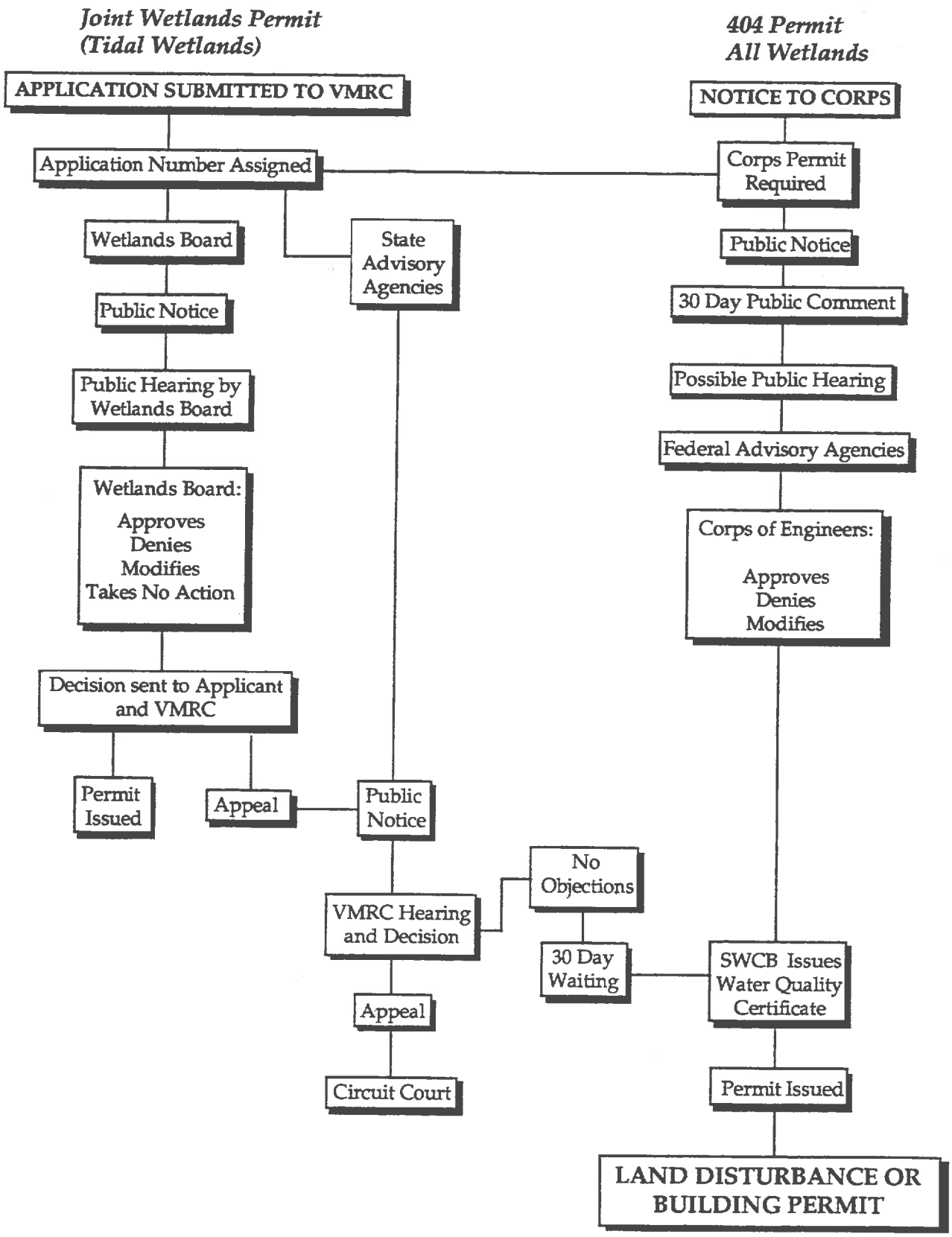
If an area has tidal wetlands, an applicant would normally use the joint permitting process through the Virginia Marine Resources Commission (VMRC). VMRC is the state agency which regulates activities within tidal wetlands. VMRC derives its authority to issue permits for activities in or **over** tidal wetlands and state-owned stream (subaqueous) bottoms from Title 62.1 of the Code of Virginia. The state has ownership of most stream bottoms as well as aerial rights over those stream bottoms. VMRC receives comments from state advisory agencies prior to issuance of a permit. These advisory agencies are: the Virginia Institute of Marine Science; the Departments of Game and Inland Fisheries; Conservation and Recreation; Historic Resources; and Health. The SWCB, the Virginia Department of Transportation, and the Council on the Environment also comment on applications for some tidal wetlands permits.

VMRC also acts as a clearinghouse for **joint** permits, which require the approval of VMRC, the Corps, and/or local wetlands boards. Joint applications should be submitted to VMRC who will, in turn, forward copies to the local wetlands board if the locality has one. This joint permit application saves time and ensures some consistency in permit conditions. The authority of local wetlands boards has to date been limited to tidal wetlands under §§ 62.1-13.5 and 62.1-13.6, Code of Virginia. An applicant can appeal denial by a local wetlands board of a tidal wetlands permit to VMRC. VMRC may also review permit approvals by a local wetlands board when any of the following occur:

- The local government requests it;
- The Commissioner of VMRC believes that the policies, guide lines, or standards of Title 62.1 have not been achieved; or
- 25 or more property owners from where the site will be located properly petition VMRC.

WETLANDS PERMIT PROCESS

FIGURE 4-16



BUFFER AREAS

INTRODUCTION

As discussed in Chapter II, vegetated buffer areas or filter strips have been found to reduce sediments in surface stormwater runoff, as well as nutrients and other pollutants that adhere to these sediments. While filter strips provide for the physical control of runoff and pollutant loadings, buffer areas are considered to be more comprehensive in character. Studies indicate that wooded buffer areas are more effective than grassed strips in terms of stormwater runoff control. In situations where a wooded buffer area cannot be preserved on site, a grassed filter strip should be managed to gradually become wooded by intentional plantings.[24]

Wooded buffer areas combine the physical control of filter strips with an added aesthetic component through a mixture of plant species that replicate the natural forest edge condition. In situations where buffer areas must be created, the initial provision of a variety of plant species and forms allows the buffer to mature over time until the forces of plant succession nurture a naturalized forest edge condition.

Research has shown that creatively landscaped filter strips and buffer areas can become a valuable community amenity, providing wildlife habitat, screening, and stream protection, in addition to stormwater runoff control.[25] Natural buffer areas have been shown to provide excellent wildlife habitat, particularly for "edge" species of songbirds and mammals. The judicious planting of selected indigenous trees, shrubs, and grasses can result in the enhancement of the quality and quantity of food and cover necessary for the maintenance of wildlife habitat which further adds to the human livability of an area.[26]

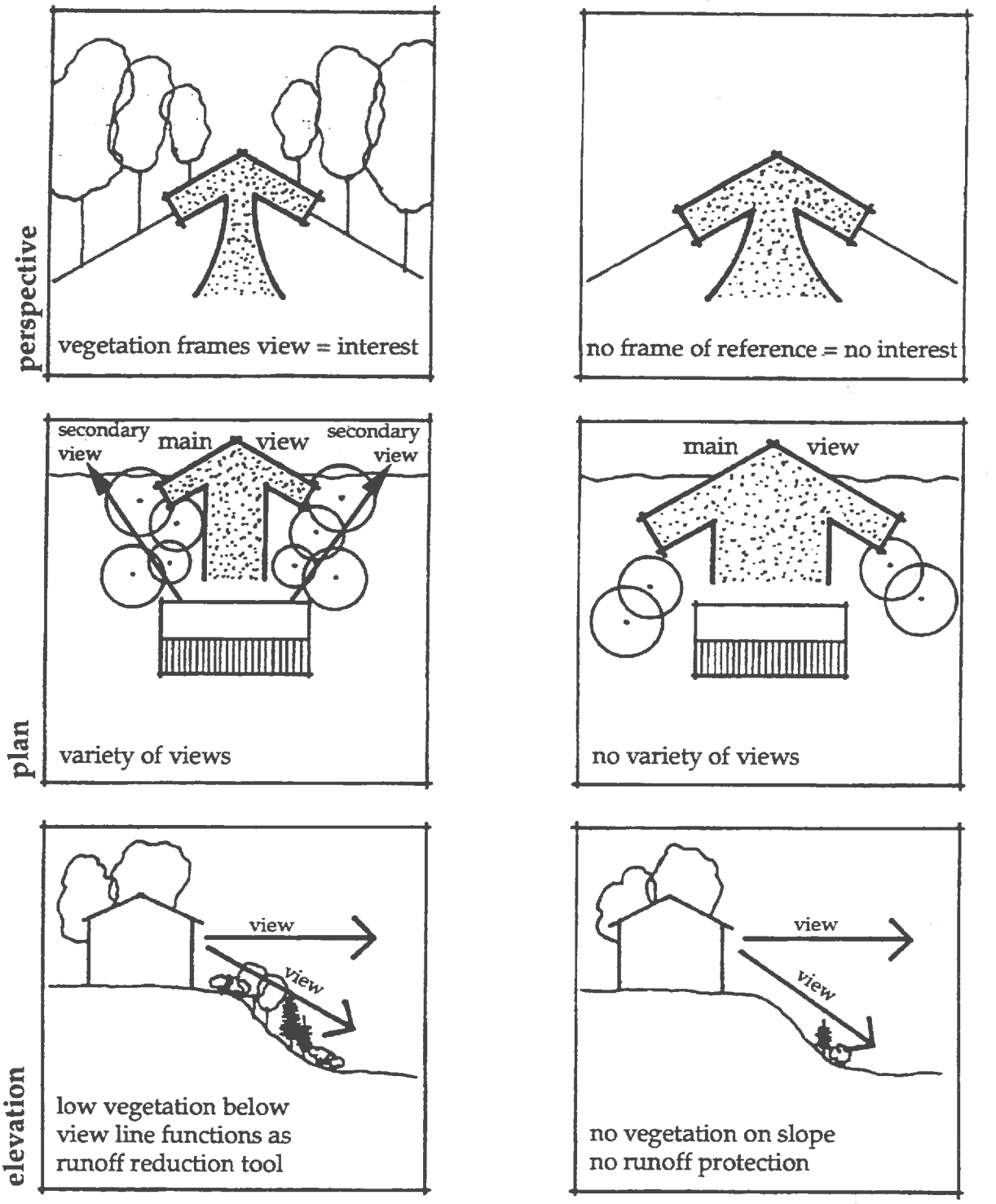
Traditional land planning has attempted to utilize the site in the most "efficient" manner possible, where "efficient" was considered to be the provision of the largest number of lots or the greatest building floor area allowed by zoning. Trends in zoning and land use regulations have emphasized the inclusion of buffer areas into the site development process essentially as an instrument to screen or "buffer" incompatible land uses. However, recent regulatory programs focused on water quality protection recognize the role buffer areas play in the reduction of off-site stormwater runoff and pollutant loading.[27]

Buffer areas are an important and requisite element of the Regulations. As stated in the Regulations, buffer areas are required:

To minimize the adverse effects of human activities on the other components of the Resource Protection Area, state waters, and aquatic life, a 100-foot buffer area of vegetation that is effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff shall be retained if present and established where it does not exist. The 100-foot buffer area shall be deemed to achieve a 75% reduction of sediments and a 40% reduction of nutrients. (§ 4.3.B)

This language in the Regulations that pertains to specific sediment and nutrient removal rates attributable to the use of a 100-foot buffer area essentially creates a quantifiable level of performance, a performance standard, that all buffer areas must achieve.

PROVISION OF REASONABLE SIGHT LINES *FIGURE 4-17*



FILTERED VIEWS vs. UNRESTRICTED VIEWS

SILVICULTURAL THINNING

Dead, diseased, or dying trees or shrubbery may be removed at the discretion of the landowner, and silvicultural thinning may be conducted based upon the recommendation of a professional forester or arborist. (§ 4.3.B(1)c)

The removal of dead, diseased and/or dying trees or shrubbery is allowed in the buffer so long as the removal process does not contribute to the degradation of adjacent water resources. In fact, the removal of diseased or dying plants would likely result in the rejuvenation of the remaining plant species since more nutrients, water, and sunlight, would be available for remaining plant species.

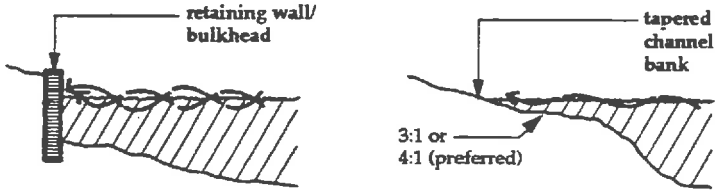
Silvicultural thinning is a method of species rejuvenation utilized by many forest management agencies where undesirable species are removed so other more valuable species can develop to their full potential. In buffer areas, shallow-rooted species may be removed to allow the establishment of more deeply-rooted species that offer a more significant contribution in terms of runoff reduction. However, care must be taken when thinning so that site erosion is not accelerated through the removal of too much valuable soil cover at one time, since such removal may result in the buffer area not meeting equivalency performance provisions.

SHORELINE EROSION CONTROL

For shoreline erosion control projects, trees and woody vegetation may be removed, necessary control techniques employed, and appropriate vegetation established to protect or stabilize the shoreline in accordance with the best available technical advice and applicable permit conditions or requirements. (§ 4.3.B(1)d)

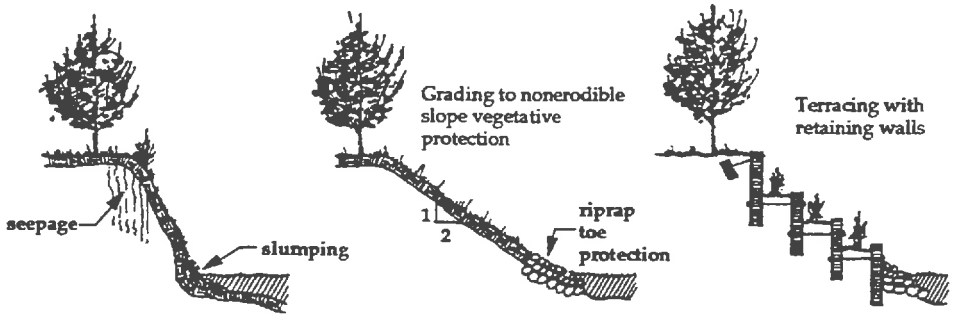
Non-structural shoreline measures are preferred over structural measures where structural measures are not absolutely necessary to control the erosion problem. Structural measures can aggravate erosion problems at adjacent properties.

SHORE STABILIZATION EXAMPLES FIGURE 4-20



Vertical bulkheads reflect a large percentage of wave energy and agitate the water surface, and can result in erosion damage to adjacent properties.

Tapered channel banks, with or without rock facing, absorb and dissipate the force of the waves.



flexibility for purchasers of lots where the buffer area was reduced. In such a situation, the developer should ensure several things:

1 BMPs placed within the buffer area should discharge in sheet flow or in some other manner that prevents the discharge from channeling through the buffer;

2 The buffer area equivalency criteria mentioned above should be satisfied for the parcel or parcels in question;

3 The BMP must be included in the long-term maintenance plan provided for the entire system by the developer; and

4 The reduced options of the parcel purchaser should be disclosed in the parcel purchase transaction.

Furthermore, in designing BMP systems that treat runoff from an entire development, the buffer itself may **not** be included as a BMP in the overall system. To do so would have the effect of allowing double credit for buffer area pollutant removals, as follows: (1) credit in the pre-development runoff loading equation, since the buffer area is undeveloped, vegetated land; and (2) credit in the summary of BMP pollution removal rates used to match the pre-development loading.

NOTE: The Department will prepare a procedure for local government use in determining buffer area equivalency. The procedure will be available as an appendix in the next installment of the Manual.

In the second circumstance, where the BMP system for the entire development is in place but the lot or parcel owner needs more building or yard space, the owner must ensure that appropriate BMPs are located **on the subject lot or parcel** in a manner that ensures equivalency with buffer area pollutant removal efficiencies required by the Regulations.

Buffer width modification should only be considered for situations where available site area is at such a minimum that it would preclude site development.

Examples of appropriate BMPs for the homeowner include directing impervious driveway and parking area runoff into an infiltration trench or directing roof drains into a dry well or french drain. Again, it is important that the BMPs used in such cases infiltrate the water into the ground or discharge it in a manner that prevents erosion and protects the functional integrity of the buffer area.

Loss of a Buildable Area

When the application of the buffer area would result in the loss of a buildable area on a lot or parcel recorded prior to the effective date of these regulations [October 1, 1989], modifications to the width of the buffer area may be allowed in accordance with the following criteria:

a. modifications to the buffer area shall be the minimum necessary to achieve a reasonable buildable area for a principal structure and necessary utilities;

b. where possible, an area equal to the area encroaching the buffer area shall be established elsewhere on the lot or parcel in a way to maximize water quality protection;

c. in no case shall the reduced portion of the buffer area be less than 50 feet in width. (§ 4.3.B(2))

Modifications to the buffer area in agricultural lands are allowed in the Regulations, as follows:

The agricultural buffer area may be reduced as follows:

a. to a minimum width of 50 feet when the adjacent land is enrolled in a federal, state, or locally-funded agricultural best management program, and the program is being implemented, provided that the combination of the reduced buffer area and the best management practices achieve water quality protection, pollutant removal, and water resource conservation at least the equivalent of the 100-foot buffer area. (§ 4.3.B(4))

Ultimately landowners are responsible for ensuring that the farmland lying within Chesapeake Bay Preservation Areas complies with the requirement of a conservation plan in § 4.2.9 of the Regulations and the buffer area requirements, discussed here. If the land is being leased to another operator, it is advisable to include language in the lease agreement to require the lessee to comply with these requirements.

The buffer area reduction criteria were crafted to allow for continued productivity from most of the land involved, as long as equivalent water quality protection is provided. To qualify for a reduction of buffer width to 50 feet, the farmland in question must be *"enrolled in a federal, state, or locally-funded agricultural best management program, and the program . . . [must be] implemented. . . ."*. Implementation of one or more best management practices that satisfy requirements of the highly erodible lands provisions of the 1985 farm bill would satisfy this buffer reduction criterion. If a farmer has implemented one or more BMPs on his field without any involvement of the local SWCD, SCS or ASCS, it would be necessary to show that the implemented BMPs are consistent with local, state or federal BMP program criteria in order to qualify for the buffer reduction (in other words, enroll retroactively).

Furthermore, in combination with the remaining 50 foot buffer area, the BMPs used on the field must result in sediment and nutrient removals from runoff at least the equivalent of performance standards for the full 100-foot wide buffer area (75 percent of sediment and 40 percent of nutrients removed). The SCS is currently studying pollutant removal efficiencies for agricultural BMPs.[28]

The agricultural buffer area may be reduced:

To a minimum width of 25 feet when a soil and water quality conservation plan, as approved by the local Soil and Water Conservation District, has been implemented on the adjacent land, provided that the portion of the plan being implemented for the Chesapeake Bay Preservation Area achieves water quality protection at least the equivalent of that provided by the 100-foot buffer area in the opinion of the local Soil and Water Conservation District Board. (§ 4.3.B(4)b)

Traditionally, Virginia SWCDs have approved soil and water conservation plans for farmers. Those plans have stressed implementing conservation practices and systems focused on soil erosion control, to protect the fragile base of topsoil so important to agricultural productivity.

To qualify for a reduction of buffer width to 25 feet, the farmland in question must have *"a soil and water **quality** conservation plan, as approved by the local Soil and Water*

planner can minimize soil exposure and the need for expensive controls during site development. Through the careful preservation of existing indigenous vegetation and the coordination of new plantings, the site planner can create attractive and cost-effective landscapes that minimize erosion during the site construction process and beyond, thus ensuring the protection of water quality.

At a minimum, buffer areas should incorporate grasses as vegetative filters that exhibit the following characteristics:[30]

1. Deep root systems to resist scouring during high velocity runoff;

2. Dense, well-branched top growth;

3. Resistance to flooding;

4. Ability to recover growth subsequent to inundation by flooding; and

5. Suitability for climatic and sun exposure conditions of the region.

Slope

Even after representative grasses have been chosen based on the above criteria, several other factors must be considered in terms of buffer efficiency. The slope of the vegetated buffer area directly affects buffer efficiency. Studies indicate that buffer area performance is best on slopes of 5% or less.[31] As slope increases, runoff velocity increases in such a manner that sediment volumes are greatly increased due to erosion. In such cases, the width of the buffer area may need to be extended in order to offset the increased sediment flows. Although research efforts have reached varying conclusions, it is generally accepted that a slope of 15% is the upper limit for effective runoff control.[32]

On slopes greater than 15%, vegetated buffer areas should be protected from off-site runoff through a combination of diversions and BMPs designed for such flows. Where such slopes exist, the 100-foot buffer width requirement set forth in the Regulations is considered a minimum for local government designation, aside from the conditions outlined in the buffer modification section. Local governments should consider the protection and/or creation of wider buffers in view of the research related to the detrimental effect of steep slopes on buffer efficiency. (See page IV-66.)

Height Of Vegetation

The height of vegetation also has a considerable effect on the efficiency of the buffer in terms of filtering sediment. Research has shown that taller grasses have a higher retardance to runoff, and when grasses are cut, their filter efficiency declines to zero.[33] Therefore, as a general rule grasses within buffer areas should remain uncut, except on those occasions needed to control troublesome insects and/or noxious weeds. When cutting is necessary, a high blade setting should be used.

Soil Conditions

Soil conditions also have a significant effect on the ability of the buffer area to absorb water and thus reduce the amount of pollutants reaching adjacent water bodies. In cases where the soils are so restrictive that

capacity of water to hold oxygen decreases. Since the presence of oxygen is necessary in the decomposition of organic matter, elevated water temperatures reduce the ability of streams and smaller rivers to assimilate organic wastes without oxygen depletion, resulting in a build-up of organic matter in the water system. Also, as water temperatures increase, the release rate of nutrients attached to sediment particles increases resulting in greater amounts of soluble nutrients in the water system. As a consequence, nutrients become more readily available for consumption by plants and humans.[36]

When stream temperatures are controlled in the upper reaches of drainage basins (smaller streams), temperature problems in downstream areas will be controlled as well, resulting in a decreased pollution load throughout the water resource system.[37]

Buffer Area Plants

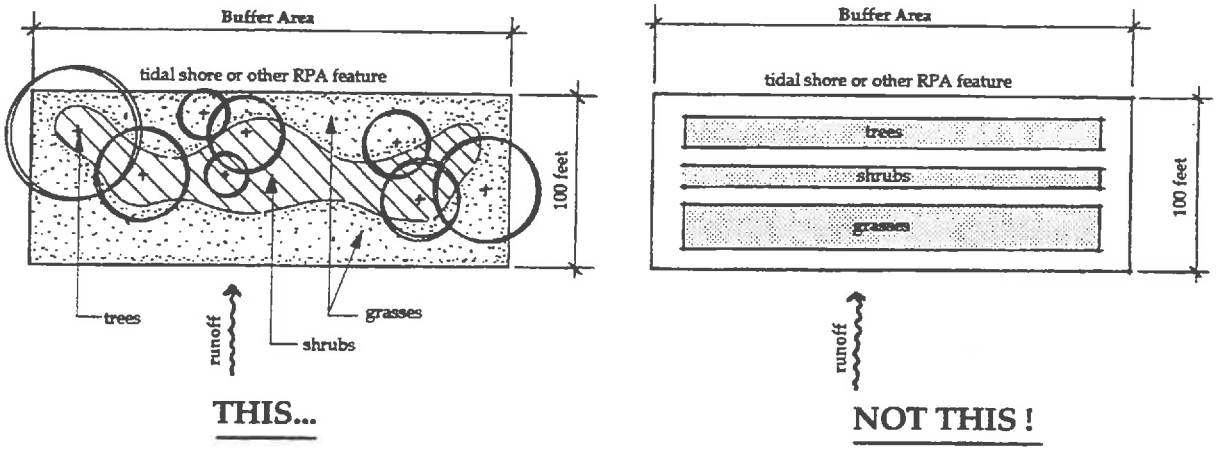
The ultimate decision on the type of vegetation that should be used in the buffer area should be based on the following considerations:[38]

1. Suitability for providing specific control of runoff and pollution;
2. Adaptability to site conditions and climate;
3. Compatibility with surrounding landscape;
4. Level of maintenance required;
5. Hardiness and durability; and
6. Life span.

The hierarchy of plant species to be considered for inclusion in buffer areas falls roughly into three main zones as illustrated in Figure 4-24. The first zone is composed of grasses, generally up to three feet in height, that intercept and filter the first rush of stormwater runoff. These grasses must be of the deep-rooted variety in order to effectively respond to the potential high velocities of runoff. Although there are many "structural" grasses that have proven to be generally effective due to their tendency for quick establishment in adverse site conditions, numerous native and ornamental grasses/groundcovers should also be considered either for use in conjunction with structural grasses, or for use on their own.

The second zone of buffer vegetation consists of deciduous and evergreen shrubs that generally occupy an area greater than three (3) feet in height but less than twenty (20) in height and may contain both indigenous and exotic species. This zone is especially important in providing protection of the buffer floor beneath the tree canopy where sensitive feeder roots may be growing. The relatively shallow, lateral roots of shrubs act to anchor the soil beneath the canopy and aid in the formation of the humus layer which is composed of dead and decaying vegetation. It is this humus layer, referenced earlier in terms of its ability to retard runoff, that acts as the "second zone of defense" against runoff that flows through the initial grass zone. Although runoff velocities should be minimal in this area, severe storms and extremely adverse site conditions may create overland flow situations that prove to be of too great a magnitude for the grass zone to effectively handle. It is also in this shrub zone that the greatest landscape aesthetic effect may be realized, given the diversity and availability of ornamental shrubs.

BUFFER AREA LAYOUT COMPARISON *FIGURE 4-25*



through the movement of surface runoff.[39] In summary, using shrubs and trees in the composition of buffer areas may result in the following benefits on a site:[40]

- Assist in stabilizing the soil and preventing erosion;
- Decrease stormwater runoff through canopy interception and root zone absorption;
- Moderate temperature changes and provide shade to small streams;
- Moderate the effects of sun and wind;
- Provide buffers and screens against noise;
- Filter pollutants from the air;
- Provide a haven for animals and birds, which help to control insect populations;
- Enhance property values; and
- Provide psychological and aesthetic counterpoints to the human-made urban setting.

BUFFER AREA PLANT REFERENCE INFORMATION

Plants Lists

The following lists of plants have been compiled from several reference publications. The plants that comprise these lists do not represent the only plants the Department recognizes as acceptable for use in the buffer. Rather, the lists should be viewed as an offering of representative plant materials that could initially be considered when selecting plant materials for use in the buffer area. The plant lists reflect a predominance of indigenous plant species. This is important, since the use of indigenous plant species is encouraged in order to provide a buffer condition that best replicates the "natural" buffer condition found in existing vegetated areas. Again, the use of indigenous plants in the buffer area promotes better plant survival since these plants are more tolerant of indigenous pests, local soil conditions, and local climatic factors.

SIZE

This category provides information on the projected mature height and width of a species. This information may show the highest degree of variability of all the categories, since growth is affected by a wide array of micro-site conditions. However, the information can be considered to represent an average mature growth condition based on acceptable micro-site conditions.

PRIMARY USE

The information in this category pertains to the primary benefit of the particular species in terms of water quality protection. A summary of each primary use subcategory is provided as follows:

disturbed areas: The protection of disturbed areas pertains to those areas where land cover has been altered, as a result of land grading, land clearing, mineral extraction, or natural disaster. Since the nutrient availability in these areas tend to be very low, only a few specialized plants can adapt to such limiting conditions. Species that adapt to such conditions act to improve the nutrient holding capacity of the soil while stabilizing the soil particles so that erosion and further site disturbance is minimized.

stabilize streambanks: The stabilization of streambank areas concerns the addition of plant species that act to reduce the structural breakdown of streambank soils, control the temperatures of streams, and promote the development of plant groups that are representative of streambank environments. The streambanks addressed in this subcategory are generally associated with tributary streams.

wildlife habitat: The maintenance of wildlife habitat is both directly and indirectly related to the protection of water quality. For instance, the normal biological activities of wildlife promote the maintenance of fertile soils through the conversion of animal and plant wastes into organic materials necessary for proper plant growth.

stabilize shores: The stabilization of shoreline areas concerns the addition of plant species that act to reduce the impact of wave action that leads to the structural breakdown of shoreline areas. The shoreline areas addressed in this category are generally associated with saltwater rivers and bays.

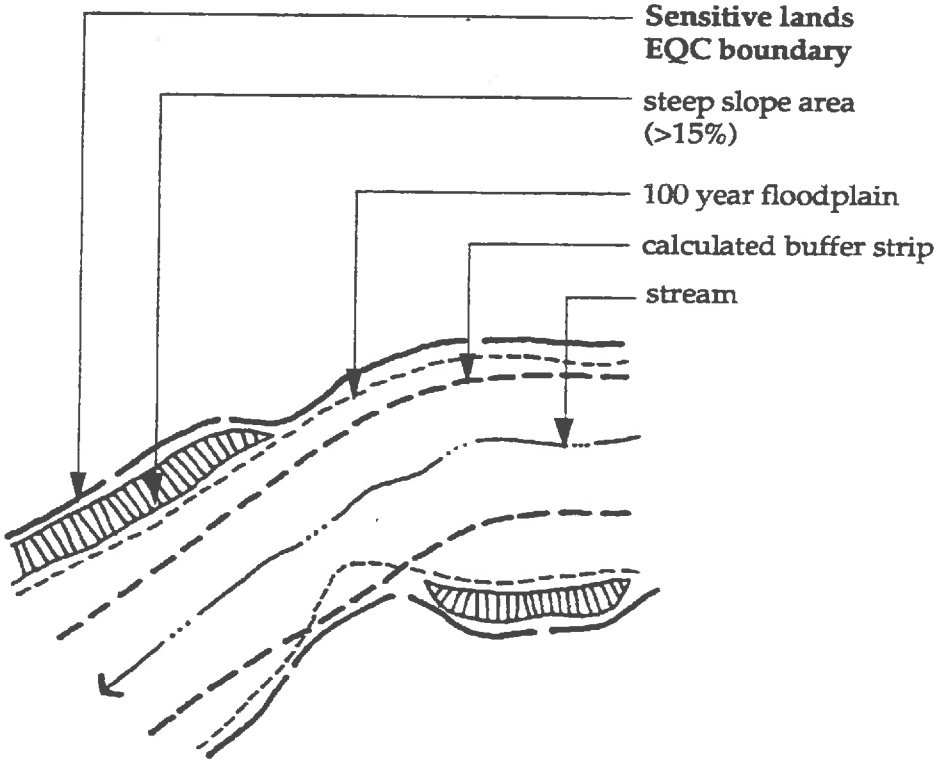
wind barrier: The reduction of wind velocities can be a very important facet of water quality protection especially when viewed in terms of the presence of loose soil particles that may be carried by the wind and deposited in water systems. The presence of wind-controlling plant species can have a significant effect on young, growing plants that have not become structurally established in their environment.

erosion control: The provision of erosion-controlling plant species is inherent to the protection of water quality since sediment transported in site runoff is a primary pollutant of water systems. The presence of erosion-controlling plant material is of major importance in the reduction of site runoff and the subsequent release of soil particles into water systems.

floodplain, wetlands, and steep slope areas extend beyond this minimum buffer strip, they should be used to determine the boundary of the sensitive lands EQC.

The county determined that the minimum buffer provides not only protection from sedimentation of streams, but also serves to preserve enough streamside vegetation to provide the shading needed to prevent wide fluctuations in water temperature and thereby provides a more healthy environment for aquatic wildlife.

ENVIRONMENTAL QUALITY CORRIDOR *FIGURE 4-26*



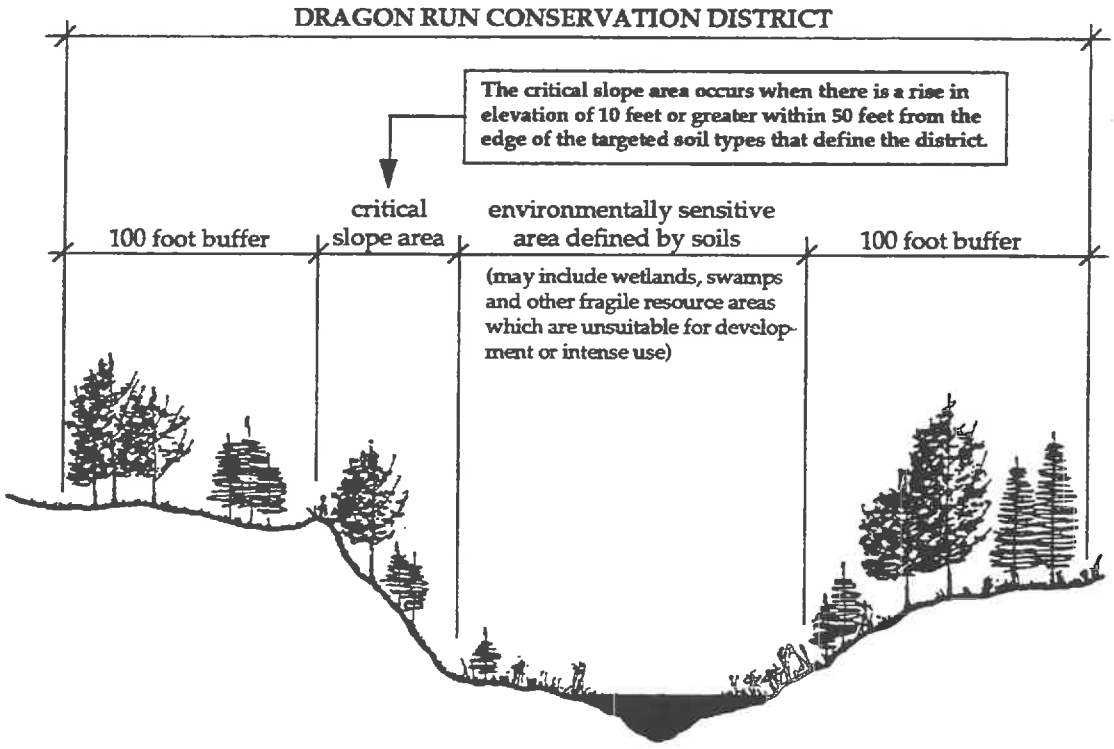
plan

Dragon Run Conservation District

The Middle Peninsula Planning District Commission in 1987 proposed the creation of the Dragon Run Conservation District (DRCD) in an effort to protect and conserve fragile resource areas which perform valuable functions in their natural state and which are unsuitable for development and intense use.[43] Areas to be designated within the DRCD included primarily wetlands and swamps, but also could include other areas deemed to be important for floodplain management, aquifer recharge, water storage, critical wildlife habitat, or the protection of other resources that perform similar functions.

The boundary of the DRCD was determined based on certain soil types plus an additional 100-foot buffer strip measured horizontally from the inland boundary of these certain soil types. An important component of the buffer strip requirement was compensation for the effect of steep slopes on buffer performance. Additional buffer requirements stated that when there is a rise in elevation of 10 feet or greater, within 50 feet measured horizontally, from the edge of the targeted soil types, then the 100 foot buffer strip should be measured from the highest point of elevation within said 50 feet. It is important to note that the 50 foot parameter was chosen in this case because the environmental inventory of the Dragon Run resource indicated that all steep slope areas were confined in a horizontal distance of 50 feet or less. The implication of the critical slope area requirement is illustrated in the Figure 4-28.

DRAGON RUN CRITICAL SLOPE AREA *FIGURE 4-28*



ENDNOTES

[1] For additional information or to obtain copies of these publications, contact the following:

(a) ***Controlling Urban Runoff: A Practical Manual For Planning and Designing Urban BMPs* (July, 1987),** Metropolitan Information Center, Metropolitan Washington Council of Governments, 1875 Eye St., N.W., Suite 200, Washington, D.C. 20006, (202) 223-6800.

(b) ***BMP Handbook for the Occoquan Watershed*** (August, 1987), Northern Virginia Planning District Commission, 7630 Little River Turnpike, Annandale, Va. 22003, (703) 642-0700.

[2] Virginia Department of Forestry, ***Forestry Best Management Practices for Water Quality*** (Charlottesville, Va.: Department of Forestry, 1989).

[3] Researchers at the American Forestry Association calculated the value of an "average" 50-year old urban tree at $57,151. The Association calculated the **annual** contribution of one shade tree in four areas: air conditioning, $73; controlling erosion and stormwater, $75; wildlife shelter, $75; controlling air pollution, $50. These values were then compounded at 5 percent for 50 years to derive the total value. See "Our Cities' Trees: An Investment in the Future," by Candace Allen in ***Virginia Town and City***, July, 1989.

[4] See York County's "Tree Preservation and Landscaping Design Ordinance," Henrico County's proposed "Landscape Ordinance," and Fairfax County's "Vegetation Preservation and Planting" section of the Fairfax County Public Facilities Manual.

[5] See Metropolitan Washington Council of Governments, Department of Environmental Programs, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs***, by Thomas R. Schueler, (Washington, D.C.: Metropolitan Washington Council of Governments, 1987), 2.13.

[6] For a variation of this, see the Model Ordinance, Chapter V, page 11. Open space ratios and impervious cover thresholds are fundamental to the concepts of "performance zoning" and "carrying capacity." See Lane Kendig, ***Performance Zoning***, (Chicago: American Planning Association, 1980) and Kendig's more recent ***New Standards for Nonresidential Uses***, Planning Advisory Service Report Number 405 (Chicago: American Planning Association, 1987.)

[7] Virginia Polytechnic Institute and State University, Virginia Water Resources Center, ***A Homeowner's Guide to Septic Systems***, by Forster D. Sponenburg, Jacob H. Kahn, and Kathryn P. Sevebeck, (Blacksburg, Va.: Virginia Water Resources Center, 1985), 1.

[8] Ibid.

[20] Virginia Department of Forestry, ***A Proposal for the Assessment of Forest Water Quality in Virginia: Overview and Implementation Details***, by Sam Austin, (Charlottesville, Va.: Department of Forestry, 1989), 4-7 passim.

[21] U. S. General Accounting Office, Resources, Community and Economic Development Division, ***Wetlands: The Corps of Engineers' Administration of the Section 404 Program***, Report to the Chairman, Subcommittee on Investigations and Oversight, Committee on Public Works and Transportation, U. S. House of Representatives, RECD-88-110, (Washington, D.C.: General Accounting Office, July, 1988).

[22] U. S. Army Corps of Engineers, ***"Section 404 Mitigation Memorandum of Agreement,"*** 7 February 1990, Washington, D.C.

[23] Bruce Williams, Environmental Scientist, U.S. Army Corps of Engineers, Norfolk District Office, Regulatory Branch, telephone conservation with Darryl M. Glover, Chesapeake Bay Local Assistance Department, January, 1989.

[24] Schueler, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs***, 9.8.

[25] Ibid., 9.7.

[26] Ibid., 9.9.

[27] See for example state water quality protection/land use programs in Maryland, New Jersey, Oregon, Delaware, North Carolina, Florida, and New York.

[28] This study, entitled "A Handbook for Designing Vegetative Filter Strips," is being carried out by SCS under a research contract with Virginia Polytechnic and State University and Clemson University. Publication is expected in January, 1991. For more information, contact Kenneth Carter, Water Quality Specialist, Soil Conservation Service, Richmond, Virginia (see Appendix of Government Resources.)

[29] Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, ***Basic Urban Erosion and Sediment Control in Virginia: Training Notebook*** (Richmond, Va.: Division of Soil and Water Conservation, 1980), 69.

[30] Maryland Department of Natural Resources, Coastal Resources Division, ***The Buffer Area Study***, by Raymond Palfrey and Earl Bradley, (Annapolis, MD: Coastal Resources Division, 1982), 5.

[31] Schueler, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs***, 9.9.

CHAPTER V

MODEL ORDINANCES

CHESAPEAKE BAY PRESERVATION AREA OVERLAY DISTRICT

Article I.
Chesapeake Bay Preservation Area Overly District

Section 100. Title.

This ordinance shall be known and referenced as the "Chesapeake Bay Preservation Area Overlay District" of the [jurisdiction name].

Section 101. Findings of Fact.

The Chesapeake Bay and its tributaries is one of the most important and productive estuarine systems in the world, providing economic and social benefits to the citizens of [jurisdiction name] and the Commonwealth of Virginia. The health of the Bay is vital to maintaining [jurisdiction name's] economy and the welfare of its citizens.

The Chesapeake Bay waters have been degraded significantly by many sources of pollution, including nonpoint source pollution from land uses and development. Existing high quality waters are worthy of protection from degradation to guard against further pollution. Certain lands that are proximate to shorelines have intrinsic water quality value due to the ecological and biological processes they perform. Other lands have severe development constraints from flooding, erosion, and soil limitations. With proper management, they offer significant ecological benefits by providing water quality maintenance and pollution control, as well as flood and shoreline erosion control. These lands together, designated by the [governing body] as Chesapeake Bay Preservation Areas (hereinafter "CBPAs"), need to be protected from destruction and damage in order to protect the quality of water in the Bay and consequently the quality of life in [jurisdiction name] and the Commonwealth of Virginia.

Section 102. Purpose and Intent.

A. This ordinance is enacted to implement the requirements of Section 10.1-2100 et seq. of the Code of Virginia, the Chesapeake Bay Preservation Act, and amends the [title of zoning code]. The intent of [governing body] and the purpose of the Overlay District is to: (1) protect existing high quality state waters; (2) restore all other state waters to a condition or quality that will permit all reasonable public uses and will support the propagation and growth of all aquatic life, which might reasonably be expected to inhabit them; (3) safeguard the clean waters of the Commonwealth from pollution; (4) prevent any increase in pollution; (5) reduce existing pollution; and (6) promote water resource conservation in order to provide for the health, safety, and welfare of the present and future citizens of [jurisdiction name].

B. This district shall be in addition to and shall overlay all other zoning districts where they are applied so that any parcel of land lying in the Chesapeake Bay Preservation Area Overlay District shall also lie in one or more of the other zoning districts provided for by the Zoning Ordinance. Unless otherwise stated in the Overlay District, the review and approval procedures provided for in Sections [reference local site plan, erosion and sediment control, grading permits, & building permits ordinances, etc.] shall be followed in reviewing and approving development, redevelopment, and uses

governed by this Article.

C. This Article is enacted under the authority of Section 10.1-2100 et seq. (The Chesapeake Bay Preservation Act) and Section 15.1-489, of the Code of Virginia. Section 15.1-489 states that zoning ordinances may "also include reasonable provisions, not inconsistent with applicable state water quality standards, to protect surface water and groundwater as defined in Section 62.1-44.85 (8)."

Section 103. Definitions.

The following words and terms used in the Overlay District have the following meanings, unless the context clearly indicates otherwise. Words and terms not defined in this Article but defined in the Zoning Ordinance shall be given the meanings set forth therein.

"Agricultural lands" mean those lands used for the planting and harvesting of crops or plant growth of any kind in the open; pasture; horticulture; dairying; floriculture; or raising of poultry and/or livestock.

"Best Management Practices" (BMPs) mean a practice, or a combination of practices, that is determined by a state or designated area wide planning agency to be the most effective, practical means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

"Buffer area" means an area of natural or established vegetation managed to protect other components of a Resource Protection Area and state waters from significant degradation due to land disturbances.

"Chesapeake Bay Preservation Area" means any land designated by the [governing body] pursuant to Part III of the Chesapeake Bay Preservation Area Designation and Management Regulations, VR 173-02-01, and Section 10.1-2107 of the Code of Virginia. A Chesapeake Bay Preservation Area shall consist of a Resource Protection Area and a Resource Management Area.

"Construction footprint" means the area of all impervious surface, including but not limited to, buildings, roads and drives, parking areas, and sidewalks and the area necessary for construction of such improvements.

"Development" means the construction, or substantial alteration, of residential, commercial, industrial, institutional, recreation, transportation, or utility facilities or structures.

"Diameter at breast height" means the diameter of a tree measured outside the bark at a point 4.5 feet above ground.

"Dripline" means a vertical projection to the ground surface from the furthest lateral extent of a tree's leaf canopy.

"Impervious cover" means a surface composed of any material that significantly impedes or prevents natural infiltration of water into the soil. Impervious surfaces include, but are not limited to: roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface.

"Intensely Developed Areas" means a portion of a Resource Protection Area or a Resource Management Area designated by the [governing body] where development is concentrated and little of the

natural environment remains.

"Nonpoint source pollution" means pollution consisting of constituents such as sediment, nutrients, and organic and toxic substances from diffuse sources, such as runoff from agriculture and urban land development and use.

"Nontidal wetlands" mean those wetlands other than tidal wetlands that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions, as defined by the U.S. Environmental Protection Agency pursuant to Section 404 of the federal Clean Water Act, in 33 C.F.R. 328.3b, dated November 13, 1986.

"Noxious Weeds" means weeds that are difficult to control effectively, such as Johnson Grass, Kudzu, and multiflora rose.

"Plan of Development" means the process for site plan or subdivision plat review to ensure compliance with Section 10.1-2109 of the Code of Virginia and this Article, prior to any clearing or grading of a site or the issuance of a building permit.

"Redevelopment" means the process of developing land that is or has been previously developed.

"Resource Management Area (RMA)" means that component of the Chesapeake Bay Preservation Area that is not classified as the Resource Protection Area. RMAs include land types that, if improperly used or developed, have the potential for causing significant water quality degradation or for diminishing the functional value of the Resource Protection Area.

"Resource Protection Area (RPA)" means that component of the Chesapeake Bay Preservation Area comprised of lands at or near the shoreline that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may result in significant degradation to the quality of state waters.

"Tidal shore" or "shore" means land contiguous to a tidal body of water between the mean low water level and the mean high water level.

"Tidal wetlands" means vegetated and nonvegetated wetlands as defined in Section 62.1-13.2 of the Code of Virginia.

"Tributary stream" means any perennial stream that is so depicted on the most recent U.S. Geological Survey 7-1/2 minute topographic quadrangle map (scale 1:24,000).

"Water-dependent facility" means a development of land that cannot exist outside of the Resource Protection Area and must be located on the shoreline by reason of the intrinsic nature of its operation. These facilities include, but are not limited to (i) ports; (ii) the intake and outfall structures of power plants, water treatment plants, sewage treatment plants, and storm sewers; (iii) marinas and other boat docking structures; (iv) beaches and other public water-oriented recreation areas; and (v) fisheries or other marine resources facilities.

"Wetlands" means tidal and nontidal wetlands.

Section 104. Areas of Applicability.

A. The Chesapeake Bay Preservation Area Overlay District shall apply to all lands identified as CBPAs as designated by the [governing body] and as shown on the [local adopted map]. The [adopted map], together with all explanatory matter thereon, is hereby adopted by reference and declared to be a part of this Article.

(1) The Resource Protection Area includes:

a. Tidal wetlands;

b. Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams;

d. [Other lands] (specified as an RPA feature at local discretion);

c. Tidal shores;

e. A 100-foot vegetated buffer area located adjacent to and landward of the components listed in subsections a. through d. above, and along both sides of any tributary stream.

(2) The Resource Management Area is composed of concentrations of the following land categories: floodplains; highly erodible soils, including steep slopes; highly permeable soils; nontidal wetlands not included in the Resource Protection Area; other lands including [those local features] necessary to protect the quality of state waters.

B. The [adopted map] shows the general location of CBPAs and should be consulted by persons contemplating activities within [jurisdiction name] prior to engaging in a regulated activity.

C. Portions of Resource Protection Areas and Resource Management Areas designated by the [governing body] as Intensely Developed Areas shall serve as redevelopment areas. Areas so designated shall comply with all erosion and sediment control requirements and the performance standards for redevelopment in Section 110 (Performance Standards.)

D. If the boundaries of a Chesapeake Bay Preservation Area include a portion of a lot, parcel, or development project, the entire lot, parcel, or development project shall comply with the requirements of the Overlay District. The division of property shall not constitute an exemption from this requirement.

Section 105. Use Regulations.

Permitted uses, special permit uses, accessory uses, and special requirements shall be as established by the underlying zoning district, unless specifically modified by the requirements set forth

herein.

Section 106. Lot Size.

Lot size shall be subject to the requirements of the underlying zoning district(s), provided that any lot shall have sufficient area outside the Resource Protection Area to accommodate an intended development, in accordance with the performance standards in Section 110, when such development is not otherwise allowed in the Resource Protection Area.

Section 107. Required Conditions.

A. All development and redevelopment exceeding 2500 square feet of land disturbance shall be subject to a plan of development process, including the approval of a site plan in accordance with the provisions of the Zoning Ordinance or a subdivision plat in accordance with the Subdivision Ordinance.

B. Development in Resource Protection Areas may be allowed only if it: (i) is water-dependent; or (ii) constitutes redevelopment.

C. A water quality impact assessment shall be required for any proposed development or redevelopment within Resource Protection Areas and for any development within Resource Management Areas when required by the [Administrative Authority] because of the unique characteristics of the site or intensity of development, in accordance with the provisions of Section 111, of this Article.

Section 108. Conflict with other Regulations.

In any case where the requirements of this Article conflict with any other provision of the [jurisdiction name] Code or existing state or federal regulations, whichever imposes the more stringent restrictions shall apply.

Section 109. Interpretation of Resource Protection Area Boundaries.

A. Delineation by the Applicant.

The site-specific boundaries of the Resource Protection Area shall ordinarily be determined by the applicant through the performance of an environmental site assessment, subject to approval by the [Administrative Authority] and in accordance with Section 112, (Plan of Development) of this Article. The [adopted map] shall be used as a guide to the general location of Resource Protection Areas.

B. Delineation by the [Administrative Authority].

The [Administrative Authority], when requested by an applicant wishing to construct a single family residence, may waive the requirement for an environmental site assessment and perform the delineation. The [Administrative Authority] may use remote sensing, hydrology, soils, plant species, and other data, and consult other appropriate resources as needed to perform the delineation.

C. Where Conflict Arises Over Delineation.

Where the applicant has provided a site-specific delineation of the Resource Protection Area, the [Administrative Authority] will verify the accuracy of the boundary delineation. In determining the site-specific RPA boundary, the [Administrative Authority] may render adjustments to the applicant's boundary delineation, in accordance with Section 112, (Plan of Development) of this Article. In the event the adjusted boundary delineation is contested by the applicant, the applicant may seek relief, in accordance with the provisions of Section 112.H. (Denial/Appeal of Plan)

Section 110. Performance Standards.

A. Purpose and Intent.

The performance standards establish the means to minimize erosion and sedimentation potential, reduce land application of nutrients and toxics, and maximize rainwater infiltration. Natural ground cover, especially woody vegetation, is most effective in holding soil in place and preventing site erosion. Indigenous vegetation, with its adaptability to local conditions without the use of harmful fertilizers or pesticides, filters stormwater runoff. Keeping impervious cover to a minimum enhances rainwater infiltration and effectively reduces stormwater runoff potential.

The purpose and intent of these requirements is also to implement the following objectives: prevent a net increase in nonpoint source pollution from new development; achieve a 10% reduction in nonpoint source pollution from redevelopment; and achieve a 40% reduction in nonpoint source pollution from agricultural uses.

B. General Performance Standards for Development and Redevelopment.

(1) Land disturbance shall be limited to the area necessary to provide for the desired use or development.

a. In accordance with an approved site plan, the limits of land disturbance, including clearing or grading shall be strictly defined by the construction footprint. These limits shall be clearly shown on submitted plans and physically marked on the development site.

b. The construction footprint shall not exceed 60% of the site.

c. Ingress and egress during construction shall be limited to one access point, unless otherwise approved by the [Administrative Authority].

(2) Indigenous vegetation shall be preserved to the maximum extent possible consistent with the use and development permitted and in accordance with the Virginia Erosion and Sediment Control Handbook.

a. Existing trees over 6 inches diameter at breast height (DBH) shall be preserved outside the construction footprint. Diseased trees or trees weakened by age, storm, fire, or other injury may be removed.

b. Clearing shall be allowed only to provide necessary access, positive site drainage, water quality BMPs, and the installation of utilities, as approved by the [Administrative Authority].

c. Prior to clearing or grading, suitable protective barriers, such as safety fencing, shall be erected 5 feet outside of the dripline of any tree or stand of trees to be preserved. Protective barriers shall remain so erected throughout all phases of construction. The storage of equipment, materials, debris, or fill shall not be allowed within the area protected by the barrier.

(3) Land development shall minimize impervious cover to promote infiltration of storm-water into the ground consistent with the use or development permitted.

a. Grid and modular pavements shall be used for any required parking area, alley, or other low traffic driveway, unless otherwise approved by the [Administrative Authority].

b. Parking space size shall be 162 square feet. Parking space width shall be 9 feet; parking space length shall be 18 feet. Two-way drives shall be a minimum of 22 feet.

(4) Notwithstanding any other provisions of this Article or exceptions or exemptions thereto, any land disturbing activity exceeding 2,500 square feet, including construction of all single-family houses, shall comply with the requirements of [local jurisdiction Erosion and Sediment Ordinance].

(5) All on-site sewage disposal systems not requiring an NPDES permit shall be pumped out at least once every five years, in accordance with the provisions of the [jurisdiction name] Health Code.

(6) A reserve sewage disposal site with a capacity at least equal to that of the primary sewage disposal site shall be provided, in accordance with the [jurisdiction name] Health Code. This requirement shall not apply to any lot or parcel recorded prior to October 1, 1989 if such lot or parcel is not sufficient in capacity to accommodate a reserve sewage disposal site, as determined by the local Health Department. Building or construction of any impervious surface shall be prohibited on the area of all sewage disposal sites or on an on-site sewage treatment system which operates under a permit issued by the State Water Control Board, until the structure is served by public sewer.

(7) For any development or redevelopment, stormwater runoff shall be controlled by the use of best management practices that achieve the following:

a. For development, the post-development nonpoint source pollution runoff load shall not exceed the pre-development load, based on the calculated average land cover condition of the [local jurisdiction];

b. For sites within Intensely Developed Areas or other isolated redevelopment sites, the nonpoint source pollution load shall be reduced by at least 10 percent. The [Administrative Authority] may waive or modify this requirement for redevelopment sites that originally incorporated best management practices for stormwater runoff quality control, provided the following provisions are satisfied:

1. In no case may the post-development non-point source pollution runoff load exceed the pre-development load;

2. Runoff pollution loads must have been calculated and the BMPs selected for the expressed purpose of controlling nonpoint source pollution;

3. If best management practices are structural, evidence shall be provided that facilities are currently in good working order and performing at the design levels of service. The [Administrative Authority] may require a review of both the original structural design and maintenance plans to verify this provision. A new maintenance agreement may be required to ensure compliance with this ordinance.

c. For redevelopment, both the pre- and post-development loadings shall be calculated by the same procedures. However, where the design data is available, the original post-development nonpoint source pollution loadings can be substituted for the existing development loadings.

(8) Prior to initiating grading or other on-site activities on any portion of a lot or parcel, all wetlands permits required by federal, state, and local laws and regulations shall be obtained and evidence of such submitted to the [Administrative Authority], in accordance with Section 112, of this Article.

(9) Land upon which agricultural activities are being conducted shall have a soil and water quality conservation plan. Such plan shall be based upon the Field Office Technical Guide of the U.S. Department of Agriculture Soil Conservation Service and accomplish water quality protection consistent with this ordinance. Such a plan shall be approved by the local Soil and Water Conservation District by January 1, 1995.

C. Buffer Area Requirements.

To minimize the adverse effects of human activities on the other components of Resource Protection Areas, state waters, and aquatic life, a 100-foot buffer area of vegetation that is effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff shall be

retained if present and established where it does not exist.

The buffer area shall be located adjacent to and landward of other RPA components and along both sides of any tributary stream. The full buffer area shall be designated as the landward component of the Resource Protection Area, in accordance with Sections 104 (Areas of Applicability) and 112 (Plan of Development) of this Article.

The 100-foot buffer area shall be deemed to achieve a 75 percent reduction of sediments and a 40 percent reduction of nutrients. A combination of a buffer area not less than 50 feet in width and appropriate best management practices located landward of the buffer area which collectively achieve water quality protection, pollutant removal, and water resource conservation at least the equivalent of the full 100-foot buffer area may be employed in lieu of the 100-foot buffer if approved by the [Administrative Authority] after consideration of the Water Quality Impact Assessment, in accordance with Section 111 of this Article.

The buffer area shall be maintained to meet the following additional performance standards:

(1) In order to maintain the functional value of the buffer area, indigenous vegetation may be removed only to provide for reasonable sight lines, access paths, general woodlot management, and best management practices, as follows:

a. Trees may be pruned or removed as necessary to provide for sight lines and vistas, provided that where removed, they shall be replaced with other vegetation that is equally effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff.

b. Any path shall be constructed and surfaced so as to effectively control erosion.

c. Dead, diseased, or dying trees or shrubbery may be removed at the discretion of the landowner, and silvicultural thinning may be conducted based upon the best available technical information.

d. For shoreline erosion control projects, trees and woody vegetation may be removed, necessary control techniques employed, and appropriate vegetation established to protect or stabilize the shoreline in accordance with the best available technical advice and applicable permit conditions or requirements.

(2) When the application of the buffer areas would result in the loss of a buildable area on a lot or parcel recorded prior to October 1, 1989, the [Administrative Authority] may modify the width of the buffer area in accordance with Section 112 (Plan of Development) and the following criteria:

a. Modifications to the buffer areas shall be the minimum necessary to achieve a reasonable buildable area for a principal structure and necessary utilities;

b. Where possible, an area equal to the area encroaching the buffer area shall be established elsewhere on the lot or parcel in a way to maximize water quality protection; and

c. In no case shall the reduced portion of the buffer area be less than 50 feet in width.

(3) Redevelopment within Intensely Developed Areas may be exempt from the buffer area, in accordance with Section 112 (Plan of Development) of this Article.

(4) On agricultural lands the agricultural buffer area shall be managed to prevent concentrated flows of surface water from breaching the buffer area and noxious weeds from invading the buffer area. The agricultural buffer area may be reduced as follows:

a. To a minimum width of 50 feet when the adjacent land is implementing a federal, state, or locally-funded agricultural best management practices program, provided that the combination of the reduced buffer area and the best management practices achieve water quality protection, pollutant removal, and water resource conservation at least the equivalent of the 100 foot buffer area;

b. To a minimum width of 25 feet when a soil and water quality conservation plan, as approved by the local Soil and Water Conservation District, has been implemented on the adjacent land. Such plan shall be based upon the Field Office Technical Guide of the U.S. Department of Agriculture Soil Conservation Service and accomplish water quality protection consistent with this ordinance.

c. The buffer area is not required for agricultural drainage ditches if the adjacent agricultural land has in place best management practices in accordance with a conservation plan approved by the local Soil and Water Conservation District.

Section 111. Water Quality Impact Assessment

A. Purpose and Intent.

The purpose of the water quality impact assessment is to: (i) identify the impacts of proposed development on water quality and lands within RPAs and other environmentally-sensitive lands; (ii) ensure that, where development does take place within RPAs and other sensitive lands, it will be located on those portions of a site and in a manner that will be least disruptive to the natural functions of RPAs and other sensitive lands; (iii) to protect individuals from investing funds for improvements proposed for location on lands unsuited for such development because of high ground water, erosion, or vulnerability to flood and storm damage; (iv) provide for administrative relief from the terms of this Article when warranted and in accordance with the requirements contained herein; and (v) specify mitigation which will address water quality protection.

B. Water Quality Impact Assessment Required.

A water quality impact assessment is required for (i) any proposed development within a Resource Protection Area, including any buffer area modification or reduction as provided for in Section 110, of this Article; (ii) any development in a Resource Management Area as deemed necessary by the [Administrative Authority] due to the unique characteristics of the site or intensity of the proposed development. There shall be two levels of water quality impact assessments: a minor

assessment and a major assessment.

C. Minor Water Quality Impact Assessment.

A minor water quality impact assessment pertains only to development within a CBPA which causes no more than 5,000 square feet of land disturbance and requires any modification or reduction of the landward 50 feet of the 100 foot buffer area. A minor assessment must demonstrate through acceptable calculations that the remaining buffer area and necessary best management practices will result in removal of no less than 75 percent of sediments and 40 percent of nutrients from post-development stormwater runoff. A minor assessment shall include a site drawing to scale which shows the following:

(1) Location of the components of the Resource Protection Area, including the 100 foot buffer area;

(2) Location and nature of the proposed encroachment into the buffer area, including: type of paving material; areas of clearing or grading; location of any structures, drives, or other impervious cover; and sewage disposal systems or reserve drainfield sites;

(3) Type and location of proposed best management practices to mitigate the proposed encroachment.

D. Major Water Quality Impact Assessment.

A major water quality impact assessment shall be required for any development which (i) exceeds 5,000 square feet of land disturbance within CBPAs and requires any modification or reduction of the landward 50 feet of the 100 foot buffer area; (ii) disturbs any portion of the seaward 50 feet of the 100 foot buffer area or any other component of an RPA; or (iii) is located in a RMA when deemed necessary by the [Administrative Authority]. The information required in this section shall be considered a minimum, unless the [Administrative Authority] determines that some of the elements are unnecessary due to the scope and nature of the proposed use and development of land.

The following elements shall be included in the preparation and submission of a major water quality assessment:

(1) All of the information required in a minor water quality impact assessment, as specified in Section 111.C.;

(2) A hydrogeological element that:

a. Describes the existing topography, soils, hydrology and geology of the site and adjacent lands.

b. Describes the impacts of the proposed development on topography, soils, hydrology and geology on the site and adjacent lands.

c. Indicates the following:

1. Disturbance or destruction of wetlands and justification for such action;

2. Disruptions or reductions in the supply of water to wetland, streams, lakes, rivers or other water bodies;

3. Disruptions to existing hydrology including wetland and stream circulation patterns;

4. Source location and description of proposed fill material;

5. Location of dredge material and location of dumping area for such material;

6. Location of and impacts on shellfish beds, submerged aquatic vegetation, and fish spawning areas;

7. Estimation of pre- and post development pollutant loads in runoff;

8. Estimation of percent increase in impervious surface on site and type(s) of surfacing materials used;

9. Percent of site to be cleared for project;

10. Anticipated duration and phasing schedule of construction project;

11. Listing of all requisite permits from all applicable agencies necessary to develop project.

d. Describes the proposed mitigation measures for the potential hydrogeological impacts. Potential mitigation measures include:

1. Proposed erosion and sediment control concepts; concepts may include minimizing the extent of the cleared area, perimeter controls, reduction of runoff velocities, measures to stabilize disturbed areas, schedule and personnel for site inspection;

2. Proposed stormwater management system;

3. Creation of wetlands to replace those lost;

4. Minimizing cut and fill.

(3) A vegetative element that:

a. Identifies and delineates the location of all significant plant material on site, including all trees on site six inches or greater diameter at breast height or, where there are groups of trees, said stands may be outlined.

b. Describes the impacts the development or use will have on the existing vegetation. Information should include:

1. General limits of clearing, based on all anticipated improvements, including buildings, drives, and utilities;

2. Clear delineation of all trees which will be removed;

3. Description of plant species to be disturbed or removed.

c. Describes the potential measures for mitigation. Possible mitigation measures include:

1. Replanting schedule for trees and other significant vegetation removed for construction, including a list of possible plants and trees to be used;

2. Demonstration that the design of the plan will preserve to the greatest extent possible any significant trees and vegetation on the site and will provide maximum erosion control and overland flow benefits from such vegetation.

3. Demonstration that indigenous plants are to be used to the greatest extent possible.

(4) A wastewater element, where applicable, that:

a. Includes calculations and locations of anticipated drainfield or wastewater irrigation areas;

b. Provides justification for sewer line locations in environmentally-sensitive areas, where applicable, and describes construction techniques and standards;

c. Discusses any proposed on-site collection and treatment systems, their treatment levels, and impacts on receiving watercourses.

d. Describes the potential impacts of the proposed wastewater systems, including the proposed mitigative measures for these impacts.

(5) Identification of the existing characteristics and conditions of sensitive lands included as components of Chesapeake Bay Preservation Areas, as defined in this Article.

(6) Identification of the natural processes and ecological relationships inherent to the site and an assessment of the impact of the proposed use and development of land on these processes and relationships.

E. Submission and Review Requirements.

(1) (Five) copies of all site drawings and other applicable information as required by Subsections C and D above shall be submitted to the [Administrative Authority] for review.

(2) All information required in this section shall be certified as complete and accurate by a professional engineer or a certified land surveyor.

(3) A minor water quality impact assessment shall be prepared and submitted to and reviewed by the [Administrative Authority] in conjunction with Section 112, (Plan of Development) of this Article.

(4) A major water quality impact assessment shall be prepared and submitted to and reviewed by the [Administrative Authority] in conjunction with a request for rezoning, special use permit, or in conjunction with Section 112 of this Article, as deemed necessary by the [Administrative Authority].

(5) As part of any major water quality impact assessment submittal, the [Administrative Authority] may require review by the Chesapeake Bay Local Assistance Department (CBLAD). Upon receipt of a major water quality impact assessment, the [Administrative Authority] will determine if such review is warranted and may request CBLAD to review the assessment and respond with written comments. Any comments by CBLAD will be incorporated into the final review by the [Administrative Authority], provided that such comments are provided by CBLAD within 90 days of the request.

F. Evaluation Procedure.

(1) Upon the completed review of a minor water quality impact assessment, the [Administrative Authority] will determine that any proposed modification or reduction to the buffer area is consistent with the provisions of this Article and make a finding based upon the following criteria:

a. The necessity of the proposed encroachment and the ability to place improvements elsewhere on the site to avoid disturbance of the buffer area;

b. Impervious surface is minimized;

c. Proposed best management practices, where required, achieve the requisite reductions in pollutant laodings;

d. The development, as proposed, meets the spirit and intent of this Article;

e. The cumulative impact of the proposed development, when considered in relation to other development in the vicinity, both existing and proposed, will not result in a significant degradation of water quality.

(2) Upon the completed review of a major water quality impact assessment, the [Administrative Authority] will determine whether or not the proposed development is consistent with the spirit and intent of this Article and make a finding based upon the following criteria:

a. Within any RPA, the proposed development is water-dependent;

b. The percentage of existing wetlands disturbed by the development. The number of square feet or acres to be disturbed;

c. The development will not result in significant disruption of the hydrology of the site;

d. The development will not result in severe degradation to aquatic vegetation or life;

e. The development will not result in unnecessary destruction of plant materials on site;

f. Proposed erosion and sediment control concepts are adequate to achieve the reductions in runoff and prevent off-site sedimentation;

g. Proposed stormwater management concepts are adequate to control the stormwater runoff to achieve "no net increase" in pollutant loadings;

h. Proposed revegetation of disturbed areas will provide optimum erosion and sediment control benefits;

j. The design and location of any proposed drainfield will be in accordance with the requirements of Section 110.

k. The development is consistent with the spirit and intent of the Overlay District;

l. The relationship and cumulative effect of the proposed development on water quality and Chesapeake Bay Preservation Areas has been considered.

(3) The [Administrative Authority] shall require additional mitigation where potential impacts have not been adequately addressed. Evaluation of mitigation measures will be made by the [Administrative Authority] based on the criteria listed above in subsections (1) and (2).

(4) The [Administrative Authority] shall find the proposal to be inconsistent with the purpose and intent of this Article when the impacts created by the proposal cannot be mitigated. Evaluation of the impacts will be made by the [Administrative Authority] based on the criteria listed in subsections (1) and (2).

Section 112. Plan of Development Process.

Any development or redevelopment exceeding 2500 square feet of land disturbance shall be accomplished through a plan of development process prior to any clearing or grading of the site or the issuance of any building permit, to assure compliance with all applicable requirements of this Article.

A. Required Information.

In addition to the requirements of [reference site plan ordinance] of this [Code, Chapter, Appendix, etc.] or the requirements of Section [subdivision plats] of the [jurisdiction name] Subdivision Ordinance, the plan of development process shall consist of the plans and studies identified below. These required plans and studies may be coordinated or combined, as deemed appropriate by the [Administrative Authority]. The [Administrative Authority] may determine that some of the following information is unnecessary due to the scope and nature of the proposed development.

The following plans or studies shall be submitted, unless otherwise provided for:

(1) A site plan in accordance with the provisions of [reference site plan ordinance] of this [Code, Chapter, Appendix,etc.]; or a subdivision plat in accordance with the provisions of Section [subdivision plans] of the [jurisdiction name] Subdivision Ordinance;

(2) An environmental site assessment;

(3) A landscaping plan;

(4) A stormwater management plan;

(5) An erosion and sediment control plan in accordance with the provisions of Section [local erosion & sediment control ordinance] of this [Chapter, Appendix, etc.].

B. Environmental Site Assessment.

An environmental site assessment shall be submitted in conjunction with preliminary site plan or preliminary subdivision plan approval.

(1) The environmental site assessment shall be drawn to scale and clearly delineate the following environmental features:

a. Tidal wetlands;

b. Tidal shores;

c. Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams;

d. [Other lands] (specified as an RPA feature at local discretion);

e. A 100 foot buffer area located adjacent to and landward of the components listed in subsections a. through d. above, and along both sides of any tributary stream;

f. Other sensitive environmental features as determined by the [Administrative Authority].

(2) Wetlands delineations shall be performed consistent with the procedures specified in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, 1989.

(3) The environmental site assessment shall delineate the site-specific geographic extent of the Resource Protection Area.

(4) The environmental site assessment shall be drawn at the same scale as the preliminary site plan or subdivision plat, and shall be certified as complete and accurate by a professional engineer or a certified land surveyor. This requirement may be waived by the [Administrative Authority] when the proposed use or development would result in less than 5,000 square feet of disturbed area.

C. Landscaping Plan.

A landscaping plan shall be submitted in conjunction with site plan approval or as part of subdivision plat approval. No clearing or grading of any lot or parcel shall be permitted without an approved landscaping plan.

Landscaping plans shall be prepared and/or certified by design professionals practicing within their areas of competence as prescribed by the Code of Virginia.

(1) Contents of the Plan.

a. The landscaping plan shall be drawn to scale and clearly delineate the location, size, and description of existing and proposed plant material. All existing trees on the site 6 inches or greater diameter at breast height (DBH) shall be shown on the landscaping plan, or where there are groups of trees, said stands may be outlined instead. The specific number of trees 6 inches or greater DBH to be preserved outside of the construction footprint shall be indicated on the plan. Trees to be removed to create a desired construction footprint shall be clearly delineated on the landscaping plan.

b. Any required buffer area shall be clearly delineated and any plant material to be added to establish or supplement the buffer area, as required by this Article, shall be shown on the landscaping plan.

c. Within the buffer area, trees to be removed for sight lines, vistas, access paths, and best management practices, as provided for in this Article, shall be shown on the plan. Vegetation required by this Article to replace any existing trees within the buffer area shall be also be shown on the landscaping plan.

d. Trees to be removed for shoreline stabilization projects and any replacement vegetation required by this Article shall be shown on the landscaping plan.

e. The plan shall depict grade changes or other work adjacent to trees which would affect them adversely. Specifications shall be provided as to how grade, drainage, and aeration would be maintained around trees to be preserved.

f. The landscaping plan will include specifications for the protection of existing trees during clearing, grading, and all phases of construction.

(2) Plant Specifications.

a. All plant materials necessary to supplement the buffer area or vegetated areas outside the construction footprint shall be installed according to standard planting practices and procedures.

b. All supplementary or replacement plant materials shall be living and in a healthy condition. Plant materials shall conform to the standards of the most recent edition of the American Standard for Nursery Stock, published by the American Association of Nurserymen.

c. Where areas to be preserved, as designated on an approved landscaping plan, are encroached, replacement of existing trees and other vegetation will be achieved at a ratio of 3 planted trees to 1 removed. Replacement trees shall be a minimum 3 1/2 inches DBH at the time of planting.

(3) Maintenance.

a. The applicant shall be responsible for the maintenance and replacement of all vegetation as may be required by the provisions of this Article.

b. In buffer areas and areas outside the construction footprint, plant material shall be tended and maintained in a healthy growing condition and free from refuse and debris. Unhealthy, dying, or dead plant materials shall be replaced during the next planting season, as required by the provisions of this Article.

D. Stormwater Management Plan.

A stormwater management plan shall be submitted as part of the plan of development process required by this Article and in conjunction with site plan or subdivision plan approval.

(1) Contents of the Plan.

The stormwater management plan shall contain maps, charts, graphs, tables, photographs, narrative descriptions, explanations, and citations to supporting references as appropriate to communicate the information required by this Article. At a minimum,

the stormwater management plan must contain the following:

a. Location and design of all planned stormwater control devices;

b. Procedures for implementing non-structural stormwater control practices and techniques;

c. Pre-and post-development nonpoint source pollutant loadings with supporting documentation of all utilized coefficients and calculations;

d. For facilities, verification of structural soundness, including a Professional Engineer or Class IIIB Surveyor Certification;

(2) Site specific facilities shall be designed for the ultimate development of the contributing watershed based on zoning, comprehensive plans, local public facility master plans, or other similar planning documents.

(3) All engineering calculations must be performed in accordance with procedures outlined in the current edition of the Local Assistance Manual, Virginia Erosion and Sediment Control Handbook, Virginia Department of Transportation Drainage Manual, or any other good engineering methods deemed appropriate by the [Administrative Authority].

(4) The plan shall establish a long-term schedule for inspection and maintenance of stormwater management facilities that includes all maintenance requirements and persons responsible for performing maintenance. If the designated maintenance responsibility is with a party other than the [local jurisdiction] then a maintenance agreement shall be executed between the responsible party and the [local jurisdiction].

E. Erosion and Sediment Control Plan.

An erosion and sediment control plan shall be submitted that satisfies the requirements of this Article and in accordance with Section [local jurisdiction erosion & sediment control requirements], in conjunction with site plan or subdivision plan approval.

F. Final Plan.

Final plans for property within CBPAs shall be final plats for land to be subdivided or site plans for land not to be subdivided as required in [reference site plan ordinance] of this [Code, Chapter, Appendix, etc.]

(1) Final plans for all lands within CBPAs shall include the following additional information:

a. The delineation of the Resource Protection Area boundary;

b. The delineation of required buffer areas;

c. All wetlands permits required by law;

d. A maintenance agreement as deemed necessary and appropriate by the [Administrative Authority] to ensure proper maintenance of best management practices in order to continue their functions.

(2) Installation and Bonding Requirements.

a. Where buffer areas, landscaping, stormwater management facilities or other specifications of an approved plan are required, no certificate of occupancy shall be issued until the installation of required plant materials or facilities is completed, in accordance with the approved site plan.

b. When the occupancy of a structure is desired prior to the completion of the required landscaping, stormwater management facilities, or other specifications of an approved plan, a certificate of occupancy may be issued only if the applicant provides to [local jurisdiction] a form of surety satisfactory to the [Administrative Authority] in amount equal to the remaining plant materials, related materials, and installation costs of the required landscaping or facilities and/or maintenance costs for any required stormwater management facilities.

c. All required landscaping shall be installed and approved by the first planting season following issuance of a certificate of occupancy or the surety may be forfeited to the [local jurisdiction.]

d. All required stormwater management facilities or other specifications shall be installed and approved within 18 months of project commencement. Should the applicant fail, after proper notice, to initiate, complete or maintain appropriate actions required by the approved plan, the surety may be forfeited to [local jurisdiction]. The [local jurisdiction] may collect from the applicant the amount by which the reasonable cost of required actions exceeds the amount of the surety held.

e. After all required actions of the approved site plan have been completed, the applicant must submit a written request for a final inspection. If the requirements of the approved plan have been completed to the satisfaction of the [Administrative Authority], such unexpended or unobligated portion of the surety held shall be refunded to the applicant or terminated within 60 days following the receipt of the applicant's request for final inspection. The [Administrative Authority] may require a certificate of substantial completion from a Professional Engineer or Class III B Surveyor before making a final inspection.

G. Administrative Responsibility.

Administration of the plan of development process shall be in accordance with [reference site plan ordinance] of this [Code, Chapter, Appendix, etc.] or Section [subdivision plats] of the [local jurisdiction] Subdivision Ordinance.

H. Denial of Plan, Appeal of Conditions or Modifications.

In the event the final plan or any component of the plan of development process is disapproved and recommended conditions or modifications are unacceptable to the applicant, the applicant may appeal such administrative decision to the Planning Commission. In granting or denying an appeal, the Planning Commission must find such plan to be in accordance with all applicable ordinances and include necessary elements to mitigate any detrimental impact on water quality and upon adjacent property and the surrounding area, or such plan meets the purpose and intent of the performance standards in this Article. If the Planning Commission finds that the applicant's plan does not meet the above stated criteria, they shall deny approval of the plan.

Section 113. Nonconforming Use and Development Waivers.

The lawful use of a building or structure which existed on [date of adoption] or which exists at the time of any amendment to this Article, and which is not in conformity with the provisions of the Overlay District may be continued in accordance with Section [reference nonconformities] of this [Chapter, Appendix, etc.].

No change or expansion of use shall be allowed with the exception that:

(1) The [Administrative Authority] may grant a nonconforming use and development waiver for structures on legal nonconforming lots or parcels to provide for remodeling and alterations or additions to such nonconforming structures provided that:

a. There will be no increase in nonpoint source pollution load;

b. Any development or land disturbance exceeding an area of 2500 square feet complies with all erosion and sediment control requirement of this Article.

(2) An application for a nonconforming use and development waiver shall be made to and upon forms furnished by the [Administrative Authority] and shall include for the purpose of proper enforcement of this Article, the following information:

a. Name and address of applicant and property owner;

b. Legal description of the property and type of proposed use and development;

c. A sketch of the dimensions of the lot or parcel, location of buildings and proposed additions relative to the lot lines, and boundary of the Resource Protection Area;

d. Location and description of any existing private water supply or sewage system.

(3) A nonconforming use and development waiver shall become null and void twelve months from the date issued if no substantial work has commenced.

Section 114. Exemptions.

A. Exemptions for Utilities.

Construction, installation, and maintenance of water, sewer, and local gas lines shall be exempt from the Overlay District provided that:

a. To the degree possible, the location of such utilities and facilities should be outside Resource Protection Areas;

b. No more land shall be disturbed than is necessary to provide for the desired utility installation;

c. All such construction, installation, and maintenance of such utilities and facilities shall be in compliance with all applicable state and federal requirements and permits and designed and conducted in a manner that protects water quality; and

d. Any land disturbance exceeding an area of 2,500 square feet complies with all [jurisdiction name] erosion and sediment control requirements.

B. Exemptions for Silvicultural Activities.

Silvicultural activities are exempt from the requirements of this Article provided that silvicultural operations adhere to water quality protection procedures prescribed by the Department of Forestry in its "Best Management Practices Handbook for Forestry Operations."

C. Exemptions in Resource Protection Areas.

The following land disturbances in Resource Protection Areas may be exempted from the Overlay District: (i) water wells; (ii) passive recreation facilities such as boardwalks, trails, and pathways; and (iii) historic preservation and archaeological activities, provided that it is demonstrated to the satisfaction of the [Administrative Authority] that:

(1) Any required permits, except those to which this exemption specifically applies, shall have been issued;

(2) Sufficient and reasonable proof is submitted that the intended use will not deteriorate water quality;

(3) The intended use does not conflict with nearby planned or approved uses; and

(4) Any land disturbance exceeding an area of 2500 square feet shall comply with all [jurisdiction name] erosion and sediment control requirements.

Section 115. Exceptions.

A. A request for an exception to the requirements of this Overlay District shall be made in writing to the [Administrative Authority]. It shall identify the impacts of the proposed exception on water quality and on lands within the Resource Protection Area through the performance of a water quality impact assessment which complies with the provisions of Section 111.

B. The [Administrative Authority] shall review the request for an exception and the water quality impact assessment and may grant the exception with such conditions and safeguards as deemed necessary to further the purpose and intent of this Article if the [Administrative Authority] finds:

(1) Granting the exception will not confer upon the applicant any special privileges that are denied by this Article to other property owners in the Overlay District;

(2) The exception request is not based upon conditions or circumstances that are self-created or self-imposed, nor does the request arise from conditions or circumstances either permitted or non-conforming that are related to adjacent parcels;

(3) The exception request is the minimum necessary to afford relief;

(4) The exception request will be in harmony with the purpose and intent of the Overlay District, and not injurious to the neighborhood or otherwise detrimental to the public welfare; and

(5) Reasonable and appropriate conditions are imposed which will prevent the exception request from causing a degradation of water quality.

C. If the [Administrative Authority] cannot make the required findings or refuses to grant the exception, the [Administrative Authority] shall return the request for an exception together with the water quality impact assessment and the writtent findings and rationale for the decision to the applicant, with a copy to the Board of Zoning Appeals. The applicant may then apply to the Board of Zoning Appeals for a variance as provided in Section [reference variances] of the Zoning Ordinance.

D. The Board of Zoning Appeals shall consider the water quality impact assessment and the findings and rationale of the [Administrative Authority] in determining harmony with the intended spirit and purpose of this Article.

CHAPTER VI

COMPREHENSIVE PLAN GUIDANCE

INTRODUCTION

This Chapter provides guidance to local governments preparing a comprehensive plan or plan amendment to protect water quality consistent with the Act and Regulations. Recommendations are process-oriented and designed to be integrated into the local planning process. Where possible, step-by-step guidelines are provided to aid local governments in data collection efforts and development of policy alternatives.

The focus of the Chapter is planning for the protection of water quality, with an emphasis on resource protection policy development. The Chapter does not attempt to provide a truly comprehensive guide to developing local land use policy with consideration of economic and social issues. In this sense, the Chapter is not a primer on land use planning or the comprehensive planning process. Local governments should, therefore, ensure to the greatest extent possible that there is consistency among individual policies developed in different policy categories. For example, a policy to "protect water quality in surface waters" should also be reflected in policies addressing economic and community development which potentially affect surface water quality. Suggestions of such interrelationships among policy areas are addressed throughout the Chapter.

CHAPTER VI

DESIGNING A COMPREHENSIVE PLAN TO PROTECT WATER QUALITY

A comprehensive plan provides a framework to guide local leaders in decisions affecting community development. The process of updating and revising comprehensive plans in accordance with the Act and Regulations affords local governments an important opportunity to **evaluate existing development patterns and their impact on water quality protection** and resource conservation. This process also represents a significant opportunity to proactively guide future development so as to assure the long-term viability of sensitive environmental resources. In order to comply with the Act and Regulations, comprehensive plans should explicitly identify the relationships between water quality protection and other land use considerations within the locality such as population growth, economic development, and the provision of public facilities and utilities. Plan recommendations should be based on a sound analysis of these relationships.

There are many benefits of a comprehensive planning approach to water quality protection. By determining the capacity of an area to support development through a detailed inventory and analysis of environmental resources, localities can prevent problems such as failed septic systems, which are both costly to remedy and damaging to natural resources. Significant cost savings may be realized by the local government and the private sector in the long term. Moreover, the information base developed will provide the public with useful information about ongoing natural processes, physical features which constrain certain types of development, and the potential consequences of resource exploitation and development in sensitive areas.

The relationships between resource protection and land development are too often ignored. The distribution and intensity of development directly influence energy conservation, efficiency in the provision of services, and the protection of environmental and cultural resources. Other factors influencing land use patterns such as accessibility, availability of public utilities, and real estate market forces, however, are more immediate and usually overshadow factors relating to land suitability. This chapter identifies steps that local governments should take in order to ensure that planning adequately considers the impact of land use on water quality.

Balancing Economic Development And Water Quality Protection

The Chesapeake Bay Preservation Act opens with the observation that "[h]ealthy state and local economies and a healthy Chesapeake Bay are integrally related; balanced economic development and water quality protection are not mutually exclusive."[1] This finding was based on decades of data showing a direct relationship between water quality and economic vitality in the Bay region. Every sector of the Tidewater economy is in some way dependent on a healthy Bay.[2]

Economic development specialists have long realized that the only successful strategy for improving local economies is diversification. When the business cycle is in decline, a locality dependent on one or two business sectors is likely destined to experience a longer and more dramatic downturn than a locality with a more diversified economy.

AUTHORITY

The Code of Virginia sets forth the scope and purpose of the comprehensive plan.[9] Virginia law required all local governments to prepare and adopt a comprehensive plan by July 1, 1980[10] and requires local governments to review and, if necessary, to revise those plans every five years.[11]

Under the Dillon Rule, Virginia local governments do not have broad latitude to shape and fashion land use and environmental protection measures unless those powers are explicitly granted by the General Assembly. During the 1988 session of the Virginia General Assembly, the Virginia Code was amended to add surface water studies to the items that may be considered in developing a local comprehensive plan.[12] As companion legislation to the Preservation Act, this provision enables local governments to base land use plans and policies on water quality considerations.

In addition, the Act requires local governments to "incorporate the protection of the quality of state waters" into their comprehensive plans consistent with the provisions of the Act.[13] The Regulations require local governments to "review and revise their comprehensive plans, as necessary, for compliance" with the Act (§ 5.6.A). This Chapter explains the provisions of § 5.6 and is designed to help local governments review and revise comprehensive plans in a manner consistent with the Act and Regulations.

The Board and Department are mindful that proper revisions to comprehensive plans require time and effort. Recent amendments to the comprehensive planning provisions of Title 15.1, as well as the requirements of the Chesapeake Bay Preservation Act, place increasing significance on the legal relationship between comprehensive planning and zoning.[14] Therefore, local governments should take care in the preparation of the comprehensive plan to ensure that the provisions of local ordinances are not arbitrary and capricious.[15]

PUBLIC PARTICIPATION

The Code of Virginia establishes minimum requirements for public notice and comment prior to the adoption of a local plan or ordinance.[16] Although local governments are familiar with these provisions, localities are encouraged to solicit additional public involvement in the development of the comprehensive plan. The comprehensive plan element provides local elected officials with the opportunity to gain public acceptance and a commitment for the long-term implementation of the Chesapeake Bay Preservation Act.

The comprehensive plan establishes local public policy on land use and water quality protection; local governments should attempt to involve the public in every aspect of plan development. A number of Tidewater localities have developed meaningful citizen involvement processes that exceed the Code's minimum requirements. All local governments should consider ways to enhance citizen participation so that recommendations in the plan are representative of public policy.

An effective public participation program will provide the opportunity for citizens to be involved in all phases of the planning process (see Table 6-1). It should engage a cross-section of the community, broadly representative of geographic areas and interests related to land use and land use decisions. **Citizen advisory committees** can be a

particularly effective way of achieving widespread public involvement.

Citizen advisory committees can enhance communication between citizens and elected and appointed officials. One or more citizen committees, bringing diverse interests to the table, can be useful and productive in building consensus and developing creative solutions to difficult issues. Moreover, the citizen advisory committee can be highly effective in assisting the governing body with the development of a program that promotes and enhances public participation in land use planning, the implementation of the program, and evaluation of the process for citizen involvement.

Requirements of the Act and Regulations

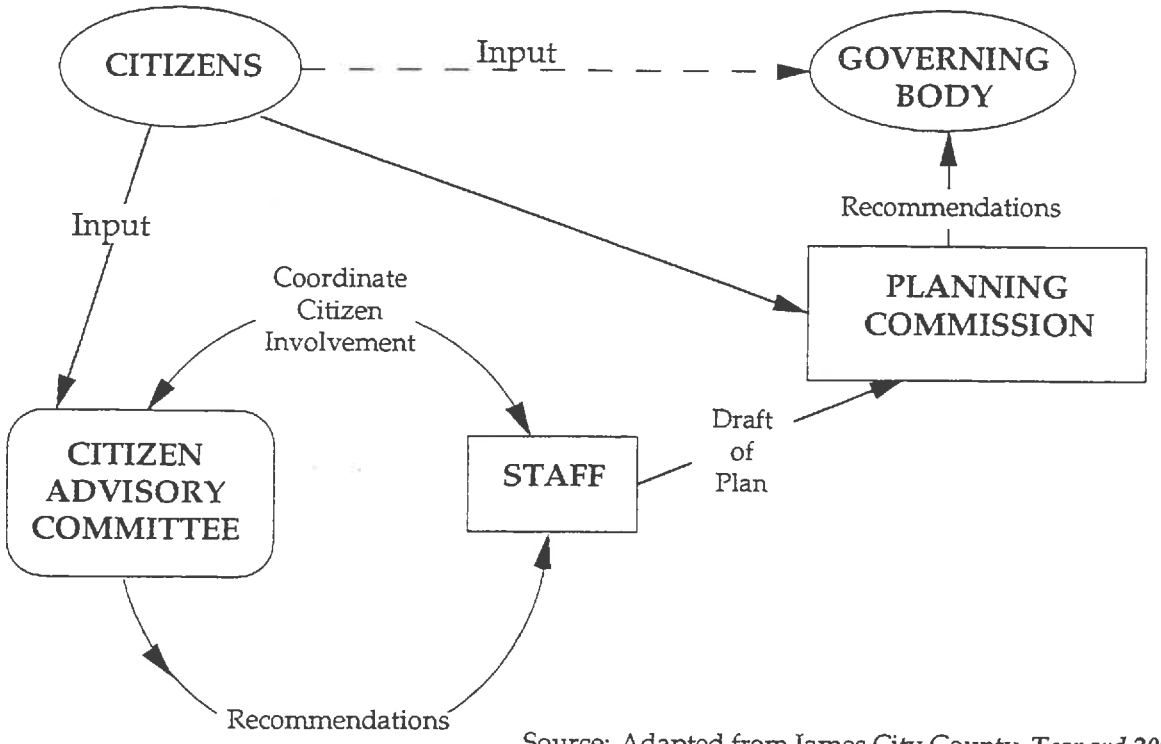
Section 10.1-2109 of the Act states:

Counties, cities, and towns in Tidewater Virginia shall incorporate protection of the quality of state waters into each locality's comprehensive plan consistent with the provisions of this chapter.

Section 2.1 of the Regulations provides guidance to local governments in the development of local programs necessary to comply with the Act and Regulations:

In conjunction with other state water quality programs, local programs shall encourage and promote: (i) protection of existing high quality state waters and restoration of all other state waters to a condition or quality that will permit all reasonable public uses and

Comprehensive Planning Process — *Figure 6-1*



Source: Adapted from James City County, *Toward 2007: Designing Our Future* (Draft), 1991

policies and other decisions set forth in the plan. They have been designed to avoid placing an unnecessary burden on local planning resources. The requirements can generally be fulfilled by utilizing existing local plans and studies as well as information provided by regional planning offices and state agencies. However, certain inventories and other forms of data outlined in this Chapter, which are critical as a basis for water quality protection policies, may not be typical to the local planning process in the past. Each of these items, as well as others important for water quality issues, are more thoroughly explored in other sections within the Chapter.

Generally, the process suggested by the data collection and analysis requirements of the Regulations begins with an examination of a community's current situation. This typically includes information on existing land use, land suitability, and identification of fragile or environmentally sensitive areas. Significantly, most local governments have already established an inventory of environmental resources to serve as a basis for the designation of Chesapeake Bay Preservation Areas (see Chapter III).

This information base establishes a solid foundation for water quality protection planning and decision-making by defining the physical characteristics of the community. Analysis of this data base will indicate areas that are fragile or environmentally sensitive and have an intrinsic value to water quality, like certain wetlands. Other areas, because of soil type or drainage patterns, pose constraints to septic systems or certain development. If these areas are improperly managed or developed, water quality degradation is likely to result. Understanding the natural characteristics of the land and directing growth and development in a way which reflects this character will ensure the long-term use and enjoyment of quality water resources.

When layered with the local environmental inventory, other data describing a locality's reliance and influence on water resources will establish a more comprehensive information base for protecting water quality. It will be important to analyze additional information in the following areas:

- population information indicating growth trends and seasonal fluctuations;
- local business and industry, including an analysis of the economic impact of water-related activities;
- local water supply sources, quality, demand level, and treatment. For groundwater sources; information on location of wells, depths of seasonal high water table, and identification of aquifers used;
- shoreline erosion and accretion patterns in comparison to proposed land use and development;
- drainage systems, including agricultural canals;
- known sources of pollution such as older septic tanks, industrial sites, wastewater treatment plants, landfills, and underground storage tanks;
- location of existing and planned public access to water resources.

Plan Formulation and Policy Development

As part of the comprehensive plan, local governments should clearly indicate local policy on land use issues

tion. The community benefits from a coordinated water quality/development strategy which provides a sound basis for land use decisions, and should simplify reconsideration of the comprehensive plan in future years by providing a thorough benchmark against which to judge the success of the plan.

IMPLEMENTATION

The General Assembly intended local comprehensive plans consistent with the Act to be *implemented;* local plans should identify specific measures for carrying out adopted policies. The plan should discuss how local policies will be implemented -- what must be done, by whom, and within what time frame. This may include revisions to existing procedures and ordinances such as the zoning and subdivision ordinances, the site plan review process, and the capital improvements program.

Although local governments will revise their zoning, subdivision, and other land use ordinances in order to implement the performance criteria, it may be necessary to revisit ordinances after the comprehensive plan element is in place. Specifically, local governments should ensure that ordinances reflect and implement plan recommendations. For example, the plan may recommend special impervious surface and density restrictions in groundwater protection areas. Local governments should then consider amendments to the zoning ordinance to reduce required dimensions for parking areas and the widths of drives. Similarly, localities should review local policies and requirements for curb and gutter. Certain standards that have developed in response to aesthetics ("quality development"), convenience, and design preference should be carefully reexamined in the context of water quality protection goals and objectives.

The fundamental purpose of this Manual Chapter is to provide local governments guidance on the complex interrelationships between water quality and land use and development policies. The first section, *Comprehensive Water Resources Management*, introduces a conceptual framework for such a planning process, given the broad range of water resource issues facing localities in the 1990s. The remainder of the Chapter is devoted to developing specific guidelines for protecting potable water supply, comprehensive strategies to address shoreline erosion problems, identifying physical constraints to development, and integrating water quality improvement objectives for redevelopment within Intensely Developed Areas. The Chapter concludes with a section on conservation and development strategies which identifies the wide variety of community benefits that can be derived from an integrated planning process to protect water quality.

This Chapter works from the premise that a piecemeal approach to water resource planning is counter-productive: given the interrelatedness of the issues, the benefits of one element can be negated when another element is not similarly protected. For that reason, local governments are encouraged to consider the spectrum of issues presented and discussed herein, and develop a plan which addresses each of the policy areas within the context of **a comprehensive local strategy**. Where time and staff are available, individual elements can be strengthened over time. A coordinated, broad-based plan will have greater water quality benefits and fewer administrative obstacles in the long term.

Globally, there are approximately 330,000,000 cubic miles of water (a cubic mile equals 1.1 trillion gallons) on the earth's surface, underground, or in the atmosphere. Over 70 percent of the earth's surface is covered with water, but approximately 97 percent is salty, leaving only a small, precious supply of fresh water (Table 6-2).

Scientists generally recognize four main mechanisms to move water molecules from one location to another: **precipitation, infiltration, evaporation and transpiration** (sometimes called evapotranspiration). Surface runoff, soil moisture, and depression storage are additional variables to the water cycle equation (Figure 6-3). In a global sense, this system is closed. If the water is not on the surface or underground, it's in the air.

Most of us think of precipitation as the beginning of the cycle. Precipitation can come in many forms: rain, snow, hail, or any combination of these. In the lower altitudes, rain

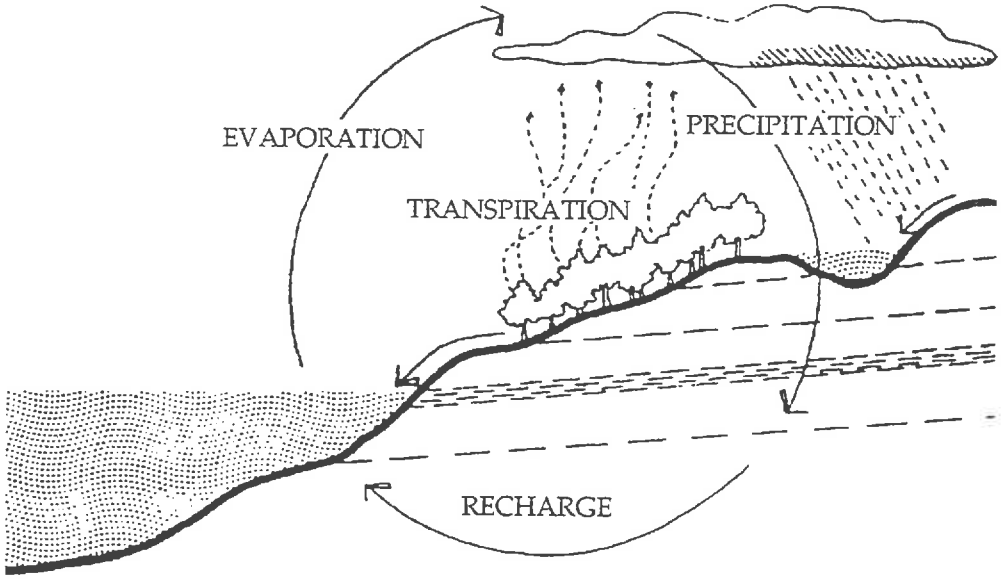
ESTIMATED WORLD WATER SUPPLY *TABLE 6-2*

Item	Area (km^2)	Volume (km^2)	% of Water
Fresh water:	147,900,000	37,300,000	2.70
Polar ice and glaciers	15,100,000	28,200,000	2.04
Groundwater 800-4,000 m deep	130,900,000	4,710,000	0.34
< 800m deep	130,900,000	3,740,000	0.27
Lakes	830,000	125,000	0.009
Soil moisture	130,900,000	69,000	0.005
Atmospheric vapour	510,100,000*	13,500	0.001
Rivers	—	1,500	0.0001
Salty water:		1,348,000,000	97.3
Oceans	362,200,000	1,348,000,000	97.3
Saline lakes and inland seas	700,000	105,000	0.008
Total supply		1,385,000,000	100

* Area of Earth's surface

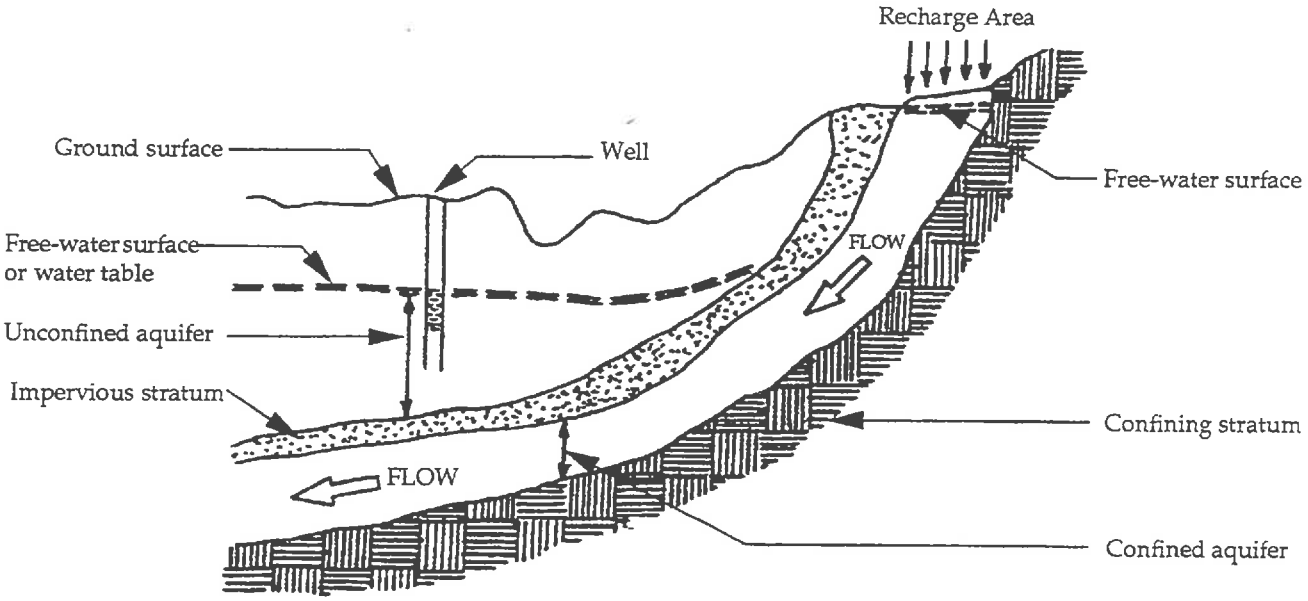
Source: ***Encyclopaedia Britannica***, Volume 20

THE HYDROLOGIC CYCLE *FIGURE 6-2*



Source: Day and Crafton, ***Site and Community Design Guidelines for Stormwater Management***, 1978

AQUIFER CLASSIFICATIONS — FIGURE 6-4

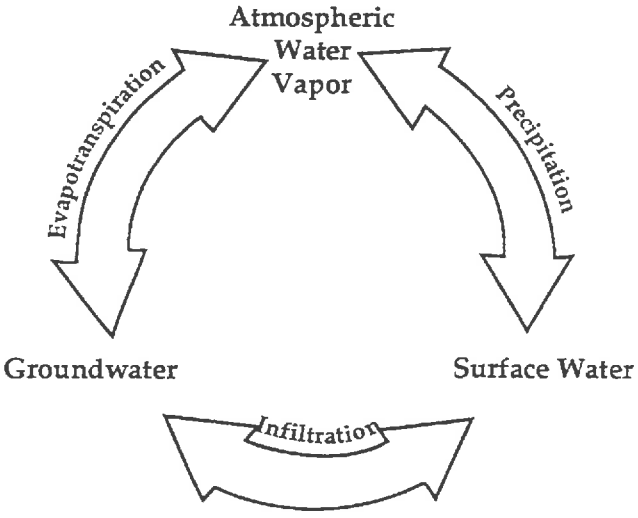


Source: Adapted from Veissman, Knapp, Lewis, and Harbaugh, *Introduction to Hydrology*, 1977

the surface. **Groundwater and surface water are interlinked**. Changing or stressing one will likely change or stress the other (Figure 6-5).

Water not infiltrated will run off to fill streams, lakes, and oceans. Any exposed water has the potential to evaporate into the Earth's atmosphere, where the process begins again. **Surface water and the atmosphere's water vapor are also interlinked.** Changing or stressing one will likely change or stress the other. The system is closed: what goes up, must come down -- but not necessarily in the same place. The moisture evaporated from Virginia's vast George Washington National Forest doesn't necessarily translate into rains for those same mountain slopes.

INTERLINKED WATER SYSTEM — FIGURE 6-5



Many localities have watershed boundaries already established for other purposes; water supply or wastewater service districts. Matching resource planning watershed boundaries to those already established is strongly recommended (Figure 6-7).

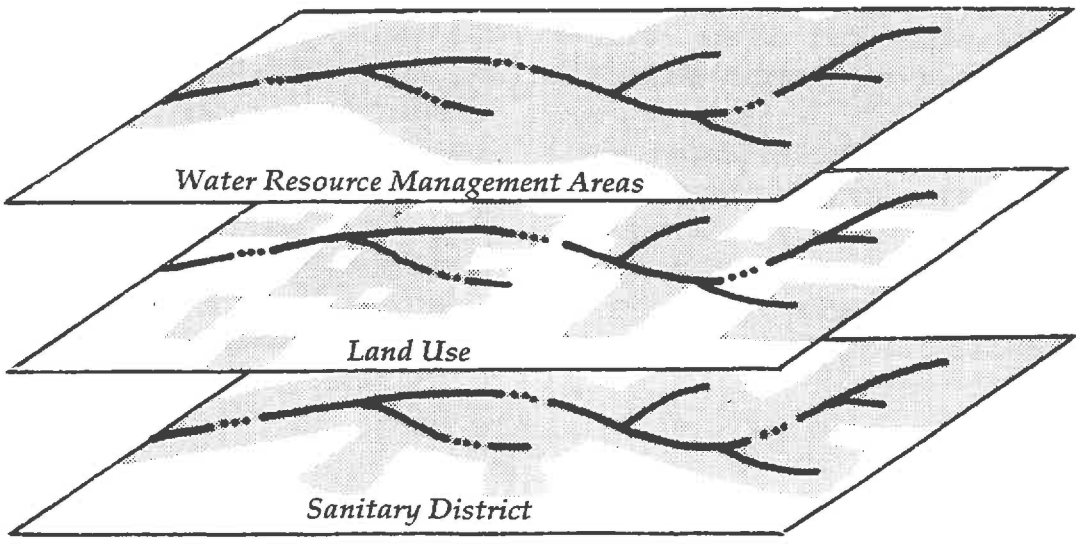
Unfortunately, many local comprehensive plans are based on magisterial district boundaries. Because nature doesn't follow political boundaries, such divisions needlessly aggravate water resource planning and protection. Computer models must still be based on real watersheds, resulting in constant frustration over attempts to reconcile the technical with the political. Moreover, magisterial districts typically change every ten years based on the most recent census. Water resource solutions will take longer to accomplish than the 10 years a district boundary remains current. It is important that planning area boundaries remain constant while long-term water resource management strategies are being implemented.

Watershed boundaries may be the focus of political aggravation when they are shared. Two localities that share a stream or river as a jurisdictional boundary may have conflicting agendas regarding the same water body. The Chesapeake Bay watershed states, with their sometimes conflicting political priorities, provide an apt example of this. Just as the Bay states have agreed on a regional approach to restoring the Bay, localities should consider developing joint solutions for their own water resource problems.

Once watersheds have been designated, localities need to determine how much water is available. Stream flow and groundwater withdrawal characteristics are most useful in developing this data. Predictably, this information is prepared on a stream-by-stream basis.

The U.S. Geological Service maintains stream flow gauges throughout the country. Selected gauge information can be found in Chapter One of the Virginia Department of

GEOGRAPHIC INFORMATION SYSTEM LAYERS *FIGURE 6-7*

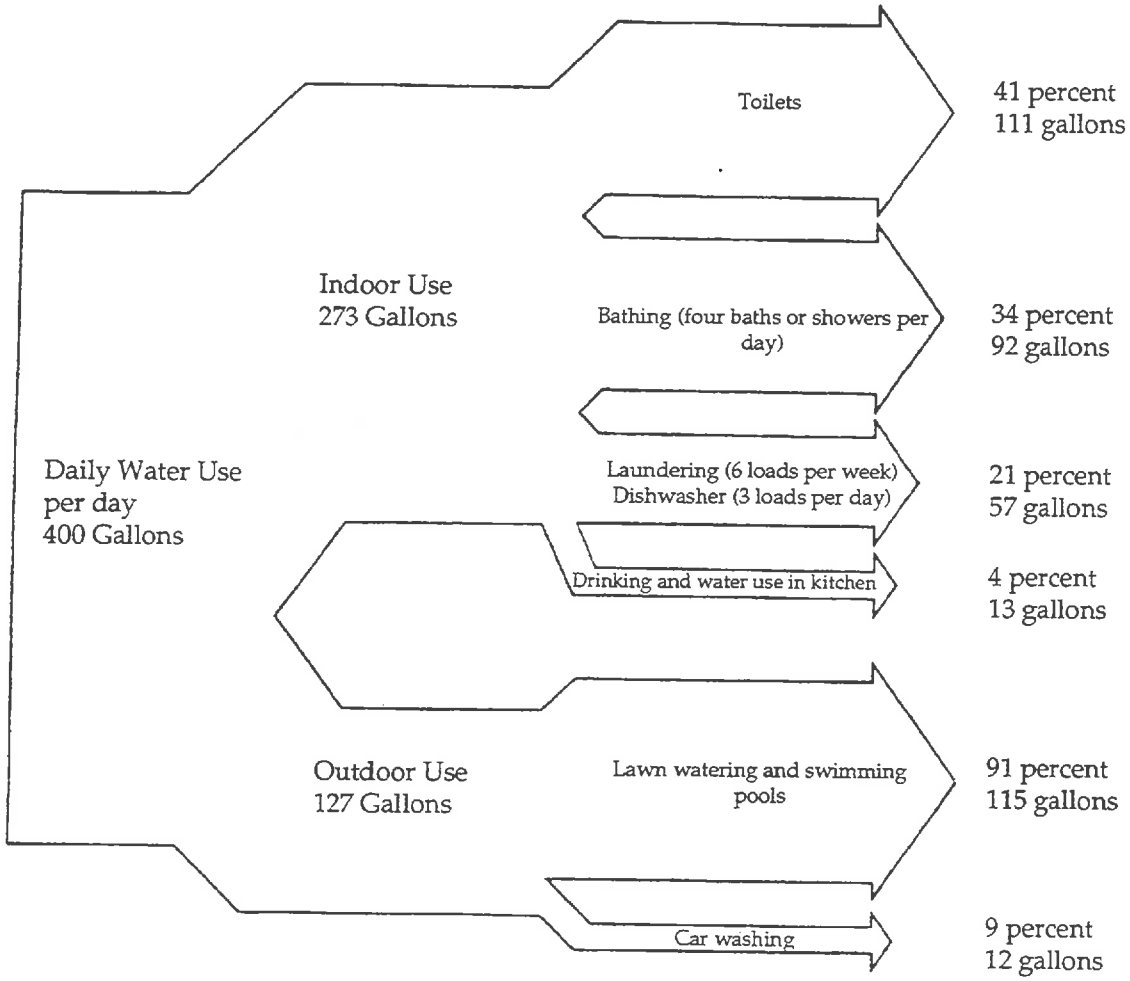


estimated. For instance, domestic use is generally based on 100 gallons per person per day (Figure 6-8). Some evidence indicates, however, that more rural populations use less per day than urban dwellers.[20] Water quality requirements vary for different uses. The more polluted the "raw" water, the more expensive the treatment to produce water fit for human consumption. Commercial and industrial uses are highly dependent on specific applications and are thus more difficult to estimate. Many of these uses are required to obtain withdrawal permits. Those permits may be valuable information sources for determining non-residential needs.

Legal Principles Regarding Water Use

The planning process must also account for limitations imposed by law. The Commonwealth of Virginia recognizes the common law concept of **riparian rights**. Riparian rights generally entitle the owner of land *directly adjacent* to a water body to receive the full natural flow of the stream without change in quality or quantity. Riparian owners are legally protected from excess flood waters being dumped on their property. A property owner is theoretically protected

Typical Residential Water Use by a Family of Four — *Figure 6-8*



Source: Adapted from Sanders and Thurow, *Water Conservation in Residential Development: Land-Use Techniques*, 1982

A comprehensive plan establishes public policy which sets the direction of a jurisdiction's growth and development. Water resource planning also requires identification of priorities and development of policy statements. Combining a water resource management plan with the local comprehensive plan increases the likelihood of identifying long-term issues and developing long-term solutions. Some localities have been known to examine critical water resource issues only after arriving at a crisis or facing a state or federal mandate. Such localities typically are forced into more costly short-term solutions because they react to problems after-the-fact rather than proactively planning to avoid the problems. For example, localities that must comply with the new EPA stormwater management regulations[25] will find addressing water resource management issues within the comprehensive plan an effective way to integrate several required programs.

Since the hydrologic system is closed, we cannot create more water. We can only decrease the demand *or* improve allocation of available resources. The more intense the competition for water, the more important management of the resource becomes. When considering solutions, it is important to recognize that things we do to one part of the water system have the potential to affect other parts we do not intend to change. The comprehensive plan process provides an excellent forum for recognizing water resource relationships and avoiding unintended problems.

On the East Coast, rainfall is abundant and people are surrounded by water. Many stream networks criss-cross Virginia. The Chesapeake Bay and Atlantic Ocean are on the Commonwealth's doorstep. Obviously much of the world's water is unexploitable in its present form. We cannot "drink" water vapor. However, some communities have tried to solve critical water supply problems with unconventional approaches of the past, present and future, such as cloud seeding, iceberg towing, and desalination plants.

Not only is most of the world's water unusable, it's often inaccessible. Communities located far from a river must pump the water through pipes. Aquifers deep within the earth's surface can be tapped only by expensive well drilling rigs. Creation of reservoirs is made more difficult by conflicting and competing regulations. The inaccessibility of water is a problem that can be overcome, but often only at great expense. Comprehensive water resource management planning, by itself or as part of the local comprehensive planning process, provides an opportunity to plan for the optimum use of available water resources while minimizing expenses.

After accumulating the data and setting parameters, hard questions must be answered. Is there a balance between the supply and demand in each watershed? Is the supply adequate? For quantity? For quality? Now? In the future? If the answer is yes, how can those characteristics be maintained?

PHYSICAL CONSTRAINTS TO DEVELOPMENT

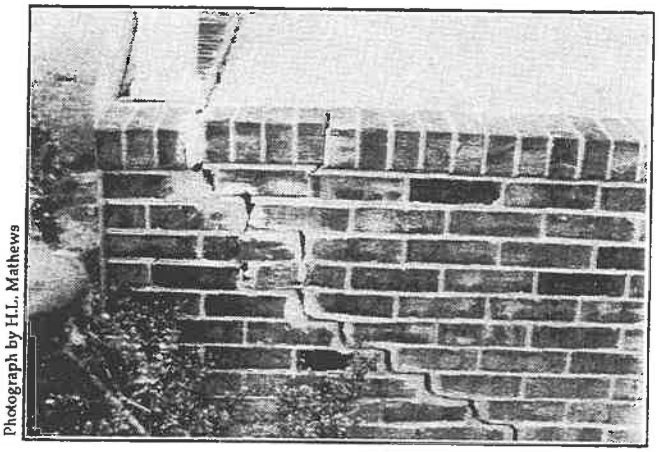
As part of the comprehensive plan, local governments should clearly indicate local policy on land use issues relative to water quality protection. Local governments should ensure consistency among the policies developed.

# # #

b. As a minimum, local governments should prepare policy statements for inclusion in the plan on the following issues:

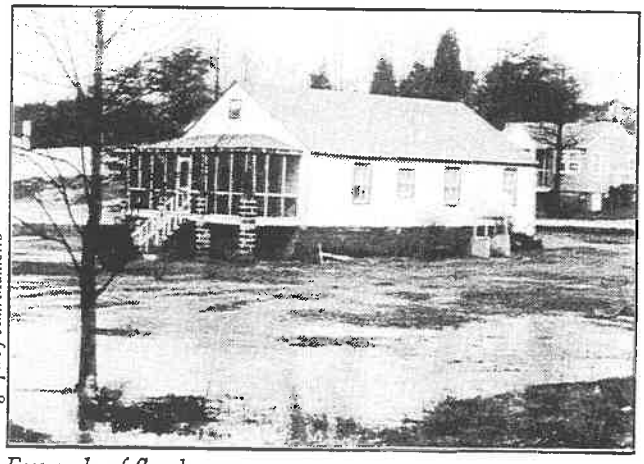
(1) Physical constraints to development, including soil limitations, with an explicit discussion of soil suitability for septic tank use[.] (§ 5.6.A.2)

The starting point for developing policies to implement a sound local development strategy is a careful assessment of physical conditions which naturally limit development. These factors include flood-prone areas, steep slopes, poor soils, wetlands, and other environmentally sensitive features which may have been designated as Chesapeake Bay Preservation Areas. The existence of these features **should** be major considerations for site design and development but have too often been ignored. Cracked building foundations, chimney separations, settling, wet basements, eroded roadways, and failing septic systems are just a few examples of environmental and economic harms that result from development in areas with physical constraints. A local government can help developers and property owners avoid hazards and high corrective costs by identifying and considering physical constraints to development during the comprehensive planning process. Moreover, matching the intensity, type, and location of development with the capacity of the land to accommodate development will have fiscal and water quality benefits for the locality as well. For example, failing septic systems can contaminate groundwater and eventually the Bay, and necessitate costly public sewer extensions in remote areas. Even though there are engineering solutions to some physical constraints, planning to avoid expensive site development or construction is much more cost-effective.



Photograph by H.L. Mathews

Cracked wall from construction in shrink/swell soil.



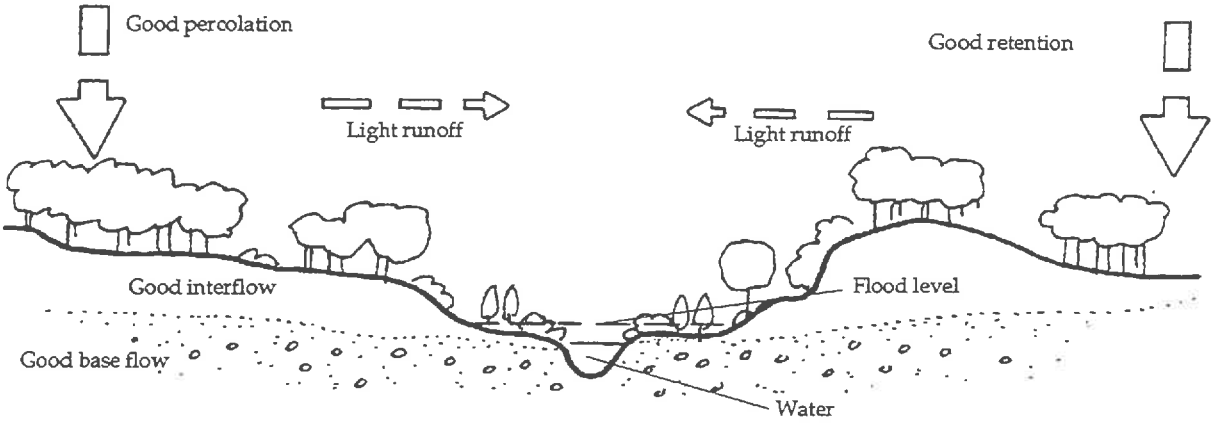
Photograph by H.L. Mathews

Example of flood-prone area.

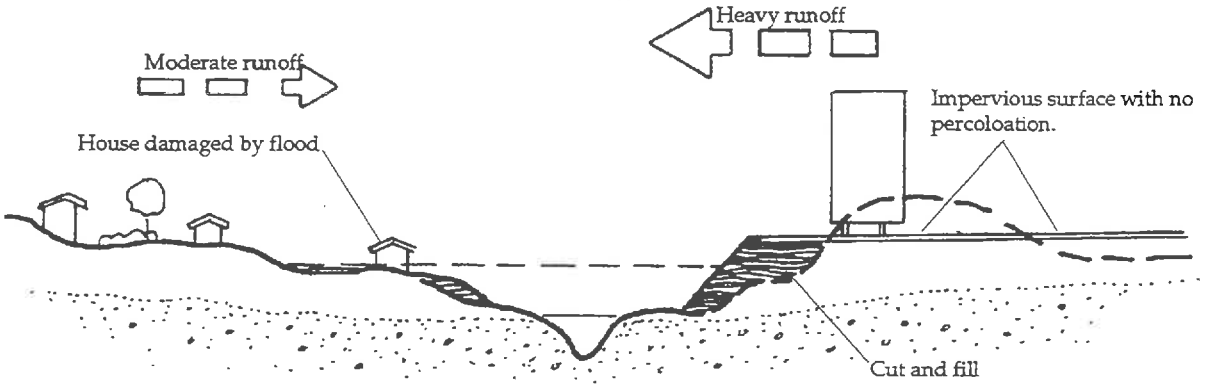
A variety of land features constrain development. Assessing the location and prevalence of these features will be a critical step in formulating local policy addressing suitable areas for development. A brief description of the major limiting features follows.

IMPACT OF DEVELOPMENT IN FLOODPLAINS *FIGURE 6-10*

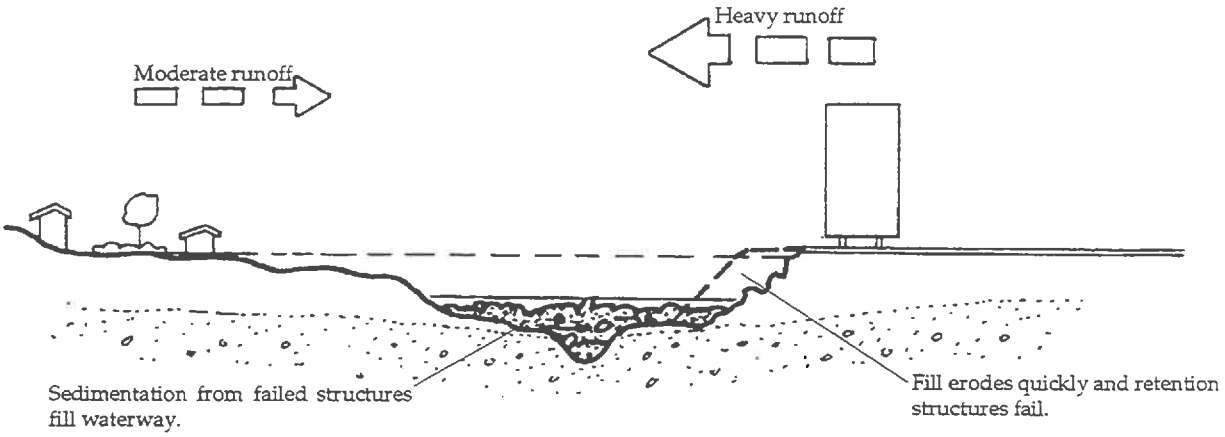
1. Undeveloped stream area with water cycle in balance.



2. Fill placed in floodplain will change flood patterns and may increase erosion.



3. Sedimentation and increasing erosion raises flood levels and increases flood frequency and severity.



For proper treatment, septage should not leach too quickly nor too slowly. When soils are saturated, or when drainfields are located on steep slopes or highly erodible soils, septage may not be sufficiently treated. Moreover, highly erodible soils and unsuitable slopes often occur near streams, creeks, and river banks, where failing septic systems would have severe and immediate water quality impacts.

Highly permeable soils, such as dry, sandy soils, even where slope is moderate, are also unsuitable for installation of septic systems. Highly permeable soils are defined in § 1.4 of the Regulations. This type of soil allows effluent to move too quickly to provide adequate treatment, and the potential for groundwater contamination is significant. Septic systems may also be unsuitable where highly permeable soils exist in combination with bedrock or seasonally high water tables less than four feet from the surface. Highly permeable soils in combination with these characteristics are particularly unsuitable for mass drainfields. [29]

If development is to occur in a manner which will protect natural resources and public health and safety, all of these factors should be considered in determining areas where septic systems will be allowed and those areas where public sewer or alternative on-site treatment are more appropriate. Local land use policy should direct incompatible development away from areas which are characterized by poor soils and toward areas where the extension of public sewer lines is planned. Areas which are unsuitable for septic tank use and where public sewer lines are not planned should be designated as potentially unsuitable for development or as areas where development should be restricted or delayed until proper infrastructure can be provided.

Prime Agricultural Lands

Soil types are also rated by the U.S. Department of Agricultural Soil Conservation Service for suitability for agricultural uses. Those soils best suited to producing food, feed, forage fiber, and oilseed crops are defined as "prime farmland" by the USDA.[30] These soils produce greater yields with less energy, fertilizer, and other expenditures, often with fewer impacts to the environment than from production on less suitable soils. However, development pressure is also higher on prime farmland because the topography is relatively flat, the land is substantially cleared, soil stability is good, and land ownership is generally consolidated into large parcels.

Localities that desire to maintain agriculture as a viable land use should recognize prime farmland areas in the planning process in order to protect these operations in the long-term. The U.S. Department of Agriculture has developed a suitability analysis for farmland protection called the Land Evaluation and Site Assessment (LESA) system. LESA helps localities identify prime farmlands for protection and also helps identify areas to target for growth.

The LESA system evaluates each parcel by assessing its soil suitability, productivity, and compatibility with primary crops. Each parcel's soils are ranked in comparison with the best soil type in the locality. LESA also factors in conservation methods, farm size, adjacent land uses, proximity to villages, infrastructure, and land use regulations to help produce a rating that allows each site to be compared with others in the locality. The system provides a valuable tool for land use decision makers to employ when trying to protect prime farmlands.[31]

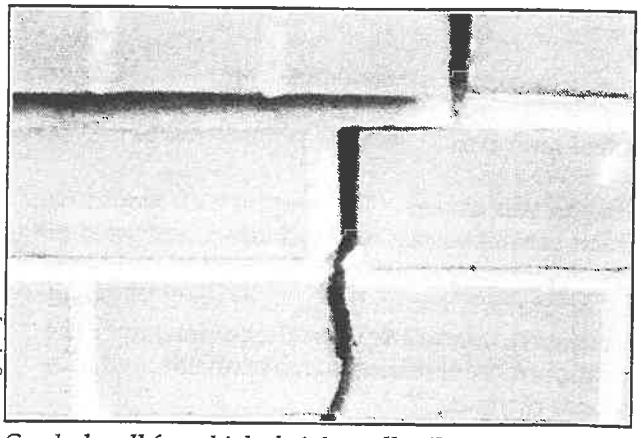
to the height differences indicated by the lines themselves. For example, topographic lines running very close together and adjacent to a water body would indicate significant relief at that point, such as a bluff. Smaller scale topographic maps (e.g., 1:400 scale) may be more useful in identifying significant relief. See Figure 6-9 for an example of reading contour lines on a topographic map.

Delineating slope suitability can be accomplished as follows:

Land Features	General Description
Flat Land	0-2% slope
Low Slope	3-7% slope
Moderate Slope	8-15% slope
Steep Slope	16-25% slope
Very Steep Slope	> 25% slope

Define slope categories which are suitable, moderately suitable, and unsuitable for development. As an example, a locality might classify low slopes (from 0-7 %) as suitable, moderate slopes (from 8-15 %) as moderately suitable, steep slopes (from 16-24%) as potentially suitable, and very steep slopes (>25 %) as unsuitable.

Then, using VirGIS maps, USGS maps, or smaller scale topographic maps, locate the moderately suitable, potentially suitable, and unsuitable slopes. Locating these slopes can usually be determined by visually examining the maps. However, calculating these slopes (rise over run) may be necessary for some areas. For example, a 20 percent slope indicates 20 feet vertical drop over 100 feet horizontal distance. The slope information should be transferred to a working map to again identify areas suitable for development and areas where development should be avoided.



Photograph by H.L. Mathews

Cracked wall from high shrink-swell soils.

STEP THREE

Identify and map sensitive soils.

Areas characterized by soils with extremely low permeability may be identified using local soil survey data or the VirGIS soil maps provided by the Department. Hydric soils and depth to water table also appear on VirGIS maps. If VirGIS is unavailable, local governments may use SCS data, ASCS data, local soil surveys, and local health department inventories to identify soils with extremely low permeability, or combinations of high permeability and depth to bedrock or water table. If a soil survey does not exist, preparing one should be a high priority. Localities interested in having a soil survey completed should contact the Department of Conservation and Recreation, Division of Soil and Water Conservation in Richmond (see Appendix A).

As part of the information base, the location of poor soils may be delineated as follows:

A VirGIS map, local soil survey, or other available resources may be used to identify the areas with low soil permeability (i.e., less than 0.6 inches per hour), highly permeable soils, and high water tables. An overlay

area with few or no constraints should be considered highly suitable. For water quality protection, this composite technique should include at least three layers of information (flood-prone areas, steep and very steep slopes, and poor soils) as well as any other features which may be of local significance. The final composite map will then depict those areas with one or more constraints.

Finally, the identified areas should be ranked according to development suitability. A locality should consider using several categories ranging from highly suitable to unsuitable.

Once the working composite maps of flood-prone areas, slopes, and soil characteristics have been developed, it is then possible to determine areas suitable for various types of development by overlaying all the maps of significant physical features. The chief objective is to determine what, if any, types of development will be allowed in sensitive areas, and this analysis should be integral in formulating the plan's future land use recommendations. Table 6-A in Appendix E describes the tolerance and suitability of various environmental features for development. This matrix includes recommended development policies for each natural characteristic and may be used to aid general decision-making about appropriate land uses. For example, impervious soils will not tolerate septic system use and areas with such soils should be designated unsuitable for development unless public sewerage is to be provided.

Plan Formulation and Policy Development

Although physical constraints to development may be a factor in the decisions of both developers and consumers, it usually is not a major factor. Location, dwelling unit character, availability of public services, and economics traditionally play much more important roles in such decisions. The course of development will be influenced by public policy and the land market. By understanding the capabilities and the limitations of land features and using this information to help determine how the land will be used, local governments can derive benefits in addition to water quality protection. Public policy which directs development into areas with little or no constraints to development also results in such community benefits as lower direct construction costs for developers, reduced renovation costs or losses in property values, and land values that are maintained or increased. [34]

Based on findings in the environmental inventory, localities should consider policies which limit or prohibit development in areas which have been classified as having low suitability or as being unsuitable for development. Comparing existing development patterns with the composite land suitability map may identify situations which pose difficult policy choices for a local government. The following discussion is designed to help identify ways in which those choices can be made.

PROPERTY SUBJECT TO FLOOD DAMAGE
TABLE 6-4

Year	Households	Total Value of Property ($1,000)
1980	320,600	14,800,000
1983	338,600	15,800,000
1987	368,900	17,400,000
1998	462,100*	22,600,000*

Note: * FEMA projections based on the rate of floodplain development in 1987.

Source: Federal Emergency Management Administration, *1987 Donnelley Report*, 1987

NOTE: Enrollment by a local government in the National Flood Insurance Program administered by the U.S. Federal Emergency Management Agency (FEMA) enables property owners to be compensated for flood damage. While enrollment limits development within the 100-year floodplain, property owners who build houses under FEMA safety standards are eligible for significantly reduced flood insurance premiums.[35]

Soil Suitability for Septic Tanks

Septic tank suitability is a local economic consideration as well as a water quality consideration. Local policies should ensure that septic systems are used only in locations where their operation will not create health hazards or have adverse effects on natural systems, especially surface and groundwater systems.

Designing, constructing, and maintaining adequate sewage treatment systems on lots with flood-prone areas, steep slopes or poor soils may be especially difficult. If the drainfield is not located in a relatively level position or in good soils, effluent will drain to the end of the field and prevent adequate treatment of bacteria. In such situations, effluent may also rise to the soil surface, posing a threat to human health.

Whether alternative sewage systems or public sewer is to be used, careful consideration should be given to potential impacts of proposed land uses (impervious surfaces and density) and potential soil limitations on sewage treatment systems. In addition, minimum low-flow levels should be considered for streams which will receive effluent from treatment plants. The proposed level of development should be balanced with the environment's ability to support sewage treatment systems. Proper design, installation, and long-term maintenance is essential to guarantee safe sewage treatment. It is the responsibility of the local government to ensure that the most suitable type of sewage treatment system is chosen. In some instances, there may be areas which are not suitable for development. These areas should be mapped and protected by local government policy.

Areas Unsuitable for Development

Areas where sewer extensions are not planned and that are also unsuitable for alternative sewage treatment systems could be designated as conservation areas or areas for other low intensity uses. Such areas are often found along waterways and may also be designated as part of the buffer area adjacent to

Resources. The Task Force has recommended several amendments to Virginia Department of Health (VDH) regulations.[36]

Increased Vertical Separation

There must be adequate unsaturated soil between the drainfield and the water table for the system to provide biological treatment. Otherwise, bacteria, viruses, and other pollutants will leach nearly unimpeded into ground and surface waters. The Septic Tank Task Force has recommended new minimum vertical separation requirements in order to minimize contamination of surface and ground waters. It proposes separations of 24 inches for Group I soils (sand and sandy loam) and 18 inches for all other soils.[37]

Setback Restrictions

In addition to vertical flow requirements, many localities have adopted increased horizontal distance requirements -- setbacks of 70 feet from shellfish waters and 50 feet from all other surface waters. In addition, septic drainfields must be located at least 25 feet from any structure and 100 feet from any well. Several localities have adopted a 100 foot setback from all surface waters to minimize the incidence of poorly treated effluent being released into surface waters.

Additionally, some localities have increased the structure setbacks to minimize impervious cover immediately adjacent to the drainfield. This allows a drainfield to operate under more optimal conditions by decreasing the quantity of runoff onto the drainfield and maximizing vegetated soil around the drainfield to provide better treatment. Localities may want to consider adopting minimum setbacks of 50 feet for structures and 100 feet for surface waters as part of amendments to the subdivision ordinance.

Lot Size

Lot size requirements directly relate to the ability of septic systems to properly function. A North Carolina coastal plain study has suggested that areas with sandy and sandy loam soils should have a minimum lot size of seven acres to prevent groundwater supplies from being contaminated with bacteria and improperly treated effluent.[38] Similar soils are prevalent in some parts of Tidewater. In addition, significant increases in nitrate concentrations in groundwater have been detected where density exceeds three drainfields per acre. Localities should consider requiring mandatory open space subdivision design or increasing the minimum lot size where public sewer is unavailable and is not planned for extension.

Alternative On-Site Systems

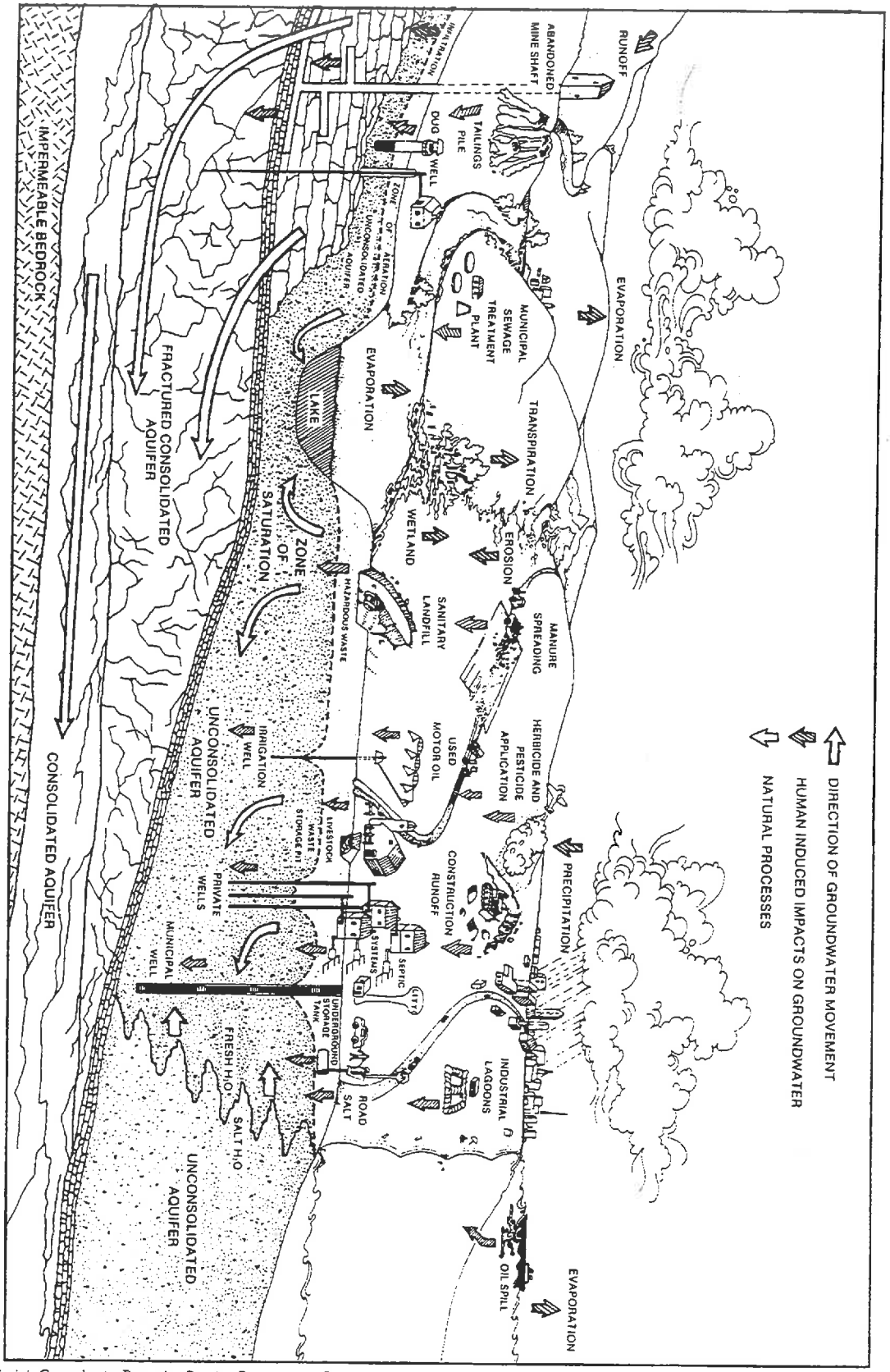
Alternative septic systems, such as Wisconsin sand mounds and low pressure distribution (LPD) systems , have gained increasing popularity among scientists as technology has improved. LPDs are particularly common in parts of North Carolina. Although a few localities in Virginia have restricted or even prohibited the use of alternative systems (mounds especially), many localities have found them to be beneficial in areas with very low or very high perk rates. Clarke County requires alternative systems in such areas.

Capital Improvements Program

The Capital Improvements Program (CIP) is an implementation tool for public expenditures, and has been used indirectly as a means for controlling the timing and rate of development. However, the CIP can also be used to implement water quality protection measures. CIP allocations should be examined for adequacy in addressing current and future physical constraints, especially those for septic systems. For example, a locality should determine whether it has the facilities to inspect and pump-out septic systems. Corrective measures for areas with known septic problems can be tied into the CIP process. Over the longer term, localities should focus on the provision of public sewerage to areas targeted for growth which are unsuitable for septic systems.

GROUNDWATER AND LAND USE IN THE WATER CYCLE

FIGURE 6-11



Source: Virginia Groundwater Protection Steering Committee, A Groundwater Protection Strategy for Virginia, 1987

tices must be applied consistent with the characteristics of the water supply and the sensitive areas affecting that supply.

For groundwater, the zone of contribution (ZOC) is that area of the aquifer from which a public well draws its water (see Figure 6-12). The ZOC's boundaries can be estimated using various modelling techniques. The size, shape, and location of the ZOC vary with the characteristics of the aquifer and the well.

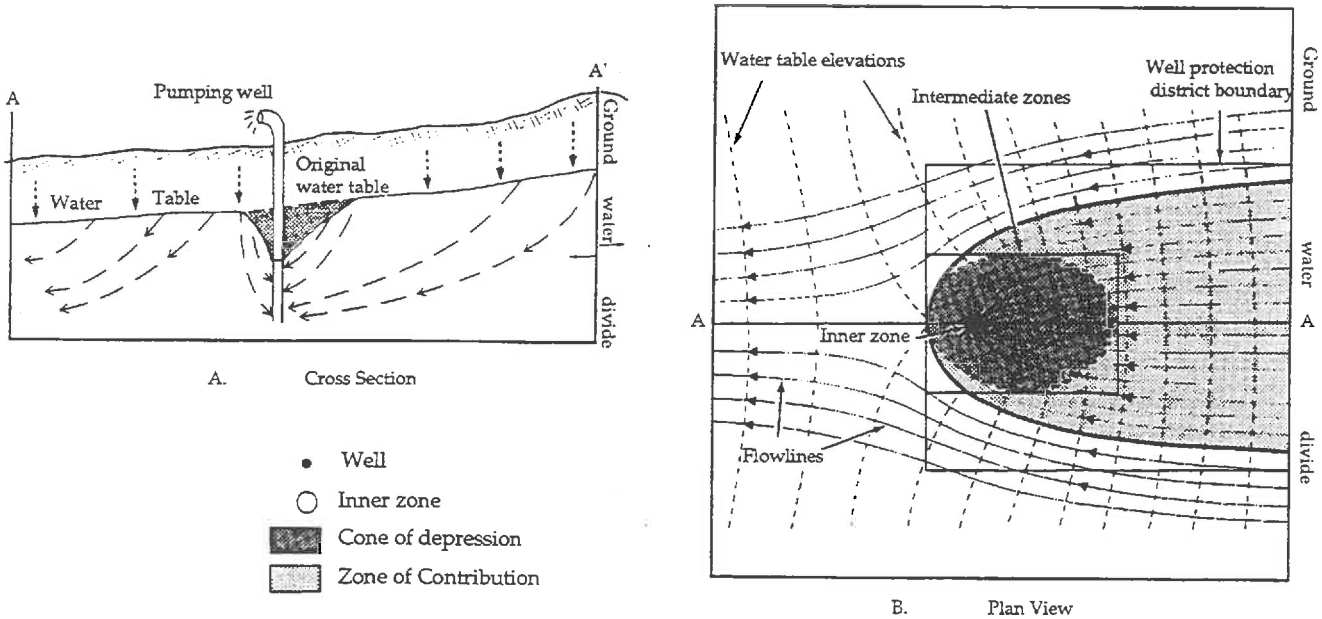
Other sensitive areas for groundwater protection are groundwater recharge areas. These areas are where groundwater flow tends to recharge aquifers. While replenishing an aquifer's water supply, these areas also have the potential to introduce contaminants into that aquifer.

For surface water, the sensitive area is the watershed contributing to the water supply. The entire watershed is included since all lands within the watershed are potential contributors of pollutants.

Regulations need to be established within sensitive areas to protect water supplies from contamination. While most human activities have the potential to pollute, the potential varies with the activity. Certain land uses such as landfills have an obvious potential to cause pollution. Land disturbances associated with residential and commercial land uses such as septic systems, roads, and underground storage tanks have just as much, or greater, potential to pollute water supplies.

For both surface water and groundwater, the rate of withdrawal and the withdrawal mechanism are important to consider in protecting the water supply. A withdrawal rate greater than the supply capacity will result in a drawdown of the water supply.

WELL PROTECTION DISTRICT AND MANAGEMENT ZONES *FIGURE 6-12*



Source: Born, Yanggen, and Zaporozec, *A Guide to Groundwater Quality Planning and Management*, 1987

(This chapter treats groundwater and surface water separately; however, many of the steps are similar and may be conducted concurrently.)

Several state agencies have useful information on both ground and surface water. Localities should contact these agencies to obtain this information. Table 6-5 provides a brief list of information available from state agencies on groundwater. The *Virginia Groundwater Management Handbook* provides a more comprehensive overview and even contains some information on surface water.[41]

Before beginning a data collection effort, a locality should define planning units and map scale. Planning units apportion a locality into logical areas for the purpose of studying areas in detail. When considering water systems, the logical planning unit is a **watershed** (see Appendix E).[42] The watershed boundaries identified in the **hydrologic units** (HU) maps (see page VI-14) should establish planning area boundaries for the water supply inventory.

STEP ONE

Inventory surface water and groundwater supply systems.

Surface Water

Identify the stream and river networks within the jurisdiction using the USGS and the HU maps. Differentiate between fresh and salt water streams and rivers where possible. Identify all impounded water bodies and their uses. This information should be used as the basis for classifying watersheds for their water supply potential.

Groundwater

In order to understand the characteristics of a groundwater system, it is important to understand the hydrologic cycle and hydrogeology of the area. Hydrogeology is the study of groundwater – its origin, occurrence, movement, and quality. Groundwater is also part of the hydrologic cycle and, in order to understand the influence of the hydrologic cycle on groundwater, it is essential to have some basic knowledge of precipitation, infiltration, the relationship between groundwater and surface water, and the influence of the geologic framework on water resources.[43] All of these characteristics have an impact on the locations and relative importance of sensitive areas, zones of contribution and aquifer recharge areas.

Identify and describe all aquifers present in the locality. Describe the location and types of each aquifer. Information on direction and rate of groundwater flow should be included. Most Tidewater localities are within the Virginia Coastal Plain which is typified by a water table aquifer underlaid by several semi-confined aquifers (see Figure 6-13). The *Ground Water Map of Virginia* (SWCB Information Bulletin 560) is a good source of general information on the location and description of these aquifers.[44] The map also provides some information on the pollution potential of each aquifer.

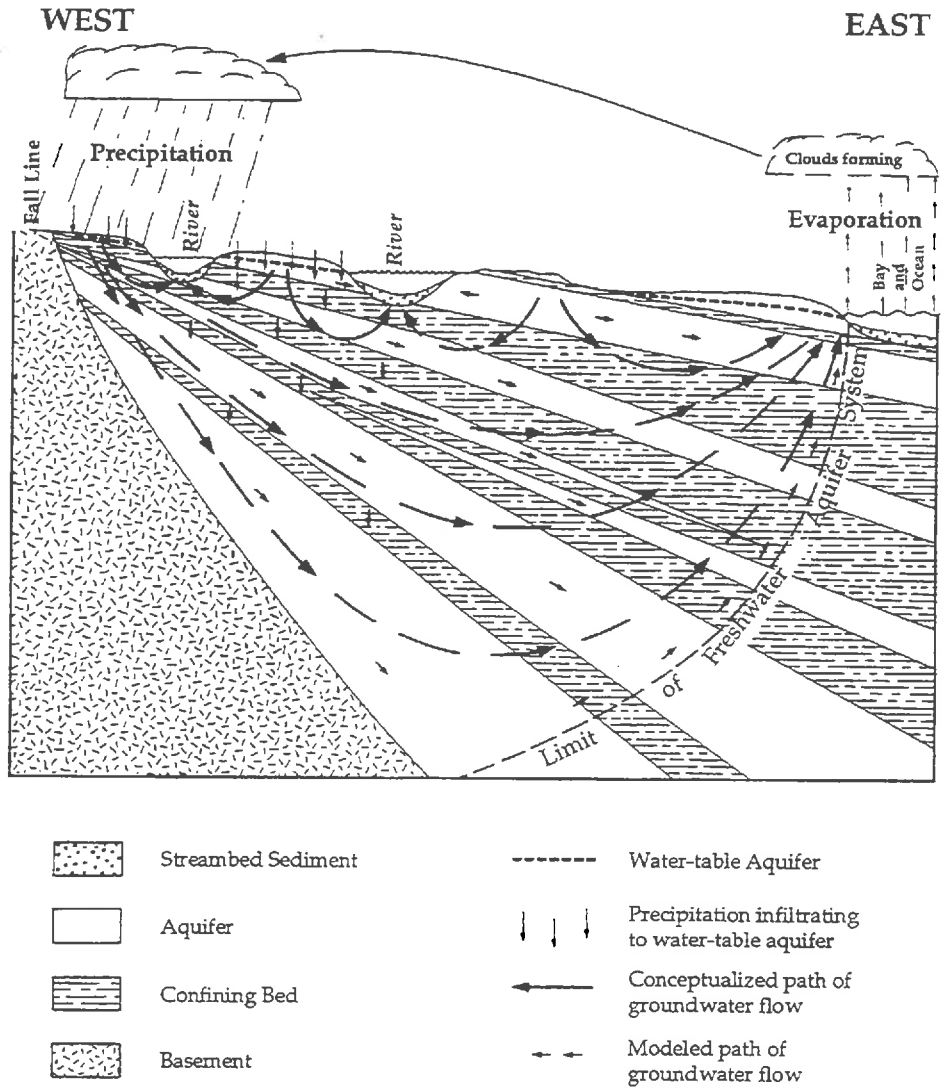
If available, a primary source of hydrogeologic data is a USGS groundwater study of the area. These studies provide maps of aquifers and confining units, accurate information about occurrence, movement, use and quality of groundwater, and hydraulic characteristics. The studies also model groundwater flow to determine characteris-

tics such as transmissivity, storage, vertical leakance, recharge, and projected effects of increased groundwater withdrawals.[45]

The State Water Control Board (SWCB) also performs groundwater studies. These studies are currently available for a limited number of localities and can be useful for information on geology, occurrence and use of groundwater, hydrology, and groundwater quality.[46]

If neither USGS nor SWCB studies are available, other resources can be used to evaluate characteristics of area aquifers. To assess the yield and importance of individual aquifers to the water supply, information on the specific characteristics (i.e. porosity and transmissivity) of the aquifers is necessary. Useful information for the surficial (water table) aquifer includes depth to groundwater and soil permeability. Information gathered from the Virginia Department of Health on well drill-

GENERALIZED HYDROLOGIC CYCLE FOR YORK-JAMES PENINSULA *FIGURE 6-13*



Source: U.S. Geological Survey, *Ground-Water Resouces of the York-James Peninsula of Virginia,* 1988

uses (within the watershed) by category: agriculture, high and low density residential, commercial, industrial, and conservation, for example. Identify potential contamination associated with each land use. For example, low density residential development may be associated with failing septic systems, runoff from extensive land clearing, and improperly constructed wells. The description should also include factors in the watershed which could impact water quality such as point source pollution discharges. Those watersheds with steep slopes and highly erodible soils should be noted, as should watersheds with a high percentage of impervious cover. The information collected should provide a picture of each watershed and its characteristics relative to water supply and degradation.

Identify the amount, location, and use of surface water withdrawals within each watershed. This information is useful to evaluate the importance of each watershed within the locality's overall water budget (supply/demand situation). The SWCB administers a program requiring the registration and reporting of water withdrawals over 10,000 gallons per day (GPD). The program does not require water users to get a permit, nor does it limit or restrict the right of water users to withdraw water. Exemptions from SWCB program include: withdrawals less than 10,000 GPD, withdrawals of saline surface water, and withdrawals made for the purpose of irrigating crops. The SWCB publishes the results of the water withdrawal reports as an aid in evaluating water use.[50]

Groundwater

Identify the amount, location, and use of groundwater withdrawals by watershed. This information is useful to evaluate the importance of groundwater within each watershed and throughout the locality. It is also useful in determining areas experiencing excessive withdrawals (see Figure 6-14).

The SWCB program requiring the registration and reporting of water withdrawals over 10,000 gallons per day (GPD), as discussed earlier in this step includes groundwater withdrawals. Again, information (available from the SWCB) on these withdrawals should be collected, and the amount, location, and use of withdrawals noted.

Information on agricultural withdrawals is difficult to obtain and may have to be estimated. Information on minor groundwater withdrawals (less than 10,000 GPD) can be obtained primarily from the Virginia Department of Health (VDH). The VDH maintains a database of all public supply wells in the Commonwealth. The local health department has information on private wells. Existing land use data can also be used to estimate location, amount, and use of withdrawals.

The public supply wells should be mapped and the information collected in STEP ONE should be used to identify the zones of contribution for each well. Sensitive areas should be considered for protection since land uses in these areas have the greatest potential to contaminate wells.

STEP THREE

Assess the quality of surface water and groundwater resources.

Surface Water

To properly evaluate the viability of existing and potential surface water supplies, surface water quality must be evaluated. The

Groundwater

Monitoring the presence of substances in groundwater is important in revealing existing conditions, trends, and potential pollution problems. This should include collecting information on total dissolved solids, pH level, heavy metals, chloride, fluoride, toxics, nutrients, dissolved oxygen, and bacteria levels. The SWCB groundwater reports will have the most detailed information on the presence of these substances and groundwater quality.

Localities without a SWCB groundwater report or those wishing to gather additional groundwater quality information can collect data from water well completion reports and well logs (of public wells) within the locality. This information is available in hard copy at the VDH Regional offices (see Appendix A).[52] Localities can also sponsor their own well testing programs, like the Cooperative Extension programs in Warren and Clarke Counties.

Based on the collected data, identify those watersheds experiencing groundwater quality problems. Problems may be evident by the presence of high total dissolved solids, high or low pH, heavy metals, chloride, fluoride, coliform bacteria, or nitrate. If historical data are available on groundwater quality, comparisons should be made with current data to determine trends in water quality degradation.

STEP FOUR

Identify point sources of pollution.

Point sources of pollution are those which reach state waters through a single source such as a pipe outlet. The outfall structures of sewage treatment plants, industrial plants, or other facilities are examples of point sources of pollution. All legal point source discharges to surface water are regulated by the SWCB through its Virginia Pollution Discharge Elimination System (VPDES) permit program.[53] Each permittee must monitor to ensure the discharge meets certain quantity and quality parameters. These parameters include flow, BOD (biochemical oxygen demand), DO (dissolved oxygen), suspended solids, settleable solids, chlorine residual, fecal coliform, pH, oil and grease, and temperature.

In this step, gather a list of point source discharges permitted under the VPDES program. This information is available either from SWCB's regional offices or from the SWCB Office of Water Resources Management in Richmond (see Appendix A). The SWCB regional office may also be able to provide additional information identifying the quality of the effluent being discharged from each source. All permitted sites other than single family dwellings are required to monitor and report information to the SWCB characterizing the quality of their effluent.

STEP FIVE

Identify nonpoint sources of pollution.

Surface Water

Nonpoint sources of pollution are those sources that cannot be traced to a single point of discharge. It is difficult to monitor and identify nonpoint source pollution, but information can be collected and analyzed to provide qualitative indicators.

Review the Department of Conservation and Recreation Division of Soil and Water Conservation's (DSWC) "Nonpoint

The Groundwater Protection Steering Committee (GWPSC) consists of representatives from eleven state agencies, all of which have programs dealing with groundwater. In 1987, the GWPSC developed a *Groundwater Protection Strategy for Virginia* and agreed upon a goal for that Strategy:

The Groundwater Protection Strategy should confirm and advance the legislatively mandated anti-degradation policy of the Commonwealth by initiating 'anticipate-and-prevent strategies' designed to protect the state's groundwater from any degradation that would be harmful to human health or the natural environment, now or in the future.

Since the development of the Strategy, the GWPSC has monitored achievements consistent with the goals presented in the Strategy and, in 1990, published a *Supplement* to the Strategy. This Supplement assesses the current situation, reviews past accomplishments, and sets an agenda for the future. Copies of these documents are available from the SWCB.

Tidewater's groundwater is also threatened by the regional problems of saltwater intrusion, excessive groundwater withdrawal, nonpoint sources of pollution in areas with highly permeable soils and/or a high water table, and contamination of confined aquifers from improperly abandoned and improperly constructed wells.

Underground Storage Tanks: Identify the location of all underground storage tanks (USTs) in the locality. There are more than 64,000 USTs in Virginia.[58] A UST leak has the potential to cause serious groundwater contamination and recent EPA studies reveal that as many as 35 percent of all USTs eventually leak.[59] USTs have been identified by the GWPSC as one of the top five priorities for groundwater protection. The SWCB administers the Virginia Underground Storage Tank Program and maintains a computer data base of all USTs in Virginia.[60] For a list of USTs, localities should contact the SWCB (see Appendix A).

Landfills: Collect information from the Department of Waste Management on groundwater contamination occurrences relating to landfills, dumps, and other disposal sites. Map the location of these occurrences, as well as the location of all known landfills, dumps, and disposal sites.

Hazardous Waste Facilities: Identify the location of hazardous waste facilities in the locality. Contact the Department of Waste Management (DWM) for a list of these facilities. DWM is also the source for sites designated as Emergency and Remedial Response Investigation Sites (ERRIS). There are 16,000 of these sites nationally. If there is an ERRIS site in the locality, check to see if it is on the National Priority List (NPL) for remediation. Over 1,000 sites nationally are on this list.[61]

Waste Lagoons: Identify all VPA permitted activities as potential sources of groundwater contamination. This would include pits, ponds, and lagoons for waste storage, treatment, or recycling.

Septic Systems: Estimate the location and number of existing on-site sewage treatment systems in the locality from the existing land use map. The local sanitarian may be able to help estimate numbers and locations of septic systems, in order to identify high densities of septic systems. Estimate the total number of future septic systems from the future land use map.

Pesticides and Fertilizers: From the existing land use map, identify those areas of the

an evaluation of alternative growth and development scenarios, policies should be developed and adopted to address local water supply protection issues and the larger issue of water resource management. The adopted policies should be interrelated with other plan policies such as economic development policies, growth areas and appropriate densities.

The local comprehensive plan should include a discussion of alternatives considered, as well as a discussion of the scope and importance of potable water supply protection (§ 5.6.A.2.c). The relationship between water supply protection policies and other land use and economic development policies should also be analyzed. If water supply protection policies are in conflict with other policies, these conflicts must be reconciled. For example, the future land use plan may designate a growth area within a future drinking water supply watershed. If the locality has no other future water supplies from which to draw, the growth area should be located elsewhere or modified so that development minimizes impacts on the water supply.

The comprehensive plan should, at a minimum, include policies to ensure the most appropriate water supply protection strategies will be utilized to provide high quality drinking water to the citizens of the locality. These policies should address a range of issues relating to water supply:

- water quality protection;
- water supply conservation and allocation;
- regional cooperation; and
- comprehensive water resource management.

Water Quality Protection

Water supply must be protected from existing and potential pollution. This requires the identification and protection of sensitive areas. For surface water, pollution sources should be regulated or restricted within the supply's contributing watershed. Strong plan policies establishing a protection strategy for critical watersheds will reduce the need for costly water treatment and increase the life of the water supply by reducing the rate of eutrophication. For a river water supply, watershed protection is more difficult since the watershed of the supply is extensive and usually goes far beyond local jurisdictional boundaries.

Groundwater protection is very important since a groundwater supply is difficult or impossible to purify once it becomes contaminated. Groundwater protection is more cost-effective than remediation.[62] Localities identified as State Groundwater Management Areas should prioritize their groundwater protection policies. These areas have been identified as having significant groundwater quality or quantity problems. These localities should also consider water supply sources other than groundwater for future supplies.

Local policies should specifically address protection of sensitive areas including critical groundwater recharge areas and zones of contribution. The greatest potential for groundwater contamination occurs in these areas. For this reason, land use and development must be carefully managed.

Groundwater recharge areas should be evaluated in terms of their significance and their ability to be managed. Deep flow re-

In areas of existing development, water conservation measures can be employed to extend the capacity of a water supply to sustain development. Several Tidewater localities have instituted voluntary water conservation during periods of peak water usage. Water supply rationing is the most drastic of water conservation measures. Rationing has also been used in Tidewater during drought times. Another water conservation strategy is requiring water-conserving plumbing fixtures through the local building code. Some localities have instituted programs and incentives to encourage or require retrofitting existing structures with such devices.

Consistent with growth and development policies, localities can also address the issue of allocation of water resources in their plan policies. Allocation policies can address expansion priorities for public water systems and priorities for allocation of water resources. Minnesota, for example, has established priorities as follows:

1. Domestic water supply;
2. Other withdrawals less than 10,000 GPD;
3. Agricultural irrigation (less than 10,000 gpd) and processing of agricultural products;
4. Power generation withdrawals over 10,000 gpd; and
5. Other withdrawals over 10,000 gpd. [68]

Allocation and expansion priorities should be established within the plan to guide future economic development within the locality.

Regional Cooperation

Water resources are a regional concern and localities should work together to develop regional water supply policies. Surface and groundwater resources often flow across political boundaries. Entire watersheds, not just the area within a locality, should be considered when developing water supply plan policies. This is especially relevant for river supplies. Entire groundwater aquifers should also be considered in regional policies. This system is extensive, especially in the coastal plain where the aquifers run the width of the region. Without a regional approach and regional cooperation, localities will not be able to properly protect their resources and may actually work against one another in their protection efforts.

In Northern Virginia, regional cooperation between all jurisdictions located within the Occoquan reservoir's watershed has protected that water supply from increased levels of nonpoint source pollution. Albemarle County and the City of Charlottesville have also cooperated in protecting their mutual water supplies.

Comprehensive Water Resource Management

Ideally, localities should develop a comprehensive water resource management plan which establishes policies and recommendations for each hydrologic unit within the locality and region. As a part of the

Albemarle County, Virginia depends on surface water resources for its (and the City of Charlottesville's) drinking water. In light of this dependence on surface water, the County instituted a management plan for all drinking water supply watersheds.

This management plan includes:

- Runoff Control Ordinance - "to protect against and minimize the pollution and eutrophication of the public drinking water supply impoundments resulting from land development in the watershed areas."

- Rezoned all publicly owned properties except school sites within water supply watersheds to a conservation district designation.

- Construction of a $5.3 million sewer interceptor and a $5 million sewage collection system for a community in a water supply watershed to eliminate several point discharges and failing septic systems. Construction of a sedimentation basin has also been proposed to alleviate non-point discharge in the community.

- The 1977 Comprehensive Plan was amended to remove all land in one water supply watershed from the "Urban Area" designation.

- The county underwent a comprehensive rezoning which placed major limitations on development in the "Rural Area" designated parts of the county. Special Use permits requirements addressed proposed developments located within water supply watersheds.

- The Comprehensive Plan was amended in 1982 which removed "Growth Areas" designations from four communities within water supply watersheds. These areas were later rezoned to "Rural Areas."

- Other activities are ongoing to continue protecting the county's water supply watersheds.

Source: Albemarle County, *The Comprehensive Plan for Albemarle County 1989-2010*, 1989

Amending Local Ordinances

Overlay Districts for Water Supply Protection

The zoning ordinance is the primary tool for protecting water supply quality. Zoning overlay districts can be used to protect critical areas within a locality that, if improperly developed, have the potential to impair a water supply. Watershed protection overlays have been implemented effectively in a number of Virginia communities to protect drinking water impoundments.[70] Use and density restrictions, performance standards, and specific design criteria applying within the overlay can ensure the water supply is protected from contamination.

Implementing aquifer recharge overlay districts can protect the both the quality and quantity of groundwater. Impervious surface restrictions, density limitations, and standards to ensure that stormwater runoff is retained on-site allow for the recharge of the aquifer.[71] The overlay district mechanism can also be an effective tool for managing land use and development within public wellhead protection areas. This technique can apply special use restrictions and best management practices which, if used in conjunction with emergency response plans, may be especially helpful in protecting public groundwater supplies.[72]

In areas not to be served by public water, community water systems are preferred where provided with strict requirements for well lot size and location.[73] Localities should consider increasing the horizontal stand-off distance between septic systems and wells to reduce the potential for well contami-

Criteria that can be incorporated into a local landscaping ordinance to help decrease water demand include:

- minimization of turf areas;
- using drought tolerant plant species;
- appropriate soil conditioning;
- grading for water flow and/or stormwater harvesting.

Water demand and usage varies greatly depending upon the type of landscape involved. Large open turf areas with no tree cover or shading require considerably more water than areas where turf is limited and existing trees are retained. Although turf can be minimized and water use reduced by designing a greater portion of the site as deck, patio, or driveway, this approach intensifies runoff and stormwater management problems and decreases groundwater recharge. Homeowners and landscape professionals can decrease impervious areas *and* promote water conserving landscape design by leaving large areas of natural vegetation in place or, when portions of a site are not left in a natural state, by using large planting or mulched beds instead of turf.

Although water conservation has not been an expressed objective of most landscape ordinances, some of the provisions included in them also save water. Trees that must be preserved or planted save water by cooling the air and soil and, in turn reducing evaporation. Incorporating water-conserving principles into local landscape ordinances would not be difficult. Specific criteria have been established for many localities that are readily available and easily adapted to any region.

Clarke County, Virginia has incorporated groundwater protection into its comprehensive plan and implemented a groundwater protection plan throughout the County. The plan was developed because the major portion of the County's population relies on groundwater as their source of drinking water and groundwater contamination has been a problem in the County.

The plan consists of a number of strategies:

1. **On-site wastewater treatment system management**
2. **Sinkhole Ordinance**
3. **Well standards**
4. **Underground storage tank requirements**
5. **Community education**
6. **Geographic information system**

These strategies were developed after a number of groundwater studies showed that groundwater resources in the County were vulnerable to contamination. Septic system siting and installation requirements were developed which relate to soil and geology conditions of the County more closely to those of the state. The sinkhole ordinance protects those sensitive areas which can act as conduits for polluted runoff to contaminate groundwater. Well standards were improved to insure that new wells would not increase the potential for groundwater pollution. Underground storage tank requirements were developed to limit the risk of pollution by petrochemical leakage. An education program was instituted to inform the public of the potential for groundwater contamination and how to reduce that risk. Finally, a geographic information system was installed to track and analyze natural resource data to achieve a higher understanding of the County's groundwater resources.

Source: Lord Fairfax PDC, *Clarke County Groundwater Protection Plan*, 1987

SHORELINE EROSION PROBLEMS AND CONTROL MEASURES

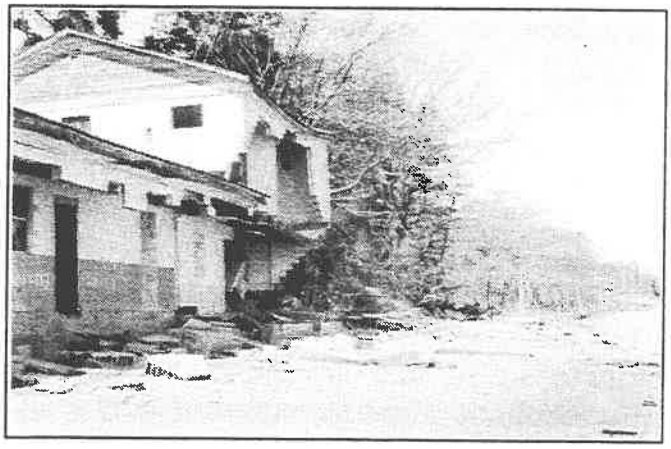
Local governments should establish an information base from which to make policy choices about future land use and development that will protect the quality of state waters. This element of the plan should be based upon the following:

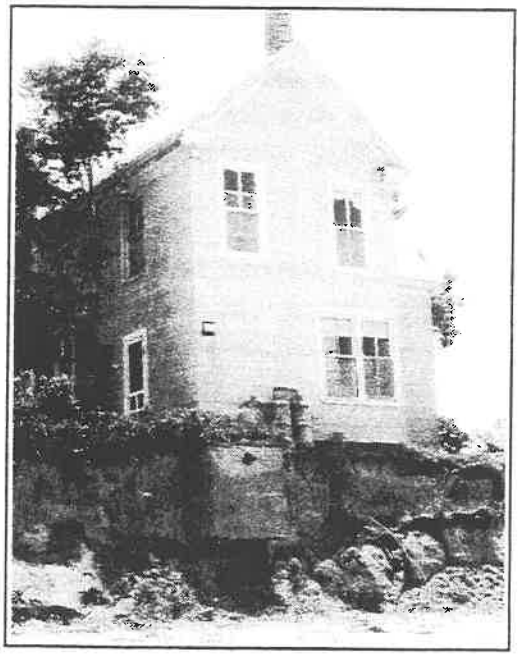
# # #

c. Shoreline erosion problems and location of erosion control structures[.] (§ 5.6.A.1.c)

Virginia has over 5,000 miles of tidal shoreline, very dynamic areas marked by the natural process of erosion and accretion. Human activity on or near the shoreline tends to increase erosion. Traditionally, *ad hoc* and post-development measures have been used to protect structures and beaches from natural and accelerated erosion. By considering erosion during the local comprehensive planning process, prior to development, localities may reduce or even prevent the need for future shoreline hardening efforts. A comprehensive approach would limit development in areas not appropriate for any type of structural control or where certain shoreline hardening measures would actually worsen erosion. Natural forces which cause shoreline erosion include wave action, storm events where water or wind damage occurs, and upland runoff. Grading, removing vegetation, and over-building usually increase stormwater runoff and erosion.

Shoreline erosion also has a significant negative effect on water quality. Initial studies have found that tidal shoreline erosion in Virginia introduces 1.37 million pounds of nitrogen and 0.94 million pounds of phosphorus into the Chesapeake Bay each year,[77] more than five percent of the total nitrogen and 23 percent of the total phosphorus in Virginia's controllable pollutant load.[78] Sedimentation in the Bay is another result of shoreline erosion, and the U. S. Army Corps of Engineers has estimated 15 to 20 percent of sediment reaching the Bay from this source could be eliminated by appropriate shoreline erosion control projects.[79] Such a reduction in pollution and sedimentation would, of course,





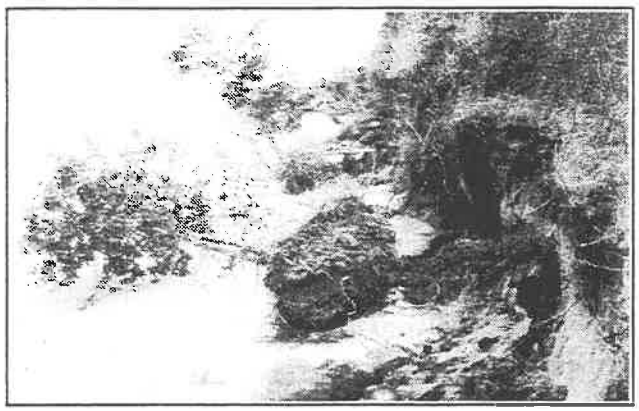
Right: Building damaged by erosion in Isle of Wight County. (James River)
Left: Farmhouse endangered by erosion on the Eastern Shore. (Chesapeake Bay)

Source: Department of Conservation and Recreation, Division of Soil and Water Conservation, Shoreline Programs Bureau

The Process of Shoreline Erosion

Daily shoreline erosion along the Chesapeake Bay is gradual, but its cumulative effect is significant. In the 100 years between 1850 and 1950, shoreline erosion accounted for a loss of approximately 21,000 acres within Virginia alone. Today's average erosion rate for Virginia's Bay shoreline is 0.7 feet per year, a loss of about 201 acres each year due to erosion.[81] Certain areas of the shoreline experience much higher shoreline erosion rates -- two or more feet per year[82] -- and nearly 40 miles of shoreline are eroding at a rate exceeding five feet per year.[83]

The climate affects a shoreline's rate of erosion. Storm events and a rise in sea level are the two climatic factors most frequently cited. High energy storms such as northeasters or hurricanes usually cause severe erosion. Storm frequency, direction, intensity, duration, and storm surges resulting from wind-driven tides are all factors that determine the impact of a particular storm event.[84] Further, sea level is rising due to melting of continental ice. As a result, higher water levels and tides will reach normally protected areas.



Trees downed by shoreline erosion resulting from storms which often pull considerable soil from bank face. (Potomac River)

Source: Department of Conservation and Recreation, Division of Soil and Water Conservation, Shoreline Programs Bureau

The physical factors involved in shoreline erosion are complex and highly variable. Planners need not be specialists in coastal processes to prepare a land use plan which takes these into account, although a general understanding of factors contributing to erosion will be helpful. Assessing the influence of these factors on the local shoreline may require assistance from a coastal engineer. A brief description of these factors is provided below.

Abundance of Vegetation: Submerged aquatic vegetation (SAV) in the near-shore area and shore grasses on either the shore bank or beach retard the movement of sediment and act as shock absorbers to baffle wave action.

Bank Composition: Consolidated soils (such as clay) resist erosion more effectively than sandy, unconsolidated soils.

Bank Height: This is the vertical area located immediately behind the beach or on the shoreline. Bank height determines a given erosion rate. Bank composition and height affect erosion along Tidewater shorelines, where a significant amount of shore is characterized by bluffs. Bluffs fail due to gravity, wave action, and freshwater runoff. Typically a bluff is weakened by runoff resulting from rainwater flowing down the bluff face and from groundwater seepage which occurs because of a clay layer at the base (see Fig. 6-15).

Boat Wakes: Shorelines fronting navigation channels are especially vulnerable to wave action created by passing vessels.

erosion control option must be chosen. Options range from the natural to the structural and should be chosen based on actual site conditions. Some options are to "do nothing," relocate threatened buildings, plant vegetation, provide beach nourishment, or establish permanent structures.

"Do Nothing"

The "do-nothing" option costs nothing and allows for natural erosion and accretion of the shoreline. This approach generally is unacceptable when development is already on-site or off-site forces influence erosion rates. The "do nothing" approach is best suited for situations where development can be carefully located and can incorporate site design features to prevent erosion from off-site sources.

Relocation

Whenever possible, threatened buildings should be relocated. Again, this option does not interfere with natural shoreline dynamics. Once buildings are relocated, no control structures must be maintained. This option may not be feasible where the building's construction does not lend itself to relocation or if the site is too small. Like the "do nothing" option, a major disadvantage of relocation is that neither technique controls shoreline erosion.

Vegetation

This method is often called a "soft barrier." Vegetation such as grasses, shrubs, trees, and wetland habitats absorbs and breaks up wave energy. Root systems also hold soil in place. Depending on the type selected, vegetation can be the least expensive means of shoreline stabilization. Where appropriate, soft barriers / natural barriers are preferable to structural mechanisms because of their ability to adapt to changing erosion forces. Vegetation is especially effective in allowing wetlands to migrate with fluctuations in sea level. In case of extreme high tide, vegetation may not be enough to provide protection. Further, it is effective only for low-energy shorelines. To remain functional, vegetative barriers require periodic maintenance, including replacement of dead or diseased vegetation. One consideration in the placement of vegetation should be the intended use of the shore. Pedestrian and vehicular traffic will quickly destroy vegetation if proper access points are not provided (see Table 6-6).

Beach Nourishment

This method is also a soft barrier. Beach nourishment consists of replacing sand on a beach. Beach nourishment is especially useful when the goal is to create or preserve a recreational beach. However, it is costly, estimated at $1 million per mile for an open-ocean beach and is a temporary solution at best.[86] Like the "do nothing" option and the relocation of buildings, nourishment does not control shoreline erosion, but may be appropriate in conjunction with other measures.

Permanent Structures

Permanent structures are useful to shield land from high energy wave action and some structures can build up beaches on the updrift side. However, there are potentially many significant negative water quality impacts from their use. Increased erosion from improperly placed and constructed structures may result in the destruction and ultimate loss of wetlands, tidal shores, and shoreline vegetation, especially downdrift and

FRESHWATER SYSTEMS	BRACKISH OR ESTUARINE SYSTEMS

MARSH SPECIES
(Reed Bank Zone)

Softstem Bulrush(*Scirpus validus*)	Saltmarsh Cordgrass (*Spartina alterniflora*)
Common Threesquare(*Scirpus americanus*)	Big Cordgrass (*Spartina cynosuroides*)
Soft Rush (*Juncus effusus*)	Saltmeadow Cordgrass (*Spartina patens*)
Cattails (*Typha spp.*)	Black Needlerush (*Juncus roemerianus*)
Sweetflag (*Acorus calamus*)	
Southern Wild Rice (*zinzaniopsis miliacea*)	
Rice Cutgrass (*Leersia oryzoides*)	

SHRUBS AND GROUNDWATER SPECIES
(Shrub Zone)

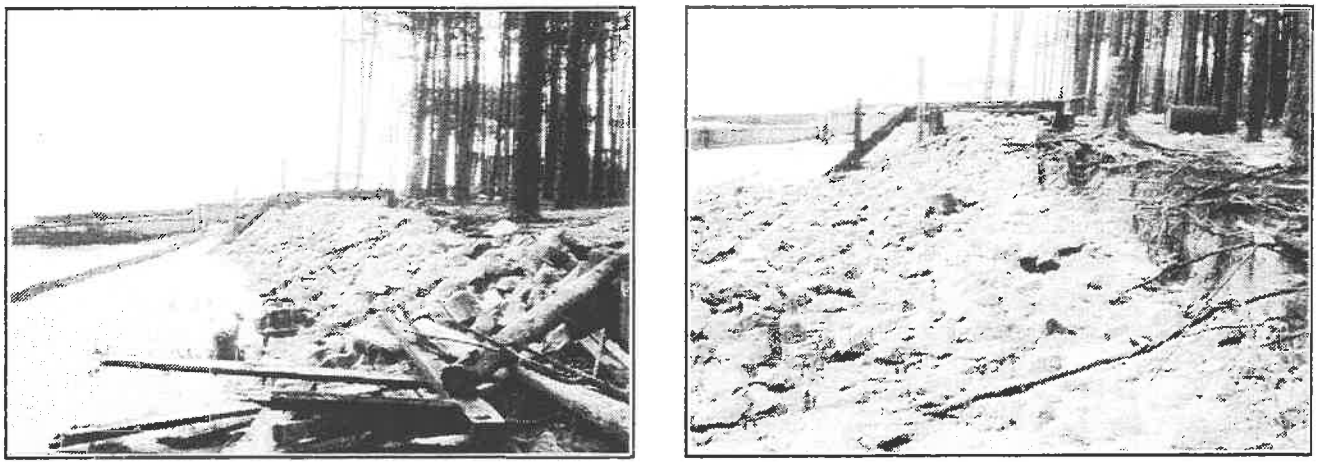
Smartweed (*Polygonum spp.*)	Saltmarsh Aster(*Aster tenuifolius*)
Sweet Pepperbush (*Clethra alnifolia*)	Wax Myrtle (*Myricacerifera*)
Button Bush (*Cephalanthus occidentalis*)	Tidemarsh Waterhemp (*Amaranthuscannabinus*)
Red Bay (*Persea borbonia*)	
Highbush Blueberry (*Vaccinium corymbosum*)	
Black Willow (*Salix nigra*)	

TREES
(Tree Zone)

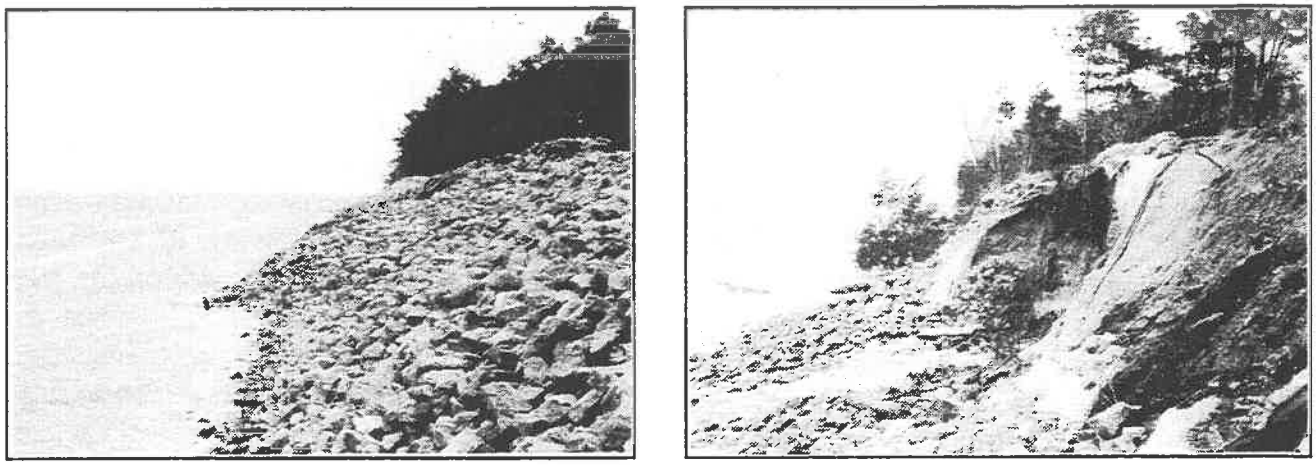
Red Maple (*Acer rubrum*)	Live Oak (*Quercus virginiana*)
Sweet Gum (*Liquidamber styraciflua*)	False Willow(*Baccharish almifolia*)
Black Gum (*Nyssa sylvatica*)	
Bald Cypress (*Taxodium distichus*)	
Black Willow (*Salix nigra*)	
River Birch (*Betula nigra*)	
American Elm (*Ulmus americana*)	
Hackberry (*Celtis occidentalis*)	
Willow Oak (*Quercus phellos*)	

Source: Chesapeake Bay Local Assistance Department, 1991

SHORELINE STABILIZATION PROJECTS - BEFORE AND AFTER — FIGURE 6-18



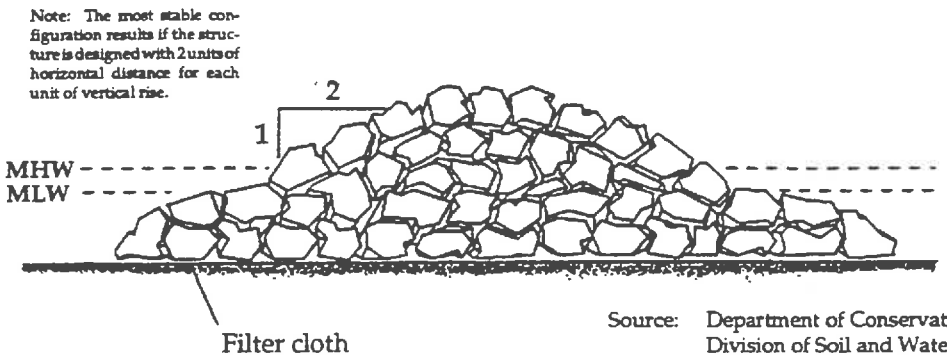
Undersized riprap reventement may afford only short-term shoreline stabilization. The photograph on the left shows a riprap reventment. The riprap structure failed (photo on right) during a storm. (Potomac River)



Riprap structures should be designed and constructed to withstand expected wave energy at any given time.

Source: Department of Conservation and Recreation, Division of Soil and Water Conservation, Shoreline Programs Bureau

RIPRAP BREAKWATER *FIGURE 6-20*



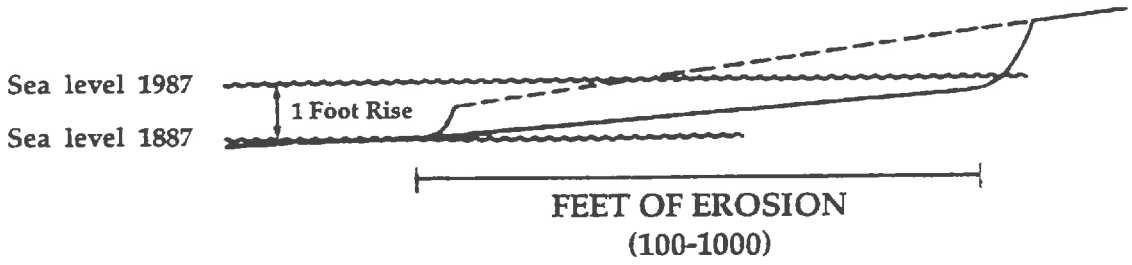
Source: Department of Conservation and Recreation, Division of Soil and Water Conservation, Shoreline Programs Bureau

tures are designed to modify wave action, reduce deep-water wave energy, and promote beach nourishment. The effect of breakwaters is to allow some transport of sand; however, the downdrift effect must still be considered in breakwater design. Because breakwaters are effective in protecting relatively long stretches of shoreline, they ultimately yield a lower cost per linear foot[89]

SEA LEVEL RISE

Localities must also begin to consider the long-term effects of sea level rise, attributed principally to global warming.[90] The burning of fossil fuels increases carbon dioxide and associated combustion gases in the atmosphere, which retains heat. The net result appears to be a slight warming of the earth's climate, leading to thermal expansion of the oceans and accelerated melting of continental ice. Sea level currently has a vertical rise rate of slightly greater than one foot per century and is expected to accelerate to several feet per century. In low-lying areas, one foot of vertical sea level rise can cause a shoreline to shift horizontally by as much as 1000 feet over 100 years (See Figure 6-21).[91]

SHORELINE EROSION AND SEA LEVEL RISE *FIGURE 6-21*



Source: Copyright 1989, Duke University Press. Reprinted by permission of the publisher.

STEP ONE

Determine planning units.

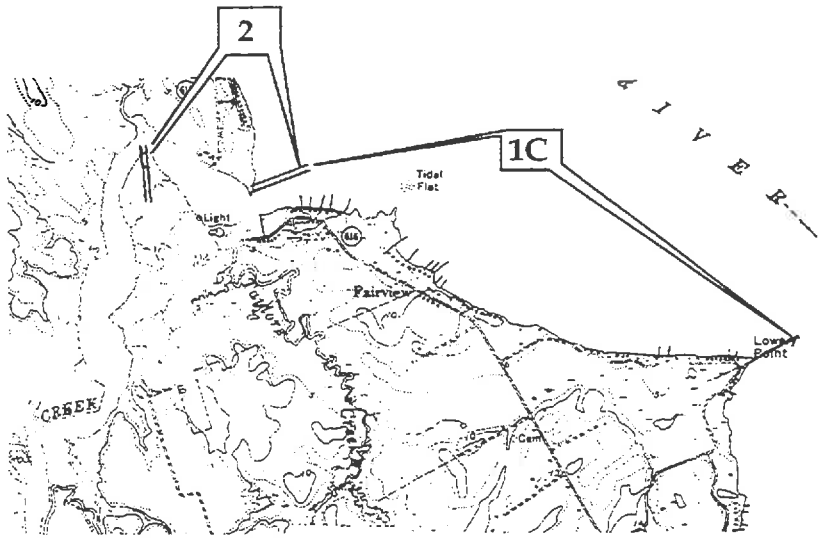
The most readily available data for local shoreline conditions are in the ***Shoreline Situation Reports*** prepared by the Virginia Institute of Marine Science (VIMS). Although somewhat dated, the *Reports* are the only comprehensive resource currently available. The *Reports* present information on shoreline types, upland land use, erosion rates, and the location of existing erosion control structures for localities in the Tidewater region. Assistance from VIMS or the Department of Conservation and Recreation, Division of Soil and Water Conservation, Shoreline Programs Bureau, can help local planners divide the shoreline into reaches. Reaches are segments of shoreline (a few yards to miles) where shoreline processes and materials are similar. Reaches become the planning units for shoreline management (see Figure 6-23).

STEP TWO

Determine existing erosion rates for each reach; define ranges for low, medium, and high rates of erosion; and identify critically eroding areas of the shoreline.

Again, the *Shoreline Situation Reports* provide a base of information from which to begin. Although erosion rates included in these reports were, in most cases, calculated ten to fifteen years ago, the rates are based upon historic trends which indicate relative changes in the shoreline. Erosion can be

EXAMPLE OF REACH DELINEATION — *FIGURE 6-23*



MAP 4A
PISCATAWAY CREEK
Segment 2 and Subsegments 1C

Source: Virginia Institute of Marine Science, ***Shoreline Situation Report for Essex County,*** 1976

= Segment Boundary. Segments are groups of subsegments. Segment boundaries are determined by physiographic features such as necks or peninsulas between tidal creeks.

= Subsegment Boundary. In the *Shoreline Situation Reports*, subsegments correspond to reaches in that the pattern of erosion or accretion is simliar. Subsegment/reach length may vary from a few hundred to several thousand feet.

ing permanent structures are effective and identify reaches where structures are aggravating erosion updrift.

Whether a locality decides to perform an itemized inventory or to conduct a less detailed investigation, **the data should be mapped by reach.** Preparing an overlay to the existing land use map will help with the analysis discussed in Step Seven.

Another effort in progress at VIMS, in cooperation with the Department of Conservation and Recreation (DCR), Division of Soil and Water Conservation (DSWC), is the *Bank Erosion Impact Study*. The study will include a digital data base delineating shoreline defense structures along 1600 miles of tidal shoreline. The study is directed toward analyzing the decrease in nutrients eroded into the Chesapeake Bay due to shoreline hardening. Using historic erosion rates estimated over 89 years (1855 to 1944) the study will compute the volume of sediment kept from the Bay between 1985 and 1990 by mapping the position of various types of shoreline defense structures. Land use conditions for 1985 and 1990 are also included in the project's database. The digital database, stored in the VIMS CCI Geographic Information System, is expected to be available through DWSC in May 1991. This information is recommended as a primary source of data for identifying the location of shoreline erosion control structures.

STEP FOUR

Conduct selective field surveys/site assessments.

Although the Comprehensive Coastal Inventory Program (CCI) at VIMS is updating available data on shoreline conditions, most Tidewater jurisdictions will not have the benefit of CCI reports prior to beginning timely comprehensive plan revisions. For most localities, the identification of critically eroding areas will require a comparison of current conditions with historical data on the shoreline. A comparison of aerial photos taken at different points in time may be useful; some aerial photos are available from the Virginia Department of Transportation, U.S. Geological Survey, and USDA Agricultural Stabilization and Conservation Service. Ideally, site visits should be made to structurally modified areas in order to determine the impacts and effectiveness of erosion control structures on the shoreline, particularly along adjacent reaches. It is important to observe evidence of scouring around the base of permanent structures and evidence of shoreline erosion downdrift.

STEP FIVE

Identify and map areas where control structures should be avoided.

For some reaches, storm frequency and intensity and shoreline geometry and orientation will rule out the construction of permanent erosion control structures. Further, where existing structures have aggravated erosion rates downdrift, as determined in Step Four, additional structural erosion controls should be prohibited, with exceptions made only when necessary to prevent the loss of an existing building. This analysis will require technical advice from a shoreline engineer. The Shoreline Programs Bureau of the DSWC may be able to assist (see Appendix A).

STEP SIX

Identify areas which require stabilization.

Based on prior evaluation, identify and prioritize areas for shoreline erosion management efforts. This evaluation should include

collected in each preceding step has been prepared as an overlay to the land use plan map, areas of potential conflict between land uses and natural processes may be readily identified.

STEP EIGHT

Consider shoreline management alternatives.

A locality should consider a number of shoreline management strategies before making policy determinations. With this analysis, a jurisdiction will most likely have several options, depending upon the specific circumstances.

One strategy would be to leave shoreline protection up to individual property owners; this may or may not include provisions for local government oversight to ensure a coordinated strategy. Another, and recommended, alternative would be the development of a **comprehensive** shoreline management plan in order to ensure the most appropriate erosion mitigation strategies for the protection of the jurisdiction's entire shoreline. This alternative may include the designation of certain reaches where only vegetative protection measures may be used, limiting structural measures to the areas where they are necessary and most effective. The policy discussion in the local comprehensive plan as required by the Regulations will necessitate a discussion of alternatives considered and justification of the final selection.

STEP NINE

Revise future land uses or intensities based on shoreline inventory findings.

At a minimum, localities should consider appropriate revisions to the land use plan map in light of shoreline factors and the feasibility of various erosion management techniques. For example, a critically eroding shoreline in a reach where intense development is proposed presents a clear land use conflict. A revision to the land use plan may avoid altogether the need for costly erosion control measures which would provide only a temporary solution. Again, a locality may have a number of options in such a situation, depending upon the circumstances.

One option would entail the recommendation of other, more appropriate land uses along the shore. Planning for the eventual acquisition of extremely vulnerable areas for public open space could be another option. Another strategy would be to reduce the intensity of allowable development. Amendments to the zoning ordinance may implement shoreline protection goals by establishing special setbacks so new development would be out of the projected range of shoreline erosion for a specified duration. Open space subdivision or cluster housing provisions could offset the loss of developable area with little effect on overall intensity of development.

Plan Formulation and Policy Development

To comply with the Act and Regulations, local governments will need to develop an overall policy framework which establishes appropriate responses to shoreline erosion. Based upon shoreline data and an evaluation of the technical merits of various shoreline stabilization techniques and their suitability for different shoreline environments, policies should be developed and adopted to address local shoreline erosion problems and mitigation structures.

Mapping

If analysis indicates that land uses should be revised in light of shoreline conditions, the future land use map must be amended. Other maps can be considered for inclusion in the plan that are useful for displaying backgound data. Maps depicting reach delineations, shoreline erosion rates, and critically eroding areas will be especially effective in support of final plan recommendations. A map or maps showing the location of existing control structures and summarizing shoreline conditions may also be helpful. A more detailed shoreline management plan might include mapping which identifies the appropriate control measures for each reach.

Since the scale of the general land use map would likely be ineffective in displaying data by reach, a map showing reach boundaries might be prepared as an overlay to local hydrologic units or other planning areas. Ultimately, the more detailed management plan might display background data and plan recommendations at a tax map or zoning map scale.

Implementation

The first step in implementing shoreline management policies is adoption of the amended local comprehensive plan in order to guide future activity. The amendment should include a thorough discussion of the benefits and hazards of various types of erosion mitigation strategies and should also establish shoreline protection priorities. Once plan policies or the shoreline erosion control element of the comprehensive plan has been adopted, the local Wetlands Board should refer to the document in the course of its permit review process in order to ensure decisions are in accordance with the plan.

The zoning ordinance should be amended to establish necessary shoreline setbacks. In any district where it has been determined that structural shoreline hardening in reaches in the district will have damaging impacts on adjacent reaches, shoreline hardening should be prohibited or conditioned.

The City of Hampton's *Beachfront Master Plan* includes a recommendation for the City to stabilize privately owned shorelines in exchange for public access to private beaches. This policy is designed to provide an incentive to owners to relinquish some of their property rights as a trade off for improved shoreline protection and also better beach access. Localities implementing shoreline management districts might use a similar strategy to increase public access along their waterfront.

Localities may wish to consider adopting an overlay district in order to implement the plan policies for appropriate erosion protection. An overlay district could be particularly effective in reconciling management strategies by reach with property boundaries and zoning lines. The creation of special shoreline management districts for critically eroding areas may be another method of implementing plan policies and a more comprehensive strategy for addressing shoreline problems. Local governments could also amend their Chesapeake Bay Preservation Area Overlay District, where applicable.

The community facilities planning process is another vehicle to achieve shoreline protection. Planning for the extension of public facilities, including shoreline stabilization, should steer facilities away from vulnerable shoreline areas and toward areas most suitable for development, given shoreline conditions. This process also enables a locality to plan for the purchase of particularly sensitive shoreline segments.

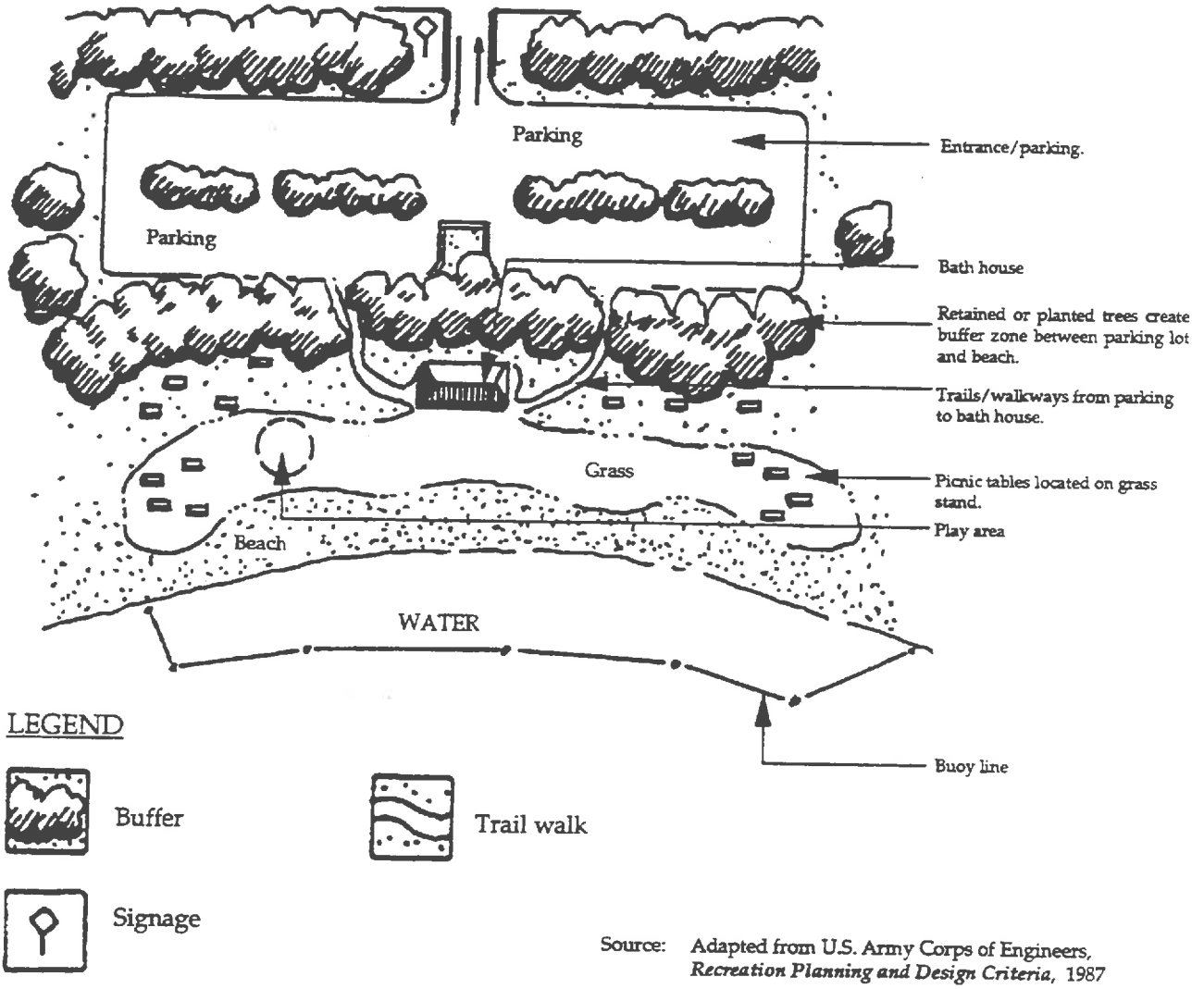
2. Swimming access, including beaches and designated areas appropriate for swimming;

3. Fishing access, including piers, bank fishing, and parking adjacent to tidal waters;

4. Natural area access, including wildlife management areas, natural area preserves, wildlife observation areas, nature trails, and educational facilities contiguous to tidal waters. [96]

The general discussion of public and private access in this section includes the activities just outlined as well as other water-related activities such as picnicking, camping, hiking, and hunting. Boat-related facilities and activities are treated in greater detail as such facilities potentially have a greater impact on water quality and they are frequently a major element in access programs.

BEACH/SWIMMING ACCESS SCHEMATIC PLAN *FIGURE 6-24*



Source: Adapted from U.S. Army Corps of Engineers, *Recreation Planning and Design Criteria*, 1987

sion analyzed this issue and concluded that although the impact from individual boats may be negligible, the **cumulative** impact in many cases may generate significant localized water quality problems. [100]

Siting Marina Facilities

In 1988, the Virginia Marine Resources Commission (VMRC) issued its *Criteria for the Siting of Marinas and Community Facilities for Boat Mooring*.[101] The *Siting Criteria* serve as guidelines VMRC uses to evaluate the location and design of proposed marinas and boat docking facilities.

The *Siting Criteria* are divided into two parts. The General Siting Criteria address the siting of boat-related facilities relative to sensitive environmental features and marine resources. The Specific Siting Guidelines focus on project design in order to minimize any adverse environmental impacts. The *Siting Criteria* are summarized in checklist form for use in evaluating permit applications (see Table 6-7).

The *Siting Criteria* provides VMRC a technical basis to evaluate potential environmental impacts of development proposals. However, the *Siting Criteria* are only **advisory** and applied on a case-by-case basis. Thus, VMRC is unable to make regional or long-term planning decisions about the suitability of certain areas for the development of water-dependent facilities. By integrating the *Siting Criteria* into a planning process, local governments will be able to **proactively** identify the most suitable locations for boating facilities.

Relationship of Land Use to Commercial and Recreational Fisheries

The Bay has always been a rich source of seafood and shellfish. However, during the past decade, commercial shellfish populations have been severely decimated by disease and pollution. Many large areas, such as entire rivers and bays, have had their harvesting condemned. Whether state efforts and initiatives to improve overall water quality in the Bay will be adequate and sufficiently timely to allow for the wholesale regeneration of these shellfish beds remains to be determined by research.

Aquaculture is an increasingly important coastal-dependent use which produces food, enhances fisheries stocks, and contributes to state and local economies. Clean waters are essential for aquaculture operations. Level of nitrogen, dissolved oxygen, salinity, changes from fresh water runoff, turbidity, temperature, and fecal coliform bacteria levels are water quality indicators which will dictate the suitability of an area for aquaculture production. The long-term viability of aquaculture sites will depend on local policy addressing the use and development of adjacent land.

Recreational fishing was identified in the ***1989 Virginia Outdoors Plan*** as one of the top ten ranking recreational demands, with 27 percent of the state's population participating. Though existing facilities for fishing are adequate to meet future demand, the Plan recommends that new opportunities for fishing be developed, and existing single purpose facilities, such as wharfs and docks, be expanded to accommodate additional low-intensity recreational fishing opportunities.

Local policies can provide opportunities for aquacultural and other uses such as commercial fishing, recreational boating, and shoreline land use in a manner which minimizes the conflicts between these uses and protects water quality.

Data Collection and Analysis

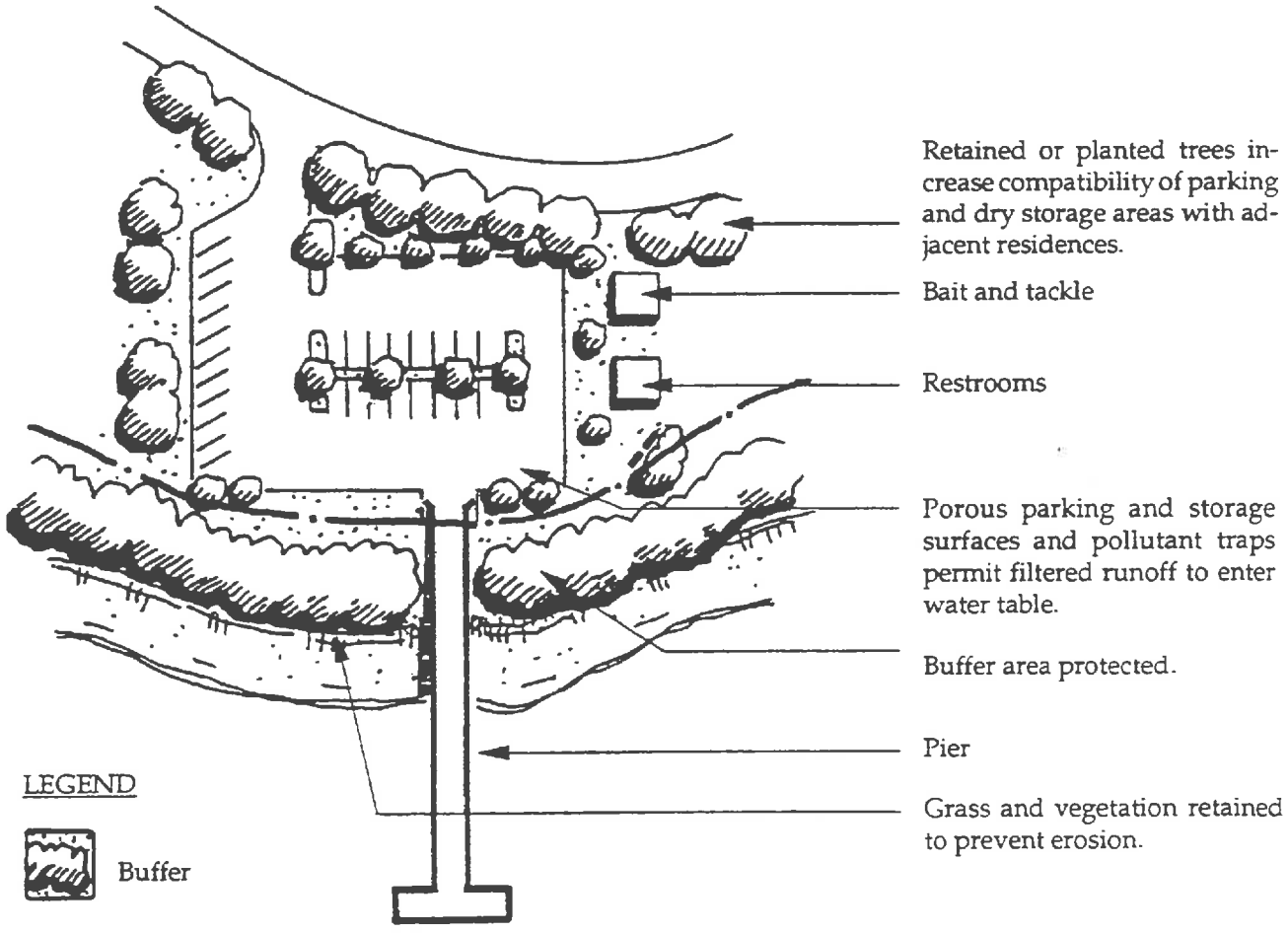
Data necessary to assess access opportunities and plan to meet future demand can augment existing information on local land use and development trends and the local environmental resources inventory. Information collected and analyzed may be used to determine existing and future demand and the general vicinity for access opportunities.

STEP ONE

Inventory environmentally sensitive areas.

The environmental inventory used in the designation of Chesapeake Bay Preservation Areas will serve as the basis for this task. Additional data on marine resources and habitats will be necessary in order to establish a more comprehensive information base for water access planning.

Pier and Bank Fishing Access Schematic Plan — *Figure 6-25*



Source: Adapted from U.S. Army Corps of Engineers, *Recreation Planning and Design Criteria*, 1987

STEP THREE

Inventory existing access sites.

Existing public and private access facilities need to be identified and mapped. The *Chesapeake Bay Area Public Access Plan* (1990) is a good resource in undertaking this task. [105] The document contains detailed information on public and private access sites in map format. Augmenting information from this resource with local data on other water access to smaller creeks, upland streams, and reservoirs is desirable. All of these sites should be delineated on the inventory map.

STEP FOUR

Evaluated existing and future demand.

Current access facilities and services should be compared to the existing and projected demand for access. Demand can be determined using the "National Recreation and Community Facilities Standards" provided in Appendix G. These national standards are provided for assessing unmet demand based on a locality's demographics and the adequacy of available services. This unmet community demand may reinforce the need for additional access and recreation facilities. Coastal localities, in particular, should distinguish between seasonal or tourist-related demand. A summary of the needs assessment should be prepared.

It will be important to assess demand in terms of the different access types to ensure a comprehensive approach in securing access opportunities. Moreover, a good "fit" between the intensity of a proposed access facility and the land/water capacity is crucial for protecting water quality.

STEP FIVE

Examine existing and proposed land use.

An examination of existing land use patterns will be an important aspect of determining demand, both existing and projected. Planning for access in relation to anticipated growth areas ensures that access opportunities are proximate to population concentrations. This not only enhances access opportunities to more people but diminishes the burden on transportation systems and provides pedestrian circulation between residential and recreational areas.

STEP SIX

Analyze data and develop planning factors map.

A thorough analysis of the data outlined in Steps One through Five can be facilitated through the preparation of a planning factors map. The collection and preliminary analysis of background information will allow an identification of key planning issues and factors. Understanding demand and supply and the carrying capacity of land and water areas will provide a sound basis for planning and policy decisions for the provision of access while ensuring water quality protection.

Through an analysis of data resources and the planning factors map, it will be possible to identify areas appropriate for the different types and intensities of access. VMRC's Siting Criteria will be a helpful tool in developing planning factors associated with the development of marinas and community docking facilities. Local goals of enhancing access to Bay waters may conflict with water quality protection goals if the location of ac-

needs and issues. For water bodies bordered by two or more jurisidictions, the compatibility of local plans will be important.

STEP EIGHT

Evaluate inventory of potential access sites.

Potential new public access areas should be evaluated using locally developed criteria. The following criteria are recommended for use in an initial site selection process, though these should be modified as necessary to reflect local need and demand. The criteria or elements within a single criterion could be weighted to reflect the relative importance of the different criteria to one another.

1. Desirability of the site for public access. Desirability of a site for public access includes consideration of its (i) potential for recreational opportunities; (ii) uniqueness and variety; (iii) scenic quality; (iv) size and opportunity for expansion; (v) accessibility; and (vi) ability to walk from the site to adjacent shoreline points of interest.

Potential sites that provide an unspoiled, highly scenic shoreline suitable for a wide variety of low-intensity recreational uses such as picnicking, swimming, fishing, viewing, and walking would be desirable and ranked high. Assessing potential sites for their accessibilty to existing public roads, available space and the opportunity each site presents for possible expansion, and opportunities to link the site with adjacent shoreline areas of interest provides other important criteria in ranking site desirabilty.

2. Physical characteristics of a site. Physical characteristics of a site which influence its suitability for public access would include topography, geologic features, capacity to sustain proposed use, and presence of fragile environmental resources, including threatened or endangered species. Hazards, significant shoreline erosion, and potential impact on water quality are other factors which would be important in a selection process.

3. Availability of access nearby. Another factor to consider in determining the appropriateness of potential access areas is the proximity of the site to existing access areas. A site may be ranked high in terms of its desirability or physical characteristics but if adequate access exists nearby, the site might not repesent a good fit to public need. However, depending on the size and type of access desired, the site together with additional adjacent property may offer an excellent opportunity for expansion of an existing public access area.

4. Adjacent land uses. The relationship between the potential access site and adjacent land uses will affect the suitability of the site for public use. Sites where users might encounter heavy industrial traffic or other potential safety hazards would clearly be less suitable. The privacy of adjacent residential property owners should be a concern with the development of public access facilities. A good "fit" between the type of access area and the surrounding land use will be an important objective. Anticipated conflicts between public use and adjacent private use might be mitigated through additional setbacks, screening, and/or limitations on the number of users.

5. Other factors. Other factors associated with ownership, the willingness of the seller, cost, proximity to service area, and/or access potential in relation to access demand will vary in importance from locality to locality.

Appropriate Density for Docks and Piers

Local governments should consider whether it may be more appropriate in particular areas to emphasize community facilities over individual docks. In evaluating or establishing local policy, it is important to consider both the economic and water quality impacts of each approach, as well as riparian rights of property owners. While it may be argued that individual docks disperse and, therefore, dilute pollutants from boat-related activities, it is more likely that concentrating activities at community facilities will make management of pollution sources easier. For example, there would be opportunities for sewage pump-out at a community docking facility that would not be feasible at an individual dock.

Some localities have chosen to encourage residential development along waterfront areas in order to build local tax bases. Yet, this development puts additional pressure on land prices and small-scale commercial fishing operations. Because most waterfront developments offer individual boating capabilities for each property, the attendant high density of docks and piers may result in significant water quality impacts.

Another consideration in determining dock and pier densities is the visual character of a predominantly natural area. Numerous facilities may diminish visual amenities, which could result in a decline in property value.

The ideal way to determine appropriate densities for docks and piers is to assess the carrying capacity of each creek to support docking facilities, rather than to allow density to be demand-driven. Factors which affect the carrying capacity of water are the volume of water, its flushing characteristics, and tidal action. Although carrying capacity of water bodies is a difficult analysis to conduct, ultimately a creek-by-creek analysis is the best way to determine appropriate densities for docks and piers.

Policy should be developed to balance competing demands in waterfront areas. The way in which land is subdivided may be an important consideration: should shoreline areas be held in common ownership to promote passive recreational access and enhance protection of buffer areas? A shoreline segmented by numerous small parcels will make management of the land/water zone more difficult. A locality might emphasize development strategies that encourage clustering houses around a central access area. Community dock facilities might be required in lieu of individual docks. Strict limits could be placed on the number of slips available at the docking facilities.

Private Access to Waterfront Areas and Effect on Water Quality

Access policies should be integrally related to local park and recreation policies and programs, and access opportunities may be expanded depending on how much shoreline is available in the jurisdiction. Local policies on access to waterfront areas, however, should also seek to balance public and private interests with water resource protection goals.

In addition to boat-related activities, other types of access opportunities should be considered in formulating local access policy. For example, passive recreational activities and facilities such as picnicking, wildlife observation, and hiking and biking trails are

generally suitable in Resource Protection Areas, including buffer areas. Local governments should consider meeting the broad range of recreational demand in their policy framework.

General Policy Considerations

Local policy on access should ensure that boat-related and other water-dependent access facilities are sited and designed consistently with the performance criteria in Part IV of the Regulations. The criteria should be considered in determining the location, type, and intensity of new facilities. In general, access desired in sensitive areas should be low impact -- local policies should be developed which will ensure a long-term orientation toward passive uses in such areas.

Larger public and private marinas will absorb some of the local demand for boat-related facilities, and some localities may wish to consider larger facilities as a component of both their water protection and economic development strategies. However, strict health and environmental controls must be scrupulously enforced to safeguard marine resources and local quality of life. Moreover, costs related to sewage treatment, public safety, and enforcement associated with this type of development must also be considered. These significant costs, along with natural resource considerations, provide substantial justification for the locality to play a more proactive role in planning the location and timing of marina construction. Considering these factors during a comprehensive planning process allows local governments to determine where and when large marina facilities are appropriate.

Another policy issue to be addressed in a planning process is improved coordination among the levels of government with oversight in the development of access facilities. Since federal (e.g., U. S. Army Corps of Engineers, Environmental Protection Agency) and state (e.g., VMRC) officials are frequently involved in local projects, local policy should encourage improved coordination among all three levels of government. Moreover, an element of local policy should ensure opportunities for the input and expertise of state and federal agencies during the planning and development process.

Other policies directed at development of public and private access facilities should relate to the physical constraints of specific locations. The size of the facility should be based on carrying capacity, recharge capacity, and other environmental constraints, regardless of the size of adjacent residential development. The size of the facility and the intensity of related uses can also be conditioned by the service capacity of supporting infrastructure. Local policies might require that only areas with an excess capacity to absorb boat-related activity may be considered for development and that development size be limited to the carrying capacity of the water body.

Mapping

The comprehensive plan map should be amended to reflect the location of major boat-related facilities and other access sites. Potential sites may be indicated after an analysis of areas deemed appropriate in the planning factors summary. Depicting these sites on the plan map will be useful for evaluating rezoning proposals.

docks and piers through land use controls. Although local government regulation of boaters is primarily limited to indirect control through marina siting guidelines, waterfront land use controls, and the use of "No Wake" signs, significant opportunities exist to control boat pollution in a manner which achieves water quality protection and other community goals alike.

Private and Community Piers

Zoning and subdivision ordinances can have a significant impact on the density of private and community piers, and therefore, on water pollution. Two primary means of implementing density controls are community mooring facilities and minimum shoreline width requirements.

Water quality protection and site design flexibility can be increased with community access facilities and waterfront open space. Waterfront residential subdivisions should be designed to provide water access to all property owners, including those without waterfront property. Community mooring facilities should be encouraged, provided the location is suitable and water quality impacts can be mitigated. If community access is secured in a subdivision, the rights of riparian property owners to install docks or piers should be limited. This can be accomplished through a number of methods:

- Clustering lots away from the waterfront;
- Establishing areas held in common as community open space along the entire waterfront area;
- Retaining the riparian rights to the land when selling waterfront lots;
- Requiring covenants or deed restrictions which restrict riparian rights.

In a planned unit development or PUD, development is focused in areas most suitable and with few physical constraints. These areas tend to be away from the waterfront. This provides the opportunity to retain the waterfront area in common open space. All property owners would then have equal rights to access the waterfront, and benefit from community facilities.

In traditional subdivisions, retaining the area adjacent to the waterfront in community open space would also facilitate well-managed community access and limit unplanned individual access. The area adjacent to the waterfront should be of a size large enough to provide design flexibility for construction of trails and community access facilities. Notably, placing the Resource Protection Area in common ownership would enhance protection of sensitive resources and the buffer area.

Riparian rights of property owners can be modified with covenants which specify that no private piers may be constructed in the subdivision. This is the least effective method of controlling private pier development since local governments have little ability to enforce a subdivision's covenants. Also, covenants could be changed at any time by the homeowners association or other entity with enforcement responsibility.

Local governments can encourage or require the use of one or more of these methods through their zoning and subdivision ordinances. Both zoning and subdivision ordinances can promote the use of cluster housing and PUDs. This can be done by

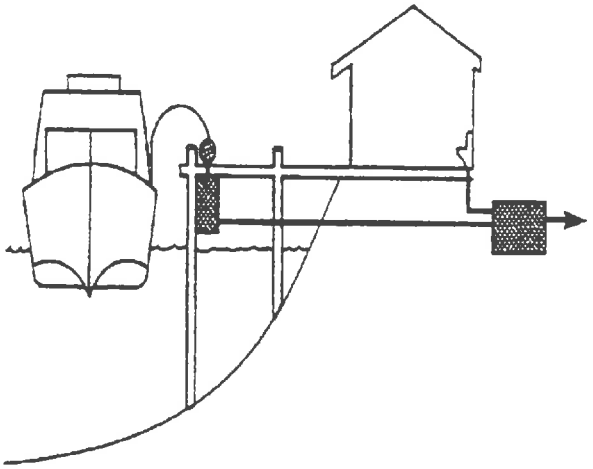
Marinas

Controlling the density of marinas is best approached by considering the natural physical constraints of the shoreline and aquatic resources. The overlay technique mentioned previously will identify areas where demand is high, as well as areas which are most appropriate from a water quality standpoint.

For example, land abutting small and shallow embayments should not be zoned to permit marinas because the water will not have the flushing capability to remove spilled oil, diesel, gasoline, antifeeze, and contaminants. Areas with high energy shorelines, submerged aquatic vegetation, or valuable wetlands are likewise unsuitable for marina development. By analyzing physical constraints in context with available infrastructure and demand, localities should be able to identify those areas best suited for marina development.

This approach has many benefits. It is futile and counter-productive to zone an area for marina development if the site will not pass muster with reviewing agencies. Other, more suitable areas could have been developed in the interim, costing the locality both in terms of tax base and community access to the water. Further, identifying marina development areas will allow the locality to plan for needed extensions of infrastructure and avoid problems associated with the disposal of marine toilet wastes into septic systems.[109] In addition, this approach allows density to be controlled by the carrying capacity of the natural environment itself, and helps to promote recreational boating by establishing a level of use which the environment can support.

BOAT SEPTAGE PUMP-OUT *FIGURE 6-28*



Source: State Department of Health, ***Commonwealth of Virginia Sanitary Regulations for Marinas and Boat Moorings***

of proposed redevelopment. For example, redevelopment of an old warehousing district into a mixed-use project may incorporate revegetation of portions of the development site. Surface parking areas can be consolidated into structured parking, breaking up expanses of impervious cover. Careful revegetation measures can be designed to improve water quality while providing important amenities to both residents and shoppers.

Waterfront revitalization efforts in particular present a clear opportunity to integrate water quality protection measures. Harbors or other waterfront areas that have been allowed to decay through neglect and disuse are often prime candidates for revitalization plans. Rotting piers, leaking underground storage tanks, and antiquated sewer lines are some of the existing conditions that may contribute to water quality degradation. Rejuvenation of older waterfront areas is often viewed as a major economic booster, potentially creating hundreds of jobs and housing, even for smaller urban centers.[112] Correcting water quality problems and upgrading dilapidated facilities should be a major thrust of local water quality improvement strategies and a significant element of any revitalization program.

Ideally, local governments should develop a set of policies for each redevelopment area with similar water quality problems. These policies should reflect area characteristics and should integrate general redevelopment policies and water quality improvement strategies. An important consideration will be the development of policies to establish the buffer area in IDAs over time, as stipulated in § 4.3.B.3 of the Regulations. Establishing the buffer area and encouraging buildings and other improvements to relocate back from the water's edge may not be possible for all segments of the shoreline. However, this can be achieved **incrementally as areas redevelop**. Fulfilling such objectives may seem unlikely today, but with a strong policy framework in the local plan, these objectives become more realistic within a typical 15-20 year planning period (see Figures 6-29 through 6-31).

Data Collection and Analysis

STEP ONE

Identify existing and potential redevelopment areas.

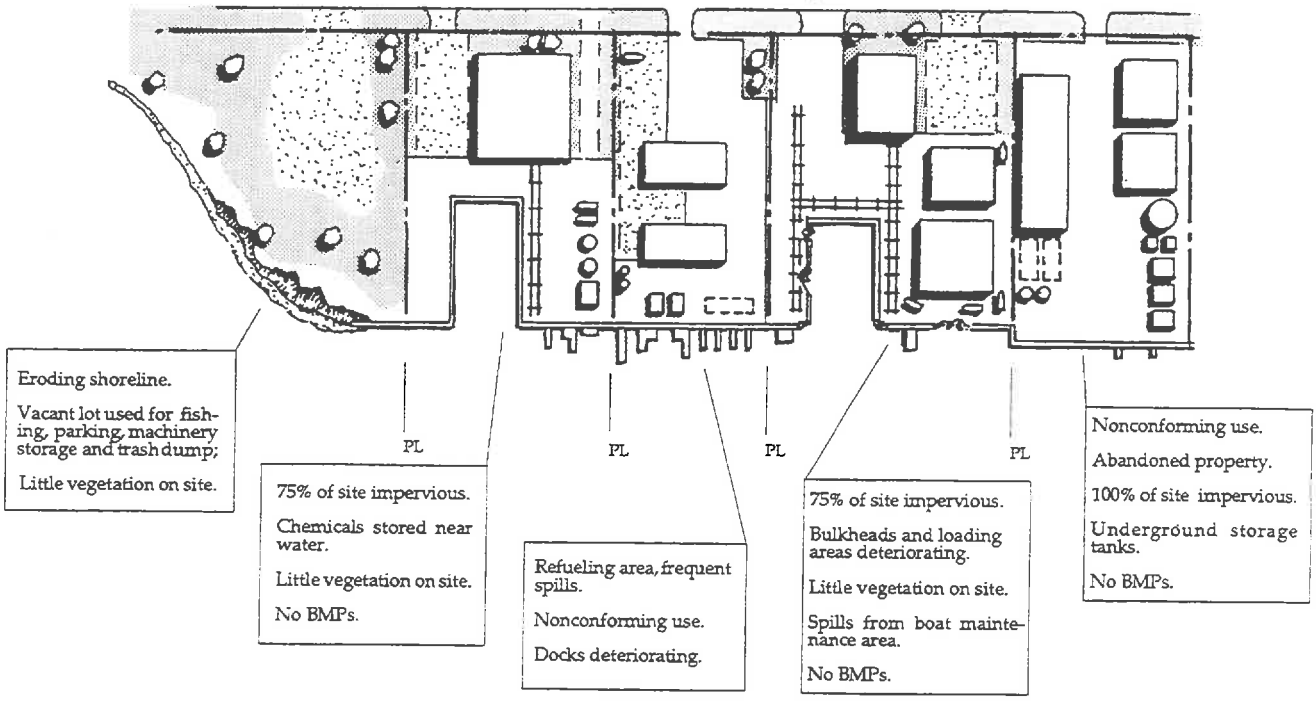
Local governments are encouraged to develop a comprehensive water quality strategy for all redevelopment areas whether within IDAs or not. Developed communities generally identify and develop goals and policies in a comprehensive plan for areas within the locality experiencing decline. Redevelopment areas can be identified from a general study of existing conditions. Data collection and analysis efforts should be coordinated with economic development staff and the local housing authority, where applicable.

STEP TWO

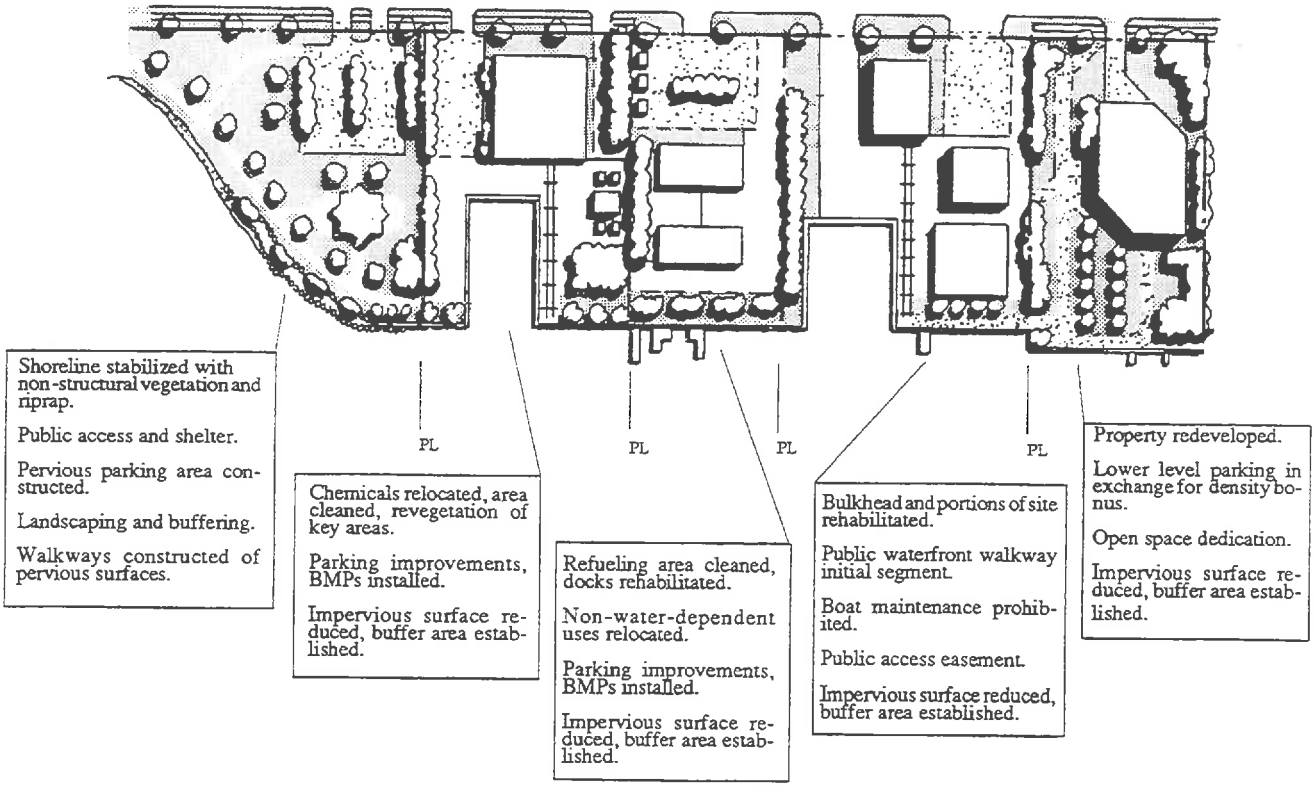
Examine existing conditions within redevelopment areas.

Characterizing the pattern of existing development within IDAs will be an important step in developing a water quality improvement strategy. Factors important to this examination include the general condition and age of structures, the amount of

IDA Example - Present Conditions — *Figure 6-29*



IDA Example - Conditions in 5 to 10 Years — *Figure 6-30*



be reexamined to determine the best location and configuration for industrial development.

Plan policies should also recognize needs and priorities and the historic character of redevelopment areas, including individual neighborhoods, while reflecting the waterfront environment and reinforcing water quality objectives. The intensity of water-dependent uses, the extent of open space and access, public amenities, building orientation, height, and massing are all components of an overall revitalization plan. Each of these components can be in harmony with or work against water quality protection goals and objectives.

Redevelopment and Public Access

The Regulations identify public access to waterfront areas and the effect on water quality as one of the issues to be addressed in the local comprehensive plan. Revitalization of urban waterfronts often involves an expansion of public access opportunities. Policies for redevelopment of intensely developed areas should complement local public access objectives. The incorporation of policies that enhance public access to municipal waterfront areas can be a central and important element of any local water quality improvement strategy. Deteriorated waterfront areas characterized by dilapidated piers and abandoned structures inhibit public access to urban waterways. These areas may no longer be suitable for today's maritime economy but a broad array of other water-dependent uses, such as commercial boating activities, water-taxi facilities, and public landings, may be viable.

Mapping

Local IDA designations will be depicted on the jurisdiction's Chesapeake Bay Preservation Area Map. A reduction of this map is recommended to be included in the plan. As an alternative, local governments may wish to amend the local land use map with a Preservation Area overlay including the depiction of IDAs. General redevelopment areas should also be identified on the general land use plan. Local governments that conduct a planning process for distinct planning areas or sectors should consider delineating individual redevelopment areas within IDAs in sector plans.

Implementation

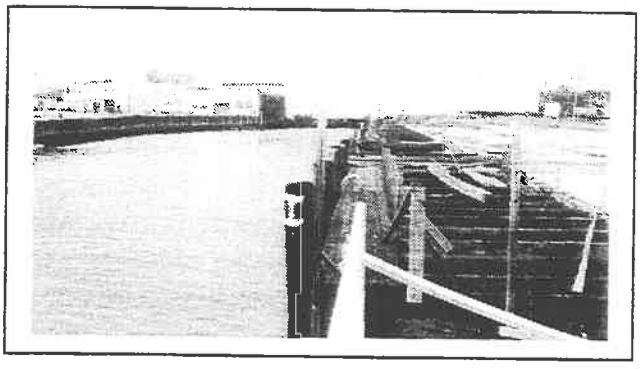
Strategies for the establishment of the buffer area in IDAs over time and for the protection and improvement of water quality should be developed in the plan. Using the information and mapping from Step Five, local governments may differentiate redevelopment areas based on the classification system and develop categories for IDAs and redevelopment areas. These categories should be focused on the character of the area and revitalization proposals, water quality protection strategies, and the ability to establish the buffer area over time. Special zoning regulations could be adopted which address the establishment of the buffer area as land within IDAs redevelops. Standards for buffer areas would vary within different IDA categories.

IDA Subcategories

After the completion of Step Five, local governments may identify different classifications for redevelopment areas and consider "customizing" IDAs to more accurately reflect the existing development patterns along the shoreline.[116] More specific standards for implementing the buffer area and other performance criteria could be instituted within different classifications. The local Chesapeake Bay Preservation Areas map should be amended to include the different classifications of IDAs, if this approach is employed. Such a classification system could include Industrial IDAs and Commercial/Residential IDAs as discussed below.

INDUSTRIAL IDAs

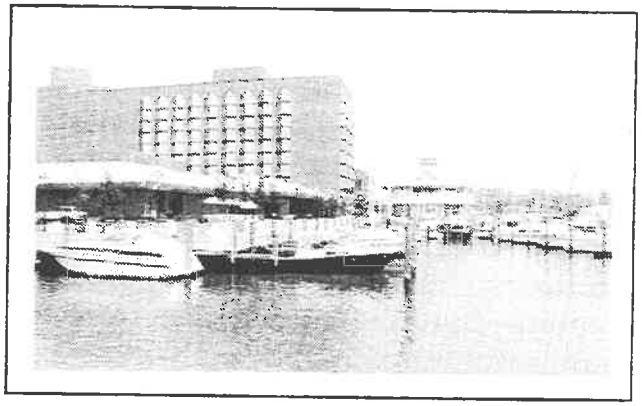
These areas would be characterized as working waterfronts by their intensive industrial activity. Working waterfronts may have limited ability for the creation of open space or establishment of the buffer area because of the necessity for access to the water, the amount impervious surface, and the lack of natural shoreline. Policies tailored to the unique character of these areas will recognize the impracticability of implementing buffer area and rely on other water quality strategies more effective for such uses. Intense industrial areas can be treated differently than other redevelopment areas which are no longer viable working waterfront areas.



Industrial intensely developed area.

COMMERCIAL/RESIDENTIAL IDAs

These areas would be characterized by less intense uses such as commercial, residential, or office areas and may include infill sites. These areas will likely provide greater latitude in establishing the buffer area since access to waterways is not paramount to their operation. Some of these areas may already have a limited natural buffer area. Implementation of on-site structural stormwater



Commercial/residential intensely developed area.

Best Management Practices could be more easily applied in areas that have less impervious surface. Policies tailored to these areas will recognize the ability of implementing the buffer area and other revegetation strategies could focus on the aesthetic appeal of natural areas. Establishment of a buffer area could enhance the attractiveness of some redevelopment projects, especially those that are oriented toward people. Localities throughout the United States have discovered the potential for profitable and popular urban waterfronts through the redevelopment of existing impervious areas.

Many urban communities across the United States have incorporated the preservation and restoration of shoreline resources into overall shoreline revitalization plans. Local governments could institute a revolving loan fund to assist developers in meeting the cost of installing water quality BMPs for redevelopment projects. This fund could also be used in conjunction with an incentive program for buffer establishment and revegetation, the provision of structured parking areas, the replacement of antiquated utility systems, and the overall "greening" of redevelopment areas as a marketing mechanism to attract investors. Success stories such as San Antonio's River Walk point to the possibility of revitalized redevelopment areas which address environmental issues in a mutually beneficial way.

As an alternative to open space requirements, a locality could set maximum impervious surface thresholds. Under such a scenario, local governments could retain the intensity of development while decreasing the permitted lot coverage for each project. Methods of achieving a reduced lot coverage may include the construction of structured parking areas in IDAs and prohibition of additional surface parking areas. This approach would enable greater development intensity on a site while providing more area for revegetation.

Source Control Program

Conventional surface stormwater management techniques designed to achieve the "no net increase" standard for stormwater pollutants in the Regulations may be difficult to implement in highly urbanized areas even as these areas redevelop. Revitalization efforts may propose to increase a site's development intensity, further limiting design flexibility, and sub-surface conditions may preclude certain structural BMP options altogether. Other effective Best Management Practices can be implemented, however, to improve the quality of stormwater runoff consistent with water quality objectives in the Act and Regulations.

NOTE: The Department is funding a Northern Virginia Planning District Commission project to conduct an assessment of BMPs for the "ultra-urban environment." This study will examine specific design modifications associated with the use of underground storage tanks and cistern stormwater collection and recycling. The assessment will be directed at evaluating actual long-term efficiencies and specific limitations on the use of these BMPs as well as maintenance requirements and costs. The Department expects the results of this study to expand not only the knowledge base in developing an effective source control program but also the array of available options for meeting stormwater quality performance standards.

Source control measures can be effective in protecting receiving waters from oil and grease in urban stormwater runoff. A local water quality improvement strategy for redevelopment areas could implement innovative measures such as wet vacuum street sweeping. Another important aspect of such a strategy might be as simple as improved litter control, including the provision of new trash receptacles and sidewalk sweeping. Underground storage facilities are another BMP that shows promise for use in urbanized centers where available land area is severely limited.

CONSERVATION AND DEVELOPMENT OPPORTUNITIES FOR WATER QUALITY PROTECTION

Community values can be preserved and citizen-identified goals can be achieved through creative land use and development strategies that may also further the objectives of the Chesapeake Bay Preservation Act. Open space subdivision or cluster development, planned unit development, performance-based zoning and site planning, and greenways are all examples of innovative development and conservation tools with the common thread of preserving local character and protecting a community's natural and cultural resources. This section explores a number of creative approaches that may represent opportunities for implementing community objectives identified in a comprehensive planning process while enhancing and reinforcing the local Preservation Act program.

Open Space Preservation

Despite the transience of contemporary life, the visible landscape remains an important component in the way we define "community." A region's character and sense of place are important contributors to the attraction it holds to new residents and business. "Quality of life" sustains as much significance to economic development as it does to urban design. Surveys have shown that open space systems and the preservation of natural areas are important factors in establishing a high quality of life and attracting new business and industry.

Local governments are increasingly concerned about the need to preserve open space as the supply of undeveloped land diminishes. Local objectives for preserving open space can vary -- to provide outdoor recreation and public use areas like beaches, trails, and riverfront lands; to preserve the rural, open character of the community and prime agricultural land, and guide the location and rate of development; and to preserve important environmental resources like wetlands, wildlife habitat, scenic areas, and aquifer recharge areas.

Land development and conservation strategies for protecting open space are numerous. Measures that work for one locality may not necessarily be appropriate for another. Therefore, it is important to identify local open space objectives to ensure the strategy or combination of strategies is effective. For localities complying with the Chesapeake Bay Preservation Act, a primary objective for open space preservation should be the protection of water quality. Opportunities for local governments that further implementation of the Act and Regulations can also address other important community needs and objectives.

Designing a Continuous Open Space System

Some community visionaries have been motivated by the desire to walk or ride a bicycle from one corner of a local jurisdiction to the opposite corner without impediment.[118] These individuals have reasoned that such a "continuous" pathway system would expand recreational opportunity while enhancing public safety. The internal pedestrian paths and bikeways within planned communities are an example of such an open space system on a micro scale. Localities interested in applying this concept on a jurisdiction-wide or regional scale see opportuni-

and private. Ownership is an important factor in selecting local strategies appropriate for implementing an open space system.

RPA and Greenway Corridors

The RPA skeleton can first be enhanced or augmented by additional linear open space configurations, such as conservation easements along scenic tributaries, abandoned railroad rights-of-way, and linear parks, trails, parkways and bikeways (see Figure 6-33). This evokes the concept of greenways planning. Greenways are corridors of private and public lands providing access to open spaces and linking population centers with recreation areas. In addition to utilizing watercourses (streams and rivers) and railroad rights-of-way, a greenways network can include floodplains, scenic byways, forests, farms, and utility rights-of-way. Greenway programs can be enhanced through regional efforts. Examples in Virginia include the Virginia Creeper in Washington County and the Washington and Old Dominion Railroad Regional Park Trail extending from Alexandria west to Purcellville.[119]

NOTE: The *1988 Palisades Conservation Plan* developed by the Regional Plan Association and the Trust for Public Land is a greenway plan for 18 miles of the New Jersey shore. The Plan involves both adoption of new land use regulations and strategic property acquisition. The Plan concept establishes a public/private greenway that "connects, both visually and physically, the new and existing parks, trails and roadways, cultural attractions, natural resources, and significant viewpoints." [120]

Scenic Rivers

Wild and scenic waterways are an important linear element to the landscape. Riparian areas retained in their natural state protect water quality and preserve the scenic qualities of the watercourse.[121] Low impact facilities like picnic areas, pedestrian paths, and bikeways provide access and recreational opportunities which complement resource protection objectives. Allowing multiple uses enhances existing corridors and generates interest in creating new links to the open space system over time.

Wildlife Corridors

The fragmentation of forests reduces and alters habitat, resulting in significant species loss. Preserving environmentally sensitive areas and open space in the form of riparian forests or wildlife corridors will establish significant habitat areas and a safe passageway for wildlife. Wildlife corridors can link with nodes of open space or woodland to provide a spatial distribution adequate to support the diversity of plant and wildlife species.

Connecting Isolated Nodes of Open Space

By using the RPA as a means of linking "nodes" of open space, the system can ultimately expand to eventually connect a full range of open space types to meet local preservation objectives. For example, nodes of open space can include recreational areas like parks and playgrounds, planned communities with their internal systems of pathways, and public or semi-public access like boat landings and marinas.

Recreational Areas and Parks

A first priority in designing a local open space system would be to connect public recreational areas. Linking parks -- federal, state, and local -- playgrounds, wildlife management areas, and public boating access areas by designated RPA corridors would enhance resource protection while expanding both passive and active recreational opportunities and public use of these areas (see Figure 6-34).

Farmland and Woodlands

Additional expansions of the open space system could be realized by connecting farmland and existing wooded areas. The preservation of farmland helps protect rural character and enhances communty open space.

Woodlands are important in moderating climatic effects, reducing impacts caused by flooding and high winds, and protecting watersheds from siltation and erosion as a result of heavy runoff. Woodlands buffer incompatible land uses, minimize noise, and absorb air pollutants. They add value to adjacent residential areas and offer recreation and hunting opportunities. The environmental diversity of woodlands is an essential resource in protecting wildlife. Woodlands should be a major component of a comprehensive open space system. Wooded stream corridors linking nodes of woodlands such as state forests, parks, or natural areas will extend the network of open space and provide areas adequate to sustain significant wildlife populations.

Residential Open Spaces

The internal open space of planned communities or even office and industrial parks can be designed to link with the larger open space system. As new residential projects are initiated, they can be designed to connect to existing or proposed parks or other elements in the community open space system (see Figure 6-35). The design of the residential project should ensure that RPA corridors are protected and incorporated as part of the local open space system, and individual lots are configured so that residents' privacy is adequately safeguarded.

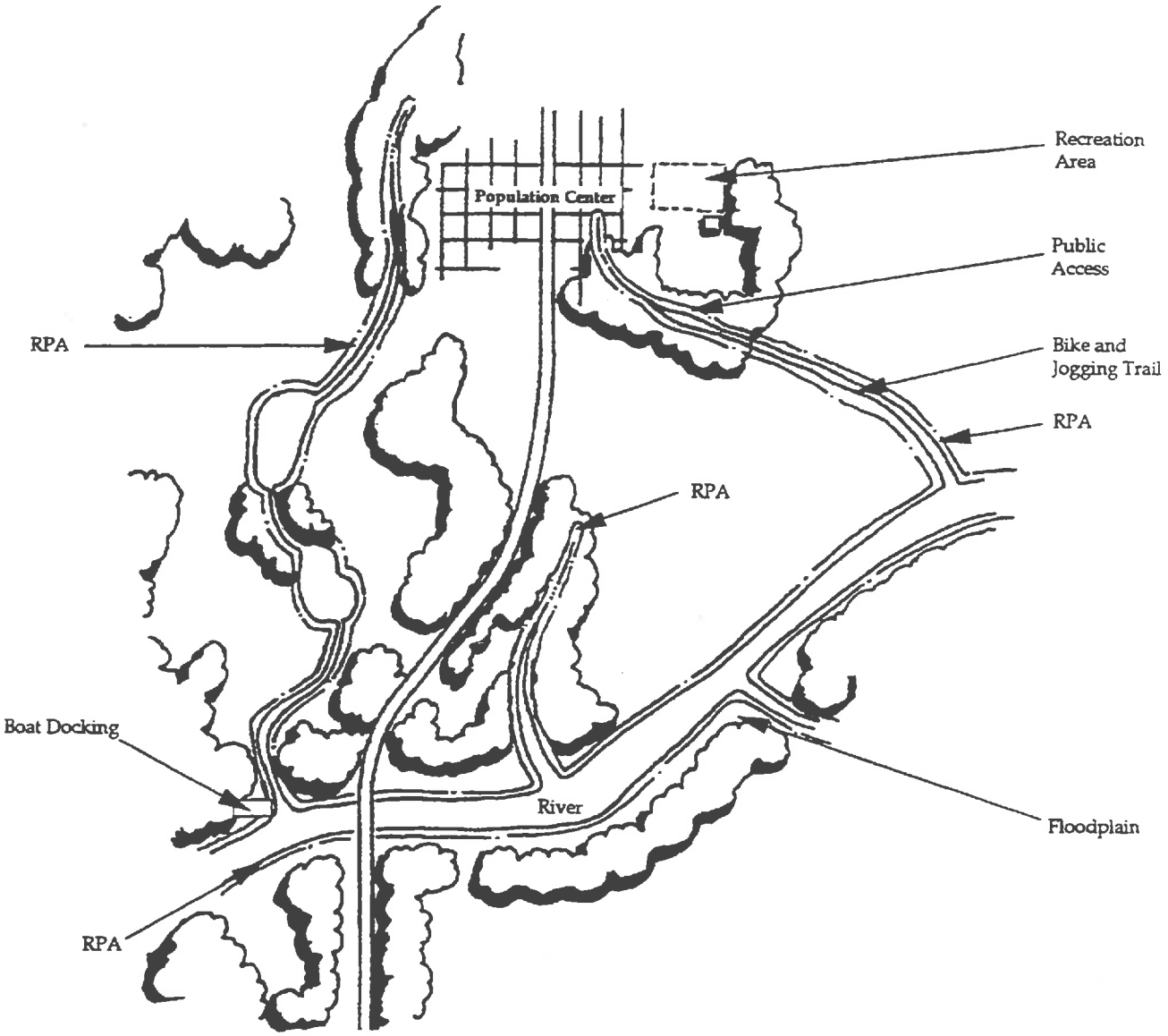
Implementation Strategies

As previously discussed, conservation and development strategies to preserve open space and protect a community's environmental and cultural resources can also be effective in protecting water quality. All of these tools can enhance implementation of local Chesapeake Bay Preservation Act programs, but some are more effective than others. Employing strategies with the greatest water quality potential enables a more comprehensive and cost-effective approach to achieve community goals.

Implementing an Open Space or Greenways System

In the Commonwealth, the Department of Conservation and Recreation (DCR) is promoting the growth and expansion of greenways and trails throughout the state on both public and private lands. A variety of programs will facilitate a local process of

EXAMPLE OF GREENWAYS AND LINKAGES *FIGURE 6-34*



GREENWAY: Locality establishes greenway network based on RPA and linkages to other natural features and public access and recreational sites.

Recreation Nodes: To include parks, boat docking, public landings.

Bike and Jogging Trails: Developed within riparian corridors to link population centers, recreation facilities, and natural resource areas.

camping areas, picnic facilities, trails, boating and fishing facilities, canoeing, and parking areas.

Once the decision has been made to initiate the planning process, data must be collected and analyzed. As for any plan development, planning for greenways must be based on objective data about the landscape. The decision to create a system of greenways should be based on evaluation of data relative to demographic and development trends, recreational demand, sensitive land features, and existing and projected land use patterns. Locally designated Resource Protection Areas form natural greenways in the landscape. Connecting RPAs to other open space or recreational areas within a jurisdiction and among neighboring localities is a way of designing a greenway network. Consideration of all related programs and activities in a region should be an important part of the greenway planning process. The record in other states has shown that cooperation among adjacent localities is important in creating extensive greenways.[123]

Local Land Use Regulations

Implementation of the general performance criteria in the Regulations can also meet local objectives relative to quality development, recreational opportunity, and community character. For example, development strategies that recognize and incorporate a site's natural features into the overall design of a project minimize land disturbance (§ 4.2.1). Design strategies that cluster buildings reduce the area needed for roads and utilities. While keeping costs down, clustering reduces the area of impervious surface (§ 4.2.5). Tree preservation and landscaping ordinances provide buffering between incompatible land uses and preserve community character while preserving indigenous vegetation consistent with the Regulations (§ 4.2.2).

Most local planners are familiar with such conservation and development strategies and many examples of local implementation of these tools exist. Where localities have already implemented open space standards, landscaping ordinances, and other strategies, **reexamination may reveal additional ways to maximize water quality protection.** In many cases, the concept may be the same but the effect may have little or no impact on water quality protection. Piggybacking water quality goals with other community objectives establishes a more comprehensive, integrated implementation strategy which will prove more cost-effective and successful both in the near and long term. The purpose of the following discussion is to examine some of these strategies based on their merits for water quality protection.

Open Space Subdivision or Cluster Development

Open space subdivision or cluster housing is a cost-effective, affordable alternative to conventional residential development. By clustering development on less sensitive portions of a site, farmland and scenic open space can be preserved while maintaining the same overall density of development. Reduced lot sizes and closer grouping of structures is exchanged for a dedication of useable open space. This type of residential development reduces site development and construction costs by reducing utility and infrastructure requirements, promoting shared access, and conserving land and energy.[124]

During the past several years, a number of cities and towns have undertaken ambitious tree planting and maintenance programs by enacting tree and landscaping ordinances. Landscaping ordinances require developers and property owners to develop landscaping plans for their projects. Most ordinances establish standards for location, quantity, sizing, spacing, buffering and screening. Some ordinances list plant species recommended for specific locales, but many fail to do this well. However, few landscaping ordinances directly consider the relationship between plant communities and local hydrology.

Local governments interested in developing a tree preservation and landscaping ordinance will benefit in seeking assistance from landscape architects, arborists, extension service agents, foresters, and other professionals. A committee comprised of citizens and landscape professionals can define community issues, build consensus, and steer development of the local ordinance. With this expertise, a list of appropriate species can be developed. A list of plants not recommended for use should also be included in a local ordinance.[128]

Local landscaping ordinances should reflect the interests, concerns, and values of the community. In designing a local landscaping ordinance, differences in communities can vary in four important ways:

- physical environment;
- community values and interests;
- the legal framework of the community; and
- the political/economic climate.[129]

Consideration of these four factors will assure a well-designed landscaping ordinance better suited for acceptance, adoption and compliance.

Landscaping ordinances set minimum standards for landscaping and screening and help a community better manage and conserve resources. Many landscaping ordinances require street tree plantings, shading of parking areas, and vegetated buffers between adjacent uses. Some localities, mostly in the Southwest, are encouraging a shift in landscaping practices from water intensive vegetation towards water conserving, drought-tolerant landscaping. Even modest measures, such as encouraging landscaping ground covers that require less maintenance and conserve energy, can reduce overall public and private costs. Though Tidewater and the East coast are generally considered "water-rich," water conservation measures employed painlessly year round maintain healthy growing conditions and help to avoid bans on water use during periods of drought.

To enhance water quality protection, local landscaping ordinances should limit ornamentals and other exotic species, instead encouraging planting schemes that rely on indigenous species. Indigenous vegetation is well-suited to the area's climate and is more resistant to disease. Many landscaping ordinances require on-site irrigation systems. Integrating landscaping requirements with stormwater management performance standards can secure an on-site water supply and meet all of a project's irrigation needs.[130] Ordinances which require the use of cisterns or other water-harvesting techniques, require the preservation of existing specimen vegetation, and discourage the use of exotic species that require greater maintenance and water will protect water quality and conserve water consistent with the Act and Regulations.

Wildlife Habitat Protection Corridors

Water quality and wildlife habitat are closely interrelated. Most aquatic organisms are directly dependent upon high quality waters for their survival or commercial value. In addition, some of the most important habitat for terrestrial species is found at the interface of land and water. The vast majority of Virginia's threatened and endangered wildlife species are located in the forested wetlands, tidal marshes, and shoreline areas of the Tidewater region.[131] These same land features are the most important for the filtering of nonpoint source pollutants and have been identified as components of Resource Protection Areas designations under the Regulations. From a comprehensive planning perspective, determining the locations and types of wildlife habitat within the locality should be an important exercise in planning for open space and water quality protection.

Perhaps the greatest impact of land development activities on wildlife and species diversity is the fragmentation of habitat into small or isolated "islands." Two problems result from habitat fragmentation. First, fragmentation leads to the loss of large, wide-ranging or ecologically specialized species that cannot survive in protected lands of inadequate size or areas subject to high levels of human disturbance. Second, it often contributes to the progressively increasing domination of remaining habitat fragments by opportunistic and exotic species that are characteristic of humanized landscapes.[132]

While the loss of habitat due to the development of large contiguous parcels of open space has been noted in planning literature, the contribution of land disturbing activities to the introduction of invasive species, and the subsequent loss of native vegetation has not received sufficient attention. Examples of this phenomenon can be found in two species of marsh vegetation, *Hydrilla* and *Phragmytes*. These species invade wetlands when soil is exposed during land disturbing activities. Such activities include residential, commercial, and industrial development; the construction of piers, docks, boat houses, and shore stabilization structures; and the building of stationary duck blinds.

Once an invasive species has taken root in an area, it is likely to spread and become the dominant species in the marsh. This has the effect of crowding out the natural diversity of a marsh (particularly tidal freshwater marshes), and can lead to the extirpation of rare and endangered plants. The decreasing diversity has an adverse impact on waterfowl. This is especially acute when a colony of *Phragmytes* invades a marsh, since this plant does not provide food for waterfowl.

Habitat Protection Planning

The first step in establishing a local habitat protection program is an inventory of habitat resources. The following outlines the inventory process:

(1) Identify habitats and their relative values;
(2) Identify species supported, including threatened and endangered species;
(3) Identify areas of important wildlife plant food;
(4) Analyze adjacent land uses;
(5) Develop continuous open space/wildlife corridor systems.

The first three steps involve identification of species and habitat using specific data resources. The Virginia Department of Con-

VIRGINIA'S NATURAL HERITAGE PROGRAM

The Department of Conservation and Recreation, through its Division of Natural Heritage, is the Commonwealth's principal manager of data on natural heritage resources, defined by the Virginia Natural Area Preserves Act (§ 10.1-209 et seq.) as unique and exemplary natural communities; habitats for rare, threatened and endangered species; and other significant biological and geological features. The Division's Natural Heritage Information Management Section maintains data in an integrated system of computer databases, maps and supporting manual files that are continually updated. Each natural heritage resource is assigned a ranking which reflects its rarity both within Virginia and around the globe. Ranking and data management procedures utilized by the Division are identical to those used by the natural heritage network, operating in all 50 states, Canada, and several Latin American and Caribbean countries. A locality can obtain a summary of data for its jurisdiction, including the legal status of rare species by writing to the Division (see Appendix A).

Under the Natural Area Preserves Act, the Division is responsible for conducting statewide inventories for natural heritage resources. The Division has also conducted a Natural Areas Inventory Program since 1989. Under this program, one or more localities contract with the Division to perform a systematic inventory of natural heritage resources. Funding has come through private and public sources, including coastal zone management funds. These inventories include a thorough review of the natural heritage maps and databases, museum collections, and other existing information; interviews with knowledgeable individuals; analysis of maps and aerial photographs; aerial reconnaissance; and field surveys. The final report includes lists and maps of natural heritage resources, protection boundaries for the most significant sites, and protection recommendations developed in cooperation with local officials. Natural heritage staff scientists provide technical assistance regarding the biology, status, or identity of natural heritage resources.

The Division has contracted to conduct inventories in Loudoun County, the City of Virginia Beach, James City County, York County, and the City of Williamsburg. The last three localities contracted with the Division jointly. This inventory is in its third, and final, year. Of roughly 90 potential natural areas identified at the start of this inventory, some two dozen have proven to support natural heritage resources. Protection recommendations for these sites and maps showing their ecological boundaries will be included in the final report.

The Division also includes a Natural Area Conservation Section that oversees the Virginia Natural Area Preserves System. Dedicating a site as a natural area preserve protects it in perpetuity. Any site supporting natural heritage resources can be dedicated, whether it is owned by the state, a locality, or a private individual. Other protection tools authorized by Virginia's Natural Area Preserves Act include conservation easements and natural area registry with the Department. The Natural Area Conservation Program staff can provide localities with general information and guidance on natural area protection and management.

EXAMPLES OF LOCAL HABITAT PROTECTION PLANNING

Fairfax County: The most successful efforts to create habitat corridors have reserved riparian habitat areas during the planning and development process. Fairfax County has incorporated this concept into its comprehensive plan through the establishment of Environmental Quality Corridors (EQCs). Corridors are delineated on two levels: sensitive lands EQCs and resource protection EQCs (see page IV-62).

The County has also undertaken the development of a computerized Ecological Resources Inventory. This effort identifies major natural vegetation communities within the County using recent aerial photography. Data from BOVA and the Natural Heritage Program was integrated into the database and areas were field surveyed to verify the photo-interpreted data and collect more specific information about species composition and relative value. The inventory is designed so that information from field observations can continually update and expand the database. The inventory will provide an important tool for County staff in completing impact assessments for development proposals. Information from the inventory has identified ecologically valuable properties which the Park Authority used in prioritizing parkland acquisitions.

Virginia Beach: The City of Virginia Beach is using the assistance of the Natural Heritage Program to digitize and incorporate the habitat inventory as an information layer in its land use planning database. The planning department will propose incorporating this information into their decision making process.

Northampton County: The County of Northampton has utilized wildlife and habitat information in the development of its land use plan. The Northampton County Board of Supervisors adopted policies to protect the flyway corridor used by migratory birds traversing the County. The Nature Conservancy's Virginia Coast Reserve contributed in collecting information and providing technical assistance based on Natural Heritage information.

Conservation Easements

The Virginia Outdoors Plan characterizes the use of conservation easements for water quality and resource protection as having "vast, untapped potential."[137] Local governments and other public bodies have had the authority to secure conservation easements since the Open-Space Land Act was enacted by the General Assembly in 1966.[138]

A conservation easement is a signed legal document which transfers some of the landowner's rights to another party, usually called a holder. The landowner retains ownership and use of the property, subject only to the restrictions mutually agreed to by the parties. The extent of restrictions depends to a great extent on the intent and desire of the landowner.

Conservation easements have typically been used to preserve open space, protect habitat and historic properties, or provide buffer zones between those resources and more intensive development. In addition, the Open-Space Land Act provides local governments with the authority to acquire easements over tidal wetlands. However, per-

ENDNOTES

[1] Code of Virginia §§ 10.1-2100 (Repl. Vol. 1989) (emphasis added).

[2] Chesapeake Bay Local Assistance Department, ***Discussion of Economic and Social Impacts of Proposed Regulations*** (Richmond, Va.: Chesapeake Bay Local Assistance Department, 1989).

[3] Virginia Department of Tourism, ***1987 Travel in Virginia - An Economic Report*** (Ricmond, Va.: Division of Tourism), 5-7; Smith, Demer, and Norman Market Research, Executive Summary, in Economic and Fiscal Impact Analysis of the Chesapeake Bay Preservation Act on Tidewater Virginia Localities (Hampton, Va.: SDN Market Research, 1989), 2.

[4] Virginia Department of Conservation and Recreation, ***The 1898 Virginia Outdoor Plan*** (Richmond, Va.: Division of Planning and Recreation, 1989), 285.

[5] Ibid.

[6] Ibid.

[7] University of Virginia, ***Virginia Statistical Abstract - 1987 Edition*** (Charlottesville, Va.: Center for Public Service, 1987), 183.

[8] Sportfishing Institute, ***Economic Impact of Sportfishing in the State of Virginia*** (Washington D.C.: Sportfishing Institute, 1989). Total economic impact of a given activity includes secondary impacts. For example, a tackle shop and wages paid to its employees are primary economic impacts of recreational fishing. The dollars those employees spend in the local economy create secondary impacts, such as employment for workers in a local grocery. Economic developers recognize this "multiplier effect" when targeting industries for recruitment.

[9] Code of Virginia §§ 15.1-446.1 to 457.

[10] Code of Virginia § 15.1-446.1.

[11] Code of Virginia § 15.1-454.

[12] 1988 Virginia Acts of Assembly, Chapter 438. (Codified at Code of Virginia § 15.1-447(1)(a)).

[13] Code of Virginia § 10.1-2109.B.

[14] E. Yokley, ***Zoning Law and Practice***, vol. 1, § 5.2 (Charlottesville, Va.: Michie Company, 1978). For an interesting discussion of the relationship of comprehensive plans to zoning and subdivision ordinances, see also Mandelker, "The Role of the Local Comprehensive Plan in Land Use Regulation," ***Michigan Law Review***, vol. 74, p. 899 (1976); Haar, "In Accordance With a Comprehensive Plan," ***Harvard Law Review***, vol. 68, p. 1154 (1955).

[28] Virginia Department of Health, ***Sewage Handling and Disposal Regulations*** (Richmond, Va.: Department of Health), parts III, IV.

[29] Bruce Hendler, ***Caring for the Land: Environmental Principles for Site Design and Review***, Planning Advisory Service Report Number 263 (Chicago: American Society of Planning Officials, 1970).

[30] U.S. Department of Agriculture, Soil Conservation Service, ***Field Office Technical Guide*** (Washington, D.C.: Soil Conservation Service).

[31] Ibid.

[32] Satellite imagery is generally available from two sources in the United States: the EOSAT Company in Lanham, Maryland (800- 344-9933) and the SPOT Image Corporation in Reston, Virginia (703-620-2200). Additionally, use of satellite imagery for natural resource applications is being evaluated by the Virginia Remote Sensing Study at the College of William and Mary (804- 221-3463).

[33] William Toner, "Environmental Land Use Planning," in Frank S. So and Judith Getzels, eds., ***The Practice of Local Government Planning*** (Washington, D.C.: International City Management Association, 1988), 117-138.

[34] Devon M. Schneider et al., ***The Carrying Capacity Concept as a Planning Tool***, Planning Advisory Service Report Number 338 (Chicago: American Planning Association, 1978).

[35] Virginia Department of Conservation and Recreation, ***The Floodplain Management Plan for the Commonwealth of Virginia.***

[36] ***Report of the Task Force on Septic Regulations*** (Charlottesville, Va.: Institute for Environmental Negotiation, 1991).

[37] Several Virginia localities already employ increased vertical separation requirements, ranging from 18" (Chesterfield, Clarke, Culpepper, Fauquier, and Poquoson) to 24" (Loudon).

[38] Virginia Polytechnic Institute and State University, ***Protecting Virginia's Groundwater: A Handbook for Local Government Officials,*** by Margaret Hrezo and Pat Nickinson (Blacksburg Va.: Virginia Water Resources Research Center, 1986).

[39] Virginia State Water Control Board, Ground Water Protection Steering Committee, ***A Ground water Protection Strategy for Virginia*** (Richmond, Va.: State Water Control Board, 1987), vi.

[40] Virginia Polytechnic Institute and State University, ***A Groundwater Primer for Virginians***, by Torsten Sponenberg and Jacob Kahn (Blacksburg Va.: Virginia Water Resources Research Center, 1984).

[50] Virginia State Water Control Board, Groundwater Protection Steering Committee, ***Virginia Groundwater Management Handbook: State Agency Programs for Groundwater Protection*** (Richmond, Va.: State Water Control Board, 1988), 2-19.

[51] Virginia State Water Control Board, ***Virginia Water Quality Assessment, 1990 305(b) Report to EPA and Congress***, Information Bulletin 579 (Richmond, Va.: State Water Control Board, 1990).

[52] Robert Taylor, Division of Water Supply Engineering, Virginia Department of Health, telephone interview by Raymond Utz, Senior Environmental Planner, Chesapeake Bay Local Assistance Department, 20 June 1991.

[53] Virginia State Water Control Board, ***Virginia Groundwater Management Handbook: State Agency Programs for Groundwater Protection***, 2-3.

[54] Ibid., 2-3 and 2-16.

[55] Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, ***Virginia Nonpoint Source Pollution Assessment Report*** (Richmond, Va.: Division of Soil and Water Conservation, 1989).

[56] Ibid.

[57] Virginia State Water Control Board, ***A Groundwater Protection Strategy for Virginia***, 23.

[58] Russel P. Ellison, Division of Groundwater Programs, Virginia State Water Control Board, telephone interview by Raymond Utz, Senior Environmental Planner, Chesapeake Bay Local Assistance Department, 18 June 1991.

[59] Virginia State Water Control Board, ***Virginia Groundwater Management Handbook: State Agency Programs for Groundwater Protection***, 2-17.

[60] Ellison, telephone interview, 18 June, 1991.

[61] Virginia State Water Control Board, ***Virginia Groundwater Management Handbook: State Agency Programs for Groundwater Protection***, 4-20 and 4-21.

[62] Paula Ripley, ed., ***Economic Implications of Groundwater Contamination to Companies and Cities*** (Navarre, Mn.: Freshwater Foundation), 6.

[63] Martin Jaffe and Frank DiNovo, ***Local Groundwater Protection***, 76.

[64] Ibid., 77.

[74] Localities which have open space requirements include Fauquier County and Fairfax County.

[75] Virginia State Water Control Board, ***Virginia Groundwater Management Handbook: State Agency Programs for Groundwater Protection,*** 4-20 and 4-21.

[76] ***Report of the Task Force on Septic Regulations*** (Charlottesville, Va.: Institute for Environmental Negotiation, 1991).

[77] Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, ***Sediment and Nutrient Contributions of Selected Eroding Banks of the Chesapeake Bay Estuarine System,*** by Nancy A. Ibison, Chris W. Frye, Jack E. Frye, Carlton Lee Hill, and Ned H. Burger, (Richmond, Va.: Shoreline Programs Bureau, 1991).

[78] Ibid.

[79] U.S. Army Corps of Engineers, ***Chesapeake Bay Shoreline Erosion Study: Feasibility Report*** (Baltimore, Md.: Baltimore District, Corps of Engineers, October 1990), unnumbered page.

[80] Scott Hardaway and Gary Anderson, ***Shoreline Erosion in Virginia*** (Gloucester Point, Va.: Virginia Institute of Marine Science, 1980), 5.

[81] Robert Byrne and Gary Anderson, "Shoreline Erosion in Tidewater Virginia," in ***Applied Marine Science and Ocean Engineering No. 111*** (Gloucester Point, Va.: Virginia Institute of Marine Science, 1977), 3.

[82] Hardaway, ***Shoreline Erosion in Virginia,*** 3, 4.

[83] Lee Hill, Shoreline Erosion Advisory Service, telephone interview by Sandra Benson, Information Officer, Chesapeake Bay Local Assistance Department, 6 May, 1991.

[84] Hardaway, ***Shoreline Erosion in Virginia,*** 3.

[85] Ibid., 5.

[86] Larry G. Ward and others, ***Living with Chesapeake Bay and Virginia's Ocean Shores*** sponsored by the National Audubon Society, (Durham, Nc.: Duke University Press, 1989), 52.

[87] Ibid., 63.

[88] Shoaling refers to the deposition of sand in an area which affects depth of water and may endanger surface navigation.

[89] Ward, ***Living with Chesapeake Bay and Virginia's Ocean Shores,*** 68.

[102] These maps are available through Virginia's Marine Resources Commission
2600 Washington Avenue
P.O. Box 756
Newport News, Va. 23607
(804) 247-2200

[103] Robert J. Orth and others, ***Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay 1987*** (Gloucester Point, Va.: Virginia Institute of Marine Science, 1988), 88.

[104] The Virginia Chesapeake Bay Local Assistance Department is investigating opportunities to provide this resource to local governments free of charge.

[105] Virginia Department of Conservation and Recreation, ***Chesapeake Bay Area Public Access Plan***, 1990.

[106] Chesapeake Executive Council, ***The 1987 Chesapeake Bay Agreement*** (Chesapeake Executive Council, 1987), 5.

[107] Virginia Department of Conservation and Recreation, ***The 1989 Virginia Outdoors Plan***.

[108] Richmond County, ***Subdivision Regulations for Richmond County, Virginia*** (Richmond County, Va.: August 10, 1989), IV-15.

[109] Marine sanitation devices often use additives such as zinc, quaternary ammonium, and formaldehyde, which can kill beneficial organisms in septic drainfields, see "Recreational Boat Pollution and the Chesapeake Bay," Report to the Chesapeake Executive Council, January 8, 1991.

[110] Chesapeake Bay Local Assistance Department, ***Local Assistance Manual: Appendix C Guidance Calculation Procedure*** (Richmond, Va.: Chesapeake Bay Local Assistance Department, 1990), C-10.

[111] See Commonwealth of Virginia, Council on the Environment, ***Case Studies in the Application of Best Management Practices to Meet the Requirements of Virginia's Chesapeake Bay Preservation Act*** (Richmond, Va.:Council on the Environment, 1990).

[112] See Jim Schwab, "Riverfront Gamblers," ***Planning*** (September 1989), 15-18.

[113] See Boston Redevelopment Authority, ***City of Boston Municipal Harbor Plan***(Boston, Ma.:Boston Redevelopment Authority, 1990), 42-44.

[114] Ibid., 8.

bridge, Ma.: Lincoln Institute of Land Policy and the Environmental Law Foundation, 1988), 32.

[126] Ibid., 37.

[127] With the increasing interest in golf, golf course facilities are frequently integrated as a component of residential community development projects. Although golf courses provide open space, their construction and operation may severely degrade water quality and adversely impact environmentally sensitive resources. See Richard D. Klein, ***Protecting the Aquatic Environment from the Effects of Golf Courses*** (Maryland Line, Md.: Community and Environmental Defense Associates, 1990).

[128] Wendelyn A. Martz with Marya Morris, ***Preparing a Landscaping Ordinance***, Planning Advisory Service Report Number 431 (Chicago: American Planning Association, 1990), 3.

[129] Ibid., 3-5.

[130] See Bruce Ferguson and Thomas N. Debo, ***On-Site Stormwater Management: Applications for Landscape and Engineering***, 2d ed. (New York: Van Nostrand Reinhold, 1990), 153-174, for a discussion on water harvesting design. The authors cite a number of examples where stormwater runoff is collected and successfully used for landscape irrigation.

[131] See Gay Mackintosh, ed., ***In Defense of Wildlife: Preserving Communities and Corridors*** (Washington, D.C.: Defenders of Wildlife, 1989).

[132] Ibid.

[133] Lowell W. Adams and Louise E. Dove, ***Wildlife Reserves and Corridors in the Urban Environment: A Guide to Ecological Landscape Planning and Resource Conservation*** (Columbia, Md.: National Institute for Urban Wildlife, 1989), 27.

[134] Ibid., 29.

[135] Ibid., 29.

[136] Ibid.

[137] Department of Conservation and Recreation, ***The 1989 Virginia Outdoors Plan***, 122.

[138] Code of Virginia §§ 10.1-1700 to 1705.

[139] Code of Virginia §§ 10.1-1009 to 1016.

[140] Code of Virginia §§ 10.1-1800 to 1804.

APPENDIX A

GOVERNMENT RESOURCES

State Agencies:

Cooperative Extension Service
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Cooperative Extension Service
Virginia State University
Petersburg, Virginia 23803

Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219
(804)786-4500
Fax (804) 225-3933
TDD (804) 786-6152

Department of Agriculture and Consumer Services
Pesticide Control Board
C. Kermit Spruill, liaison
Division of Product and Industry Regulation
P.O. Box 1163, Room 403
Richmond, Virginia 23209
(804) 786-3523

Department of Air Pollution Control
801 Ninth St. Office Building
Richmond, Virginia 23219
(804) 786-5474
Fax (804) 225-3933

Department of Conservation and Recreation
Division of Soil and Water Conservation
203 Governor Street, Suite 206
Richmond, Virginia 23219
(804) 786-2064
Fax (804) 786-6141

Local Soil and Water Conservation Districts:

Appomattox River SWCD
City of Petersburg
P.O. Box 277
Dinwiddie, Virginia 23841

Peanut SWCD
Counties of Isle of Wight and Surry, City of Suffolk
Public Services Building
Isle of Wight, Virginia 23397
(804) 539-9270

Prince William SWCD
Prince William County
8715 Plantation Lane
Suite 301
Manassas, Virginia 22110
(703) 361-1710

Three Rivers SWCD
Counties of Essex, King and Queen, and King William
P.O. Box 815
Tappahanock, Virginia 22560
(804) 443-2327

Tri-County/City SWCD
Counties of King George, Spotsylvania, and Stafford
and the City of Fredericksburg
605 William Street
Fredericksburg, Virginia 22401
(703) 373-8592

Virginia Dare SWCD
Cities of Chesapeake and Virginia Beach
Agricultural Department
Municipal Center
P.O. Box 6097
Virginia Beach, Virginia 23456
(804) 427-4775

Department of Emergency Services
310 Turner Road
Richmond, VA 23225-6491
(804) 674-2400

Department of Forestry
P.O. Box 3758
Charlottesville, Virginia 22903
(804) 293-8605

Regional Offices:

Culpeper Field Office
102 North Main Street - 3rd Floor
Culpeper, Virginia 22701
703) 829-7340
Fax (703) 829-7337

Richmond Field Office
5001 West Broad Street
5001 Building - 3rd Floor
Richmond, Virginia 23230
(804) 662-9530
Fax (804) 662-7437

Southeast Field Office
5700 Thurston Avenue - Suite 203
Virginia Beach, Virginia 23455
(804) 363-3876
Fax (804) 363-3955

Department of Housing and Community Development
205 North Fourth Street
Richmond, Virginia 23219-1747
(804) 786-7891

Department of Mines, Minerals and Energy
Division of Mineral Resources
2201 West Broad Street
Richmond, Virginia 23220

Department of Transportation
1401 East Broad Street
Richmond, Virginia 23219
Att: Aerial Photography Department
(804) 786-2575
Fax (804) 786-1788

Department of Waste Management
101 N. 14th Street, 11th Floor
Richmond, Virginia 23220
(804) 225-2667
Fax (804) 225-3753
TDD (804) 371-8737

Federal Agencies:

Federal Emergency Management Adminstration
Floodplain Map Distribution Center
6930 A.F. San Tomas Road
Baltimore, Maryland 21227
1-800-638-6620

National Oceanic and Atmospheric Administration
6501 Lafayette Avenue
Riverdale, Maryland 20737
(301) 436-6990

U.S. Army Corps of Engineers

District Office
803 Front Street
Norfolk, Virginia 23510
(804) 441-7650

Northern Neck Field Office
(804) 462-5382

Eastern Shore Field Office
(804) 787-3133

U.S. Department of Agriculture

Soil Conservation Service
Virginia Office
400 North 8th Street, 9th Floor
Richmond, Virginia 23240-9999
(804) 771-2463

Agricultural Stabilization and Conservation Service
Virginia Office
400 North 8th Street
Richmond, Virginia 23240-9999
(804) 771-2581

Richmond Office
3600 West Broad Street
Richmond, Virginia 23230
(804) 771-2427

Other Contacts:

Chesapeake Bay Foundation
Suite 815
Heritage Building
1001 E. Main Street
Richmond, Virginia 23219
(804) 780-1392

Clarke County
Allison Teetor
Clarke County Planning Department
(804) 955-3269

Friends of the Rappahannock (FOR)
P.O. Box 7254
Fredericksburg, Virginia 22401
(703) 373-3448

Lower James River Association
6526 Mechanicsville Turnpike
Mechanicsville, Virginia 23111

APPENDIX B

SEPTIC SYSTEMS

Code of County of Lancaster, as amended

SUBDIVISION ORDINANCE AMENDMENT

AS APPROVED BY THE BOARD OF SUPERVISORS ON 10/26/89

Section 5-7 Septic Systems
"Beginning on the 26th day of October, 1989 the Committee shall not approve any subdivision where sanitary sewers are not provided unless the Committee receives evidence that each lot has a valid septic permit and an approved 100% reserve site. The subdivider may be required by the health official to provide the Virginia Department of Health with information on soil studies, percolation tests, topographic studies, and other engineering data as evidence that the land is suitable for septic system, and it's 100% reserve site is not fully contained within the boundaries of each lot in at least 75% of the total lots within the subdivision."

The County is currently seeking legislative approval to make this amendment retroactive to October 1, 1989 as this is the effective date of the Chesapeake Bay Regulations.

This amendment supersedes the present section 5-7 Septic Tanks.

APPROVED BY BOARD OF SUPERVISORS 6/28/89

AN ORDINANCE TO AMEND CHAPTER 18.1, CODE OF THE COUNTY OF CHESTERFIELD, 1978, AS AMENDED, BY ADDING A NEW SECTION 18.1-55 AND AMENDING SECTION 18.1-54(b) RELATING TO SIZE OF LOTS SERVED BY SEPTIC SYSTEMS

BE IT ORDAINED by the Board of Supervisors of Chesterfield County:

(1) That Chapter 18.1 of the Code of the County of Chesterfield, 1978, as amended, is amended and reenacted as follows:

Sec. 18.1-54. Generally.

o o o

(b) Residential lots to be served by conventional, private or individual sewerage disposal facilities shall comply with the rules of the state health department and the provisions of section 18.1-55 and Chapter 20, Article VI of this Code.

o o o

Sec. 18.1-55. Size of lots served by conventional septic systems.

In any subdivision utilizing conventional septic systems the average lot size shall be no less than 40,000 square feet, at least 90% of all lots in the subdivision shall be at least 40,000 square feet in size, and no lot shall be less than 30,000 square feet in size. In addition, all lots in the subdivision shall have a minimum lot width of 120 feet measured at the building line. This section shall apply to any property for which residential zoning is

APPROVED BY BOARD OF SUPERVISORS 6/28/89

AN ORDINANCE TO AMEND ARTICLE 20 OF THE CODE OF THE COUNTY OF CHESTERFIELD, 1978, AS AMENDED, BY ADDING A NEW ARTICLE XI RELATING TO SEPTIC SYSTEMS

BE IT ORDAINED by the Board of Supervisors of Chesterfield County:

(1) That the Code of the County of Chesterfield, 1978, as amended, is amended and reenacted by adding the following article to Chapter 20:

ARTICLE XI. Septic Systems

Sec. 20-194. Septic system. The term "septic system" as used in this article shall mean a conventional septic tank and drainfield system with a septic tank and with gravity feed drainfields 18 inches to 96 inches deep or a pump system with a septic tank and pump station and with drainfields 18 inches to 96 inches deep.

Sec. 20-195. Restrictions on use of septic systems.

a) Except as provided in section 18.1-55 of this Code, any lot which utilizes a septic system and 1) for which zoning is obtained after February 23, 1989 or 2) which is recorded after January 1, 1991 shall be no smaller than 40,000 square feet in size and shall have a minimum lot width of 120 feet at the building line. Except as otherwise provided herein, all industrial and commercial uses for which a building permit is issued after the effective date of this ordinance shall be prohibited from utilizing septic systems.

(c) No storm drain connections to a septic system shall be permitted.

(d) All septic systems serving a residential dwelling unit, shall be designed and constructed to accommodate the disposal of waste from a garbage disposal unit. Disposal units shall be connected to a septic system by a separate 1250 gallon septic tank installed between the disposal unit and the primary septic tank. Such 1250 gallon tank shall be pumped every two and one-half years after the disposal unit is installed.

(e) No portion of a septic system serving a lot or parcel of property shall be located on another lot or parcel of property, unless such portion is located within a recorded easement.

(f) Any person who constructs a septic system must have a Class B contractors license and be approved by the Health Department.

(g) Any person who constructs a septic system on a lot or parcel of property shall prepare an as-built drawing of the system showing 1) the size, orientation and location of each component of the system, 2) the distances between the system and all structures on the property and 3) the distances between the system and all property lines. The as-built drawing shall be filed with the Health Department within 30 days after construction of the system has been completed.

Sec. 20-197. Prohibited materials in septic systems.

(b) Every septic system shall be kept in good repair so that the system functions as originally designed.

(c) If the county administrator, or the official designated by him, determines that the owner of a septic system has failed to comply with the requirements of subsections (a) or (b) of this section, he shall notify the owner of such determination by certified mail, return receipt requested, sent to the address listed in the real estate tax records. Such notice shall also notify the owner that he is required to correct the violation of subsections (a) or (b), as applicable. If the violation is not corrected within thirty (30) days of receipt of such notice, the county administrator, or his designee, may correct the violation using county forces or a private contractor. The cost of such correction, together with an administrative handling charge of one hundred fifty dollars ($150.00), shall be billed to the owner and if not paid within thirty (30) days, the cost of correction and handling charge shall be added to, and collected in the same manner as the real estate tax on such property. In addition, the county administrator, or his designee shall certify to the clerk of the circuit court of the county that the cost and charge is unpaid and the clerk shall record such unpaid cost and charge in the judgment lien docket book.

(d) No person shall connect a storm drain to a septic system.

SUBDIVISION REGULATIONS

FOR

RICHMOND COUNTY, VIRGINIA

ADOPTED AUGUST 10, 1989

PREPARED BY THE

RICHMOND COUNTY PLANNING COMMISSION

Section 4. Surface Drainage Facilities

In accordance with the requirements of this Ordinance and good engineering practice, the subdivision shall be provided with such storm drains, culverts, drainageways, or other works as are necessary to collect and dispose of surface and storm water originating on or flowing across the subdivision, in order to prevent inundation and damage to streets, lots, and buildings in accordance with the approved storm water management plan for the subdivision.

A continuing maintenance plan shall be submitted in accordance with the requirements of Article IV.

Section 5. Erosion and Sedimentation Control

All subdivision plans shall include adequate provision for control of temporary flooding or erosion and sediment control, both during construction and after completion of construction in accord with applicable laws and ordinances and the requirements of Article IV.

Section 6. Shoreline Protection and Waterfront Facilities

Shoreline subdivisions shall be provided with shoreline protection and waterfront facilities in accordance with the provisions of Article IV.

A continuing maintenance plan shall be submitted in accordance with the requirements of Article IV.

Section 7. Water Supply Facilities

Every subdivision with lots of such size as to require a public water supply under State or County regulations shall be provided with a community water supply and distribution system and appropriately spaced fire hydrants. The source of supply may be a county, municipal, or private water system, in which case the distribution system for the subdivision shall meet the standards for such jurisdiction or State standards or it may be an independent source of supply approved by the County and the State, in which case an arrangement, approved by the County Attorney, shall be made for its ownership and operation.

Section 8. Fire Protection

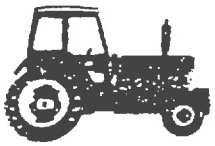
The Agent may require special fire protection measures and facilities as may be reasonably necessary in a particular case, whether or not a public or community water supply is provided.

Section 9. Sanitary Sewerage Facilities

Every subdivision with lots of such size as to require a public sewer system under the provisions of this Ordinance or the zoning regulations or the regulations of the State or the County shall be provided with a community sanitary sewer system connected to a county or municipal system or to an adequate community sewerage disposal plant meeting the requirements of the State and the County. If connected to a county or municipal system, sewers shall be constructed to meet the standards and require-

e Pennsylvania State University, College of Agriculture, Cooperative Extension Service, University Park, Pennsylvania

AGRICULTURAL ENGINEERING FACT SHEET



SW-40

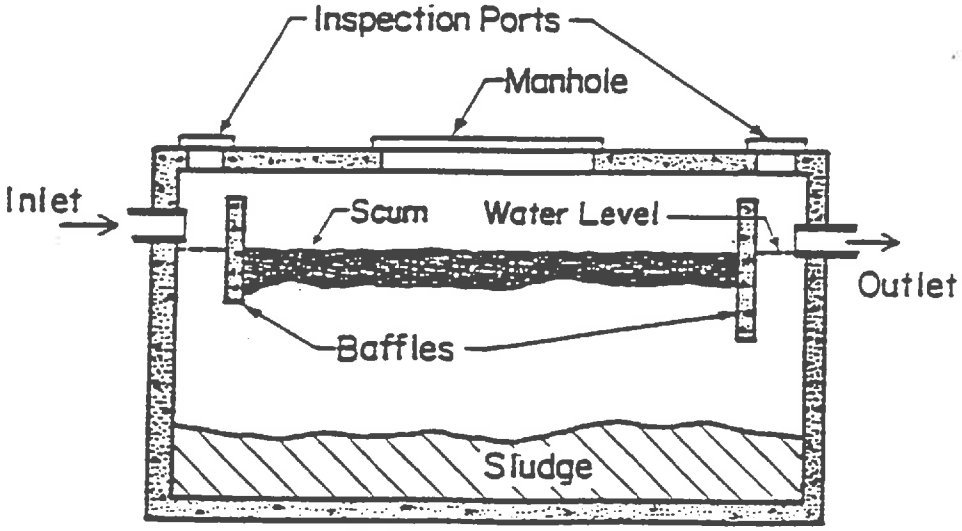
SEPTIC TANK PUMPING

Paul D. Robillard, Water Quality Specialist

The most common wastewater treatment system used in rural areas is the septic tank-soil absorption system. The septic tank removes settleable and floatable solids from the wastewater. The soil absorption field then filters and treats the clarified septic tank effluent. Removing the solids from the wastewater, protects the soil absorption system from clogging and failure. In addition to removing solids, the septic tank also permits biological digestion of a portion of the solids and stores the undigested portion.

The septic tank removes solids by holding wastewater in the tank, which allows the solids to settle and scum to rise to the top. To accomplish this, wastewater should be held in the tank for at least 24 hours. Up to 50% of the solids retained in the tank decompose; the remainder accumulates in the tank. Biological and chemical additives are not needed to aid or accelerate decomposition.

As the septic system is used, sludge continues to accumulate in the bottom of the septic tank. Properly designed tanks have enough space for up to three years safe accumulation of sludge. When the sludge level increases beyond this point, sewage has less time to settle before leaving the tank. As the sludge level increases, more solids escape into the absorption area. If too much sludge accumulates, no settling occurs before the sewage flows to the soil absorption field. To prevent this, the tank must be pumped periodically. The material pumped is known as "septage."



CROSS-SECTION OF SEPTIC TANK

Cleaning Tank

Septic tank pump and haul contractors can clean your tank. It is a good idea to supervise cleaning to ensure that it is done properly. To extract all the material from the tank, the scum layer must be broken up and the sludge layer stirred up into the liquid portion of the tank. This is usually done by alternately siphoning liquid from the tank and reinjecting it into the bottom of the tank. The septic tank should be pumped out through the large central manhole, not the baffle inspection ports. Pumping out a tank through the baffle inspection ports can damage the baffles.

Before closing the tank, check the condition of the baffles. If they are missing or deteriorated, replace them with sanitary tees. It should never be necessary to enter a septic tank. Any work to replace the baffles or repair the tank should be made from the outside. The septic tank produces toxic gases which can kill in a matter of minutes. When working on a tank be sure the area is well ventilated and someone is standing nearby. Never go into a septic tank to retrieve someone who fell in and was overcome by toxic gases without a self-contained breathing apparatus (SCBA). If a SCBA is not available, call for emergency services and put a fan at the top of the tank to blow in fresh air.

To facilitate future cleaning and inspection, install risers from the central manhole and inspection ports to the surface before burying the tank. Also mark the location of the tank, so it can be easily located.

Summary

The septic tank is only one part of an on-site wastewater system. It is designed to remove solids to protect the soil absorption system, provide for the digestion of a portion of those solids, and store the remaining solids. Biological and chemical additives are not needed to aid or accelerate decomposition. Garbage grinders are also not recommended, because they impose an additional solids load on the system. Solids must be removed periodically to keep them from entering the soil absorption system. For a properly designed septic tank, the tank should be inspected and pumped every 1 to 5 years.

APPENDIX C

GUIDANCE CALCULATION PROCEDURE

GUIDANCE CALCULATON PROCEDURE

INTRODUCTION

This procedure is designed to help applicants determine compliance with a locality's Chesapeake Bay Preservation Act program. This procedure does not supplant any information or requirement of other stormwater management programs, namely any local initiative adopted pursuant to either the Erosion and Sediment Control (ESC) Law [§ 10.1-560, et. seq.] or the Stormwater Management (SWM) Law [§ 10.1-603.1, et. seq.]. While all three programs are intended to protect water resources from further degradation, each requires separate engineering analysis. In general, these programs require calculations as follows:

- a CBPA program : stormwater quality
- a SWM program : stormwater quantity and quality
- an ESC program : two-year design storm runoff volumes and velocities

Many localities may combine all aspects into one, comprehensive program. This calculation procedure would then be just one aspect of that program and a development proposal's submittal.

STEP ONE: **Determine if the site is in a Chesapeake Bay Preservation Area.**

The Regulations[1] require localities to designate Chesapeake Bay Preservation Areas (CBPAs). Guidelines for local designation are contained in Chapters II and III of the ***Local Assistance Manual*** and Part III of the Regulations. CBPAs consist of two different classifications: Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). The stormwater management criteria apply **equally** to both RPAs and RMAs.

While localities have flexibility to determine their own CBPAs, those areas will generally include the following land features:

In RPAs: tidal wetlands, nontidal wetlands contiguous to tidal wetlands, tidal shores, tributary streams, a buffer area (of not less than 100 feet), and other lands as designated by the locality;

In RMAs: floodplains, highly erodible soils, highly permeable soils, nontidal wetlands not in the RPA, and other land as designated by the locality.

(2) **If BMPs are structural, facilities must currently be in good working order, performing at the design levels of service.** The local authority may require a review of both the original structural design and maintenance plans to verify this provision. A new maintenance agreement may be required to ensure consistency with the locality's SWM requirements.

STEP THREE: **Determine the relative pre-development pollutant load of the Keystone Pollutant (L_{pre}).**

The Keystone Pollutant for Tidewater Virginia is total phosphorous. The selection of total phosphorous as the keystone pollutant is discussed in Attachment A. For the remainder of this procedure, "pollutant" or "pollutant loading(s)" will mean total phosphorous.

Following development or redevelopment, impervious cover is the key determinant in the levels of pollutant export. Up to 90 percent of the atmospheric pollutants deposited on impervious surfaces are delivered to receiving waters.[2] So, for **STEPS THREE** and **FOUR**, the site designer need only determine the amount of total area subject to these criteria and the proposed amount of impervious cover (or equivalent). Guidance on determining equivalents is given in Attachment B. Worksheets A and B will help with these next two steps.

The zoning classification or proposed density of a site will allow applicants to estimate impervious cover. Compliance and final engineering calculations, however, should be based on impervious cover shown on the final site plan. Even so, localities and applicants are encouraged to "err" conservatively, as properties tend to become more impervious with time, e.g. the expansion of a structure, paving a driveway, adding more parking spaces. A conservative estimate indicates more, rather than less, impervious cover. Localities may wish to set a minimum for particular land uses but require the determination of proposed impervious cover and **use the higher number**. Representative land use categories and associated pollutant exports are shown in Table 1.

FOR DEVELOPMENT:

Average Land Cover Conditions ($I_{watershed}$)

Just as a locality must designate CBPAs, a locality must also establish baseloads for watersheds within its jurisdiction. Once set, the baseload will not change unless technology provides a more precise answer. Watershed delineations serve as the baseline for a calculation procedure and do not constitute an additional regulatory step. The two options available to localities are:

With $I_{site(pre)}$, L_{pre} can be calculated using the Simple Method.

$$L_{pre} = P \times P_j \times [0.05 + 0.009(I_{site(pre)})] \times C \times A \times 2.72 / 12$$

where:

L_{pre} = relative pre-development total phosphorus load (in lbs)
P = average annual rainfall depth (in inches)
= 40 inches for Northern Virginia area
= 43 inches for Richmond Metropolitan area
= 45 inches for Hampton Roads area
P_j = unitless correction factor for storm with no runoff = 0.9
$I_{site(pre)}$ = equivalent pre-development impervious cover of the site (percent expressed in whole numbers)
C = flow-weighted mean pollutant concentration (in mg/l)
= 0.26 mg/l when $I_{site(pre)} < 20$
= 1.06 mg/l when $I_{site(pre)} \geq 20$
A = applicable area of site (in ac)

NOTE: 12 and 2.72 are conversion numbers

STEP FOUR: **Determine the relative post-development pollutant load (L_{post}).**

Just as with **STEP THREE**, the designer needs to know the post-development impervious cover (or equivalent). For both new development and redevelopment, post-development loadings are site-specific.

FOR NEW DEVELOPMENT

Again, the Simple Method is used.

$$L_{post} = P \times P_j \times [0.05 + 0.009(I_{site(post)})] \times C \times A \times 2.72 / 12$$

where:

L_{post} = relative post-development total phosphorus load (in lbs)
P = average annual rainfall depth (in inches)
= 40 inches for Northern Virginia area
= 43 inches for Richmond Metropolitan area
= 45 inches for Hampton Roads area
P_j = unitless correction factor for storms with no runoff = 0.9

FOR REDEVELOPMENT:

$$RR = L_{post} - 0.9(L_{pre})$$

If the calculated number is less than or equal to zero, STOP. ***Note that in watersheds using the Tidewater weighted average, F_{VA} = 0.45 lbs/ac/yr, new single-family home parcels one acre or greater do not require BMPs.***

If no BMPS are required, the applicant need only submit documentation to support his or her findings. If such findings are found correct by local officials, the applicant has then satisfied the stormwater management criteria. The state Stormwater Management Law and the Erosion and Sediment Control Law also deal with other water resource related provisions, such as quantity-related requirements.

If removal efficiencies are required, continue on with **STEP SIX.**

STEP SIX: **Identify BMP options for the site.**

Best Management Practices (BMPs) can be used to remove pollutants. BMPs are not always structural. For instance, trash removal can drastically reduce the amount of solid wastes that reach our streams. However, for the purpose of this discussion BMPs will mean any structural or mechanical device capable of preventing or reducing the amount of pollution from nonpoint sources.

The use of certain BMPs may be limited on some sites by soils, topography, area and other physical characteristics. Most BMPs can only be applied under restricted site conditions. Improperly sited, a BMP cannot perform as designed and may become a chronic maintenance problem. A poorly maintained BMP may even contribute pollutants, e.g. an eroding pond embankment sends sediment into the receiving stream.

BMPs and their associated pollutant removal efficiencies are shown in Table 2. This list is by no means a complete listing of available BMPs, nor does appearance on this list indicate appropriateness for a given situation.

ENDNOTES

[1] Chesapeake Bay Local Assistance Board, Final Regulations: VR 173-02-01 *Chesapeake Bay Preservation Area Designation and Management Regulations.* September 1989.

[2] Thomas R. Schueler, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*** (Washington, D.C.: Metropolitan Washington Council of Government, Department of Environmental Programs, 1987), 1.4.

[3] Ibid, 1.9-1.13.

Structural BMPs For Chesapeake Bay Preservation Areas — *Table 2*

	Acceptable BMP	Average Total P Removal Efficiency
A.	Extended Detention	
	(1) Design 2 (6-12):	20%
	(2) Design 3 (24 hours):	30%
	(3) Design 4 (shallow marsh):	50%
B.	Wet Pond	
	(1) Design 5 (0.5 in/imp.ac):	35%
	(2) Design 6 (2.5 V_r):	40-45%
	(3) Design 7 (4.0 V_r):	50%
C.	Infiltration	
	(1) Design 8 (0.5 in/imp. ac):	50%
	(2) Design 9 (1.0 in/imp. ac):	65%
	(3) Design 10 (2-year storm):	70%
D.	Grassed Swale	
	(1) Design 15 (check dams):	10-20%

These designs are taken from Metropolitan Washington Council of Governments, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs***, ,1987

Effeciency ratings are taken from John P. Hartigan, P.E., ***Three Step Process for Evaluating Compliance with BMP Requirements for Chesapeake Bay Preservation Areas***, 1990

WORKSHEET A : NEW DEVELOPMENT *OPTION ONE: LOCALLY DESIGNATED WATERSHEDS*

5 **Calculate the pre-development load (L_{pre}).**

L_{pre} = $P \times P_j \times [0.05 + (0.009 \times I_{watershed})] \times C_{pre} \times A \times 2.72 / 12$

= _____ × 0.9 × [0.05 + (0.009 × _____)] × _____ × _____ × 2.72 / 12

= _____ pounds per year

6 **Calculate the post-development load (L_{post}).**

L_{post} = $P \times P_j \times [0.05 + (0.009 \times I_{site})] \times C_{post} \times A \times 2.72 / 12$

= _____ × 0.9 × [0.05 + (0.009 × _____)] × _____ × _____ × 2.72 / 12

= _____ pounds per year

7 **Calculate the pollutant removal requirement (RR).**

RR = $L_{post} - L_{pre}$

= _____ - _____

= _____ pounds per year

To determine the overall BMP efficiency required (%RR) when selecting BMP options:

%RR = $RR / L_{post} \times 100$

= (_____ / _____) × 100

= _____ %

WORKSHEET A : NEW DEVELOPMENT

OPTION TWO: VA. CHESAPEAKE BAY DEFAULT

5 **Calculate the pre-development load (L_{pre}).**

L_{pre} = $P \times P_j \times [0.05 + (0.009 \times I_{watershed})] \times C_{pre} \times A \times 2.72 / 12$

= _____ × 0.9 × [0.05 + (0.009 × _____)] × 0.26 × _____ × 2.72 / 12

= _____ pounds per year

6 **Calculate the post-development load (L_{post}).**

L_{post} = $P \times P_j \times [0.05 + (0.009 \times I_{site})] \times C \times A \times 2.72 / 12$

= _____ × 0.9 × [0.05 + (0.009 × _____)] × 0.26 × _____ × 2.72 / 12

= _____ pounds per year

7 **Calculate the pollutant removal requirement (RR).**

RR = $L_{post} - L_{pre}$

= _____ - _____

= _____ pounds per year

To determine the overall BMP efficiency required (%RR) when selecting BMP options:

%RR = $RR / L_{post} \times 100$

= (_____ / _____) × 100

= _____ %

WORKSHEET C: COMPLIANCE

Select BMP options using screening tools and list them below. Then calculate the load removed for each option. DO NOT LIST BMPs IN SERIES HERE.

1

Selected Option	Removal Efficiency (%/100)	×	Fraction of CBPA Drainage Area Served (expressed in decimal form)	×	L_{post} (lbs/yr)	=	Load Removed (lbs/yr)
_____	_____		_____		_____		_____
_____	_____		_____		_____		_____
_____	_____		_____		_____		_____

2a **Estimate parameters for non-CBPA drainage areas on the project site (if the locality does not require complete compliance for the whole site). If the locality requires compliance for the whole site, omit this step.**

A (on site, non-CBPA) = _____ acres

I_a: structures = _____ acres
parking lot = _____ acres
roadway = _____ acres
other = _____ acres
= _____ acres
= _____ acres

total I_a = _____ acres

$I = (\text{total } I_a / A) \times 100$ = _____ %

$R_v = 0.05 + (0.009 \times I)$ = _____

C: $I \geq 20 = 1.08$ mg/l
$I < 20 = 0.26$ mg/l
= _____ mg/l

When using VIRGINIA CHESAPEAKE BAY DEFAULT ($F_{V_a} = 0.45$ lbs/ac/yr), C=0.26 mg/l for all I_{site}

2b **Calculate post-development load for on-site non-CBPAs.**

$L_{post(outside)} = P \times P_j \times R_v \times C \times A \times 2.72 / 12$

= _____ × 0.9 × _____ × _____ × _____ × 2.72 / 12

= _____ pounds per year

ATTACHMENT A

Many different pollutants can be identified in our streams and water bodies. The Regulations merely require the control of "nonpoint source (nps) pollution." The Model Ordinance defines NPS as pollution consisting of constituents such as sediment, nutrients, and organic and toxic substances from diffuse sources. Trying to deal with all the possible pollutants would make any calculation procedure complicated and expensive. To simplify the calculations needed, a "keystone" pollutant can be selected. A keystone pollutant shares the general characteristics of most other pollutants. By removing the keystone pollutant, other important pollutants will be simultaneously removed. Chapter 2 of *A Framework for Evaluating Compliance with the 10% Rule*[1] reviews each of the major pollutants found in urban runoff for their suitability as the keystone pollutant, based on the following three criteria:

1. The pollutant must have a well-defined adverse impact on the Chesapeake Bay.

2. The pollutant should exist in a "composite" form, i.e. in a roughly equal split between particulate and soluble phases.

3. Enough research data must be available to provide a reasonable basis for estimating how keystone pollutant loads change in response to development and to current stormwater control measures.

The only urban pollutants that appear to meet all three criteria for suitability as a keystone pollutant are: total phosphorus, total nitrogen and zinc (Table 3). Of these three, total phosphorus exists in the most equivalent proportions of soluble and particulate forms (40/60). Total nitrogen and zinc are less proportionate, at 20/80 and 25/75, respectively.

TABLE 3

Pollutant	Well-Defined Impacts on the Bay?	Composite Form?	Adequate Data?
Sediment	yes	no	no
Total Phosphorous	yes	yes	yes
Total Nitrogen	yes	yes	yes
Coliform Bacteria	yes	no	no
BOD/COD	yes	yes	no
Oil/Grease	yes	no	no
Zinc	yes	yes	yes
Lead	yes	no	yes
Toxics	no	no	no

ATTACHMENT B

The Regulations require new development stormwater management criteria be based on "average land cover conditions." Watershed designations serve as the baseline for a calculation procedure and do not constitute an additional regulatory step. Localities will have two options:

1. A locality will designate watersheds within its jurisdiction and calculate the average phosphorus loading and impervious cover for each individual watershed, or

2. A locality will declare its entire watershed as part of Virginia's Chesapeake Bay watershed with an average phosphorus loading of 0.45 pounds/acre/year and impervious cover of 16 percent.

A locality may begin with Option Two while they gather the necessary data for Option One. Figure 1 shows how Fairfax County could break up its watersheds. This discussion revolves around Option One. Option Two is discussed in Attachment C.

To determine average land cover conditions within a watershed, the locality must follow a three-step procedure:

1. **Evaluate individual watersheds.** We recommend a minimum watershed area of 100 acres. Localities may wish however, to use watershed delineations used for other aspects of its work, e.g. a sanitary sewer master plan.

2. **Know existing land use data.** The Regulations are based on present land uses, not proposed land uses. A comprehensive plan is more future oriented than a zoning map. Still, a zoning map does not always indicate present use. A locality may also be able to use current aerial photographs. Data may be cross-referenced with Commissioner of Revenue information.

3. **Compute a weighted average of impervious cover (or its equivalent).** The Simple Method (and the nonpoint source pollution load) is highly dependent on the percent of impervious cover. Some land uses contribute nonpoint source pollution but do not have "impervious covers," e.g. forest and agriculture lands. Therefore, conversions, or equivalents, must be determined. Use Table 1 to find equivalent loading/impervious factors for non-urban uses. Localities may use other documented loading factors, especially if found to be more appropriate to that locality, as long as the factors are used consistently.

   Weighted averages are frequently computed for quantity related analyses and this process is identical. Figure 2 shows how average land cover conditions might be calculated for a 100-acre watershed.

Calculating Average Land Cover Conditions

Figure 2

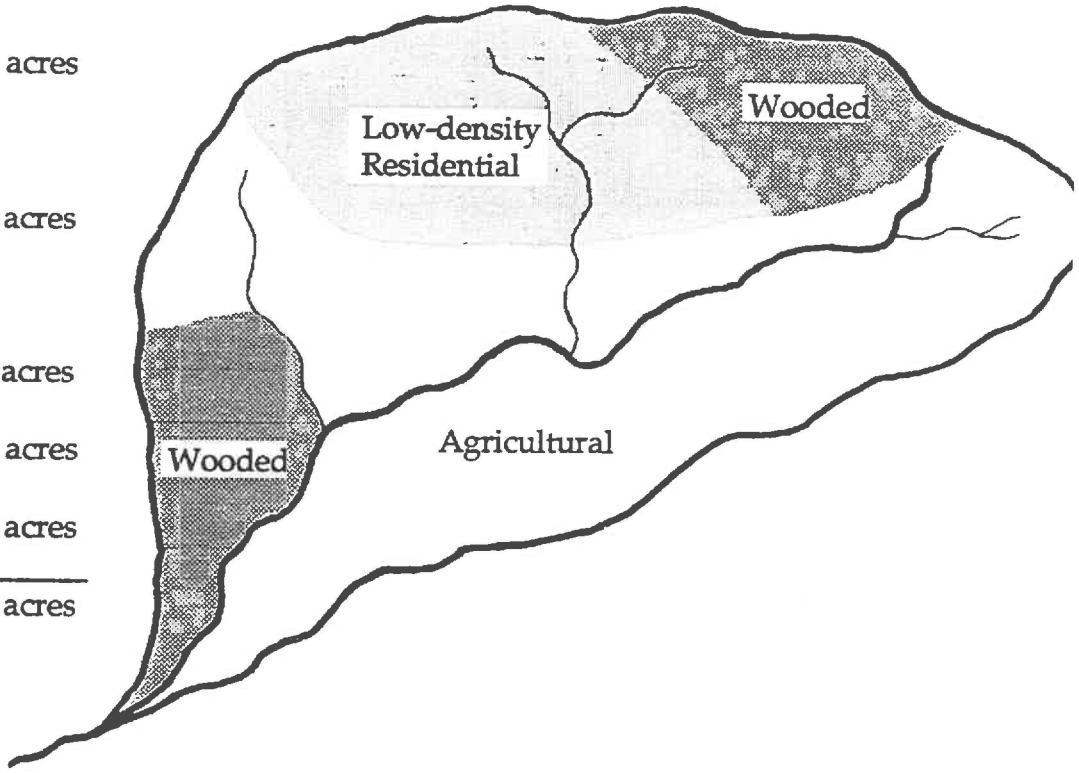
100 acre Watershed

Wooded = 20 acres

Low-density Residential = 20 acres
(1-acre lots)

Agriculture
Pasture = 30 acres
Conservation tillage = 15 acres
Conventional tillage = 15 acres

Total acreage 100 acres



Land Use	Loading: * lbs/acre/year	# of Acres	Weighted Load: lbs/year
Wooded	0.12	20	2.4
1-acre lots	0.42	20	8.4
Pasture	0.59	30	17.7
Conventional	2.42	15	36.3
Conservation	1.52	15	22.8
		100	87.6

* Phosphorous; based on rainfall of P=43 inches/year and loam soils.

$$\Sigma = \frac{\text{Sum of weighted loadings}}{\text{total acreage}}$$

$$= \frac{0.12(20) + 0.42(20) + 0.59(30) + 2.42(15) + 1.52(15)}{20 + 20 + 30 + 15 + 15} = \frac{88 \text{ lbs per year}}{100 \text{ acres}} = 0.88 \text{ lbs per acre per year}$$

Equivalent Impervious Cover = $I_{watershed}$ = 19

Therefore, the default load for Virginia's Chesapeake Bay watershed is 0.45 lb/ac/yr with an equivalent impervious cover of 16 percent. Localities are encouraged, but not required, to customize this aspect of the procedure, even if computing individual watersheds is not feasible. The Town of Herndon might use $I_{VA} = 18$, Caroline County might use $I_{VA} = 17$ and Isle of Wight County would retain $I_{VA} = 16$.

VIRGINIA LAND USE DATA *FIGURE 3*

River Basin	total area (sq.mi.)	% URB	URB area (sq.mi.)	% FOR	FOR area (sq.mi.)	% PAST	PAST area (sq.mi.)	% CST	CST area (sq.mi.)	% CVT	CVT area (sq.mi.)
Potomac	14670	7	1027	56	8215	26	3814	7	1027	4	587
Rappahannock	2630	1	26	64	1684	20	526	8	210	7	184
York	2980	0.2	6	70	2090	13	388	10.1	302	6.7	200
James	10495	3	315	73	7661	14	1469	6	630	4	420
Eastern Shore	1000	1.5	15	50	500	805	85	9	90	31	310
Total (w/urban)	31781	5	1389	63	20150	20	6286	7	2259	5	1701
Total (w/o urban)	30398	n/a	n/a	66	20150	21	6286	7	2259	6	1701

URB = urban land uses
FOR = forest cover
PAST = pasture land
CST = conservation till acreage
CVT = conventional till acreage

Source: Commonwealth of Virginia, Council on the Environment, ***Virginia's Chesapeake Bay Initiatives: First Annual Report*** (Richmond, Va.: Council on the Environment, 1985).

APPENDIX D

PLANT LISTS

GROUNDCOVER

PLANT NAME COMMON NAME *Botanical Name*	FOLIAGE				HABITAT			SOIL			LIGHT*			GROWTH			SIZE		PRIMARY USE					
	EVERGREEN	SEMI-EVERGREEN	DECIDUOUS	HERBACEOUS	UPLAND	BOTTOMLAND	SHORE	DRY	MOIST	WET	SUN	SHADE	EITHER	SLOW	MODERATE	RAPID	MATURE HEIGHT (FEET)	MATURE WIDTH (FEET)	DISTURBED AREAS	STABILIZE STREAMS	WILDLIFE HABITAT	STABILIZE SHORES	WIND BARRIER	EROSION CONTROL
AMERICAN BEACHGRASS *Ammophila breviligulata*				X			X	X	X		X					X	4	–				X		X
'APPALOW' LESPEDEZA *Lespedeza cuneata*				X	X	X		X	X		X				X		1	6	X					X
BEARBERRY COTONEASTER *Cotoneaster dammeri*		X			X	X			X		P		X	X			1.5	3						X
BERMUDAGRASS *Cynodon dactylon*				X	X	X	X	X	X		X					X	1	–	X					X
BIG BLUESTEM *Andropogon gerardii*				X	X	X		X	X		X			X			6	–	X		X			X
BIRDSFOOT TREFOIL *Lotus corniculatus*				X	X	X		X	X		X				X		2	–						X
BLACK-EYED SUSAN *Rudbeckia hirta*				X	X	X		X	X		X					X	3	–	X					X
BUGLEWEED *Ajuga reptans*				X	X	X			X			P	X			X	.5	–						X
CHRISTMAS FERN *Polystichum acrostichoides*				X	X	X			X	X		X			X		3	1		X				
COASTAL PANICGRASS *Panicum amarum*				X		X	X	X	X		X					X	3	–	X			X		
CREEPING JUNIPER *Juniperus horizontalis*	X				X	X	X	X	X		X					X	1.5	5				X		X
CROWNVETCH *Coronilla varia*				X	X	X	X	X	X		X				X		3	–	X					X
DAYLILY *Hemerocallis spp.*				X	X	X	X		X		P		X			X	3	3	X					X

* for those plants shown as growing in either sun or shade, (P) denotes the light condition that is preferred

GROUNDCOVER

PAGE 3 OF 3

PLANT NAME COMMON NAME *Botanical Name*	FOLIAGE				HABITAT			SOIL			LIGHT*			GROWTH			SIZE		PRIMARY USE					
	EVERGREEN	SEMI-EVERGREEN	DECIDUOUS	HERBACEOUS	UPLAND	BOTTOMLAND	SHORE	DRY	MOIST	WET	SUN	SHADE	EITHER	SLOW	MODERATE	RAPID	MATURE HEIGHT (FEET)	MATURE WIDTH (FEET)	DISTURBED AREAS	STABILIZE STREAMS	WILDLIFE HABITAT	STABILIZE SHORES	WIND BARRIER	EROSION CONTROL
SALTMEADOW CORDGRASS *Spartina patens*				X		X	X		X	X	X				X		3	–		X		X		X
SEA OATS *Uniola paniculata*				X			X	X	X		X				X		4	–				X		X
SHORE JUNIPER *Juniperus conferta*	X					X	X	X	X		P		X			X	1.5	5				X		X
SIBERIAN IRIS *Iris sibirica cv.*				X	X	X		X	X	X		P	X		X		1.5	–		X				X
SMOOTH CORDGRASS *Spartina alterniflora*				X		X	X		X	X	X				X		3	–		X		X		X
ST. JOHNSWORT *Hypericum calycinum*		X			X	X		X	X		P		X			X	1	–						X
SWITCHGRASS 'SHELTER' *Panicum virgatum*				X	X	X	X	X	X		X				X		6	–	X		X	X		X
TALL FESCUE KY-31 *Festuca arundinacea*				X	X	X	X	X	X		P		X			X	4	–	X		X			X
WESTERN SWORDFERN *Polystichum munitum*				X	X	X			X	X		X			X		3	1.5		X				
WINTERCREEPER EUONYMUS *Euonymus fortunei*	X				X	X	X	X	X				X		X		2	5		X				X

* for those plants shown as growing in either sun or shade, (P) denotes the light condition that is preferred

SHRUBS

PAGE 2 OF 3

PLANT NAME **COMMON NAME** *Botanical Name*	FOLIAGE: EVERGREEN	FOLIAGE: SEMI-EVERGREEN	FOLIAGE: DECIDUOUS	FOLIAGE: HERBACEOUS	HABITAT: UPLAND	HABITAT: BOTTOMLAND	HABITAT: SHORE	SOIL: DRY	SOIL: MOIST	SOIL: WET	LIGHT*: SUN	LIGHT*: SHADE	LIGHT*: EITHER	GROWTH: SLOW	GROWTH: MODERATE	GROWTH: RAPID	SIZE: MATURE HEIGHT (FEET)	SIZE: MATURE WIDTH (FEET)	PRIMARY USE: DISTURBED AREAS	PRIMARY USE: STABILIZE STREAMS	PRIMARY USE: WILDLIFE HABITAT	PRIMARY USE: STABILIZE SHORES	PRIMARY USE: WIND BARRIER	PRIMARY USE: EROSION CONTROL
INKBERRY *Ilex glabra*	X				X	X	X		X	X	P		X	X			8	10		X				
LEATHERLEAF VIBURNUM *Viburnum rhytidophyllum*	X				X	X		X	X			X			X		10	8			X			
MOUNTAIN LAUREL *Kalmia latiflolia*	X				X	X			X			P	X	X			10	6			X			
PAMPAS GRASS *Cortaderia selloana*	X					X		X	X		P		X			X	10	10						X
PFITZER JUNIPER *Juniperus chinensis 'Pfitzerana'*	X				X	X		X	X		X					X	6	8						X
REDOSIER DOGWOOD *Cornus stolonifera*			X		X	X			X	X	P		X		X		10	10		X	X			X
ROSEBAY RHODODENDRON *Rhododendron maximum*	X				X	X			X			X		X			25	25		X			X	
RUGOSA ROSE *Rosa rugosa*			X		X	X	X	X	X		X					X	5	5			X	X		
SCHIPKA LAUREL CHERRY *Prunus laurocerasus 'Schipkaensis'*	X				X	X		X	X		P		X		X		4	6			X			X
SCOTCH BROOM *Cytisus scoparius*			X		X	X		X	X		P		X		X		6	4		X				X
SHRUB LESPEDEZA *Lespedeza thunbergii VA-70*				X	X	X		X	X		X					X	6	4		X	X			X
SMOOTH SUMAC *Rhus glabra*			X		X	X		X	X		P		X			X	10	6			X			X
STAGHORN SUMAC *Rhus typhina*			X		X			X	X		X				X		15	15	X					X

* for those plants shown as growing in either sun or shade, (P) denotes the light condition that is preferred

TREES

PLANT NAME COMMON NAME *Botanical Name*	FOLIAGE				HABITAT			SOIL			LIGHT*			GROWTH			SIZE		PRIMARY USE					
	EVERGREEN	SEMI-EVERGREEN	DECIDUOUS	HERBACEOUS	UPLAND	BOTTOMLAND	SHORE	DRY	MOIST	WET	SUN	SHADE	EITHER	SLOW	MODERATE	RAPID	MATURE HEIGHT (FEET)	MATURE WIDTH (FEET)	DISTURBED AREAS	STABILIZE STREAMS	WILDLIFE HABITAT	STABILIZE SHORES	WIND BARRIER	EROSION CONTROL
AMERICAN BEECH *Fagus grandifolia*			X		X	X			X				X	X			70	50			X		X	
AMERICAN HOLLY *Ilex opaca*	X				X	X		X	X				X	X			40	20			X		X	
AMERICAN HORNBEAM *Carpinus caroliniana*			X			X			X				X		X		40	25		X				
AMERICAN MOUNTAIN ASH *Sorbus americana*			X		X				X		X				X		35	20			X			
BALD CYPRESS *Taxodium distichum*			X			X		X	X	X	P		X		X		80	50		X		X		
BASSWOOD *Tilia americana*			X		X				X				X			X	60	40	X				X	
BLACK CHERRY *Prunus serotina*			X		X	X			X		X					X	75	45			X			
BLACK GUM *Nyssa sylvatica*			X		X	X		X	X	X	X				X		60	40		X	X			
BLACK LOCUST *Robinia pseudoacacia*			X		X			X	X		X					X	60	40	X				X	X
BLACK WILLOW *Salix nigra*			X			X			X	X	X					X	40	25		X				
CANADIAN HEMLOCK *Tsuga canadensis*	X				X				X				X		X		60	25	X				X	
CUCUMBER TREE *Magnolia acuminata*			X		X				X				X		X		75	45					X	
EASTERN COTTONWOOD *Populus deltoides*			X			X			X	X	X					X	80	50		X	X			

* for those plants shown as growing in either sun or shade, (P) denotes the light condition that is preferred

TREES

PAGE 3 OF 4

PLANT NAME COMMON NAME *Botanical Name*	FOLIAGE				HABITAT			SOIL			LIGHT*			GROWTH			SIZE		PRIMARY USE					
	EVERGREEN	SEMI-EVERGREEN	DECIDUOUS	HERBACEOUS	UPLAND	BOTTOMLAND	SHORE	DRY	MOIST	WET	SUN	SHADE	EITHER	SLOW	MODERATE	RAPID	MATURE HEIGHT (FEET)	MATURE WIDTH (FEET)	DISTURBED AREAS	STABILIZE STREAMS	WILDLIFE HABITAT	STABILIZE SHORES	WIND BARRIER	EROSION CONTROL
PIN OAK *Quercus palustris*			X		X	X		X	X		X				X		65	50			X		X	
POSSUMHAW *Ilex decidua*			X			X	X	X	X	X	P		X		X		20	15		X	X	X		
RED MAPLE *Acer rubrum*			X		X	X	X	X	X	X	P		X			X	60	45	X	X			X	
RIVER BIRCH *Betula nigra*			X			X	X	X	X	X	P		X			X	50	30		X		X		
SARGENT CRABAPPLE *Malus sp.*			X		X	X			X		X				X		15	10			X		X	
SASSAFRAS *Sassafras albidum*			X		X	X		X	X		P		X		X		40	25	X					
SAWTOOTH OAK *Quercus acutissima*			X		X	X		X	X		X				X		60	40			X		X	
SOUTHERN RED OAK *Quercus falcata*			X		X	X		X	X		X				X		70	50			X		X	
SOUTHERN WAX MYRTLE *Myrica cerifera*	X						X		X	X	X					X	15	10			X	X		
SWAMP CHESTNUT OAK *Quercus michausii*			X			X	X		X	X	X				X		70	45		X		X		
SWEET BAY *Magnolia virginiana*		X	X				X		X	X	X				X		30	15		X		X		
SWEETGUM *Liquidambar stryaciflua*			X		X	X		X	X	X	P		X		X		80	40			X		X	
SYCAMORE *Platanus occidentalis*			X		X	X			X		P		X			X	80	15		X			X	

* for those plants shown as growing in either sun or shade, (P) denotes the light condition that is preferred

APPENDIX E

WATERSHED DELINEATION

A watershed is an area drained by a specific stream or river. Watershed areas are not hard to delineate; a topographic map contains all the necessary information.

A. Identify Major Watercourses (see Figure E-1)

1. Locate outlet reference point -- this point is frequently where one watercourse joins another.
2. Highlight watercourses (streams, creeks and swales) -- USGS maps designate these with a blue line.

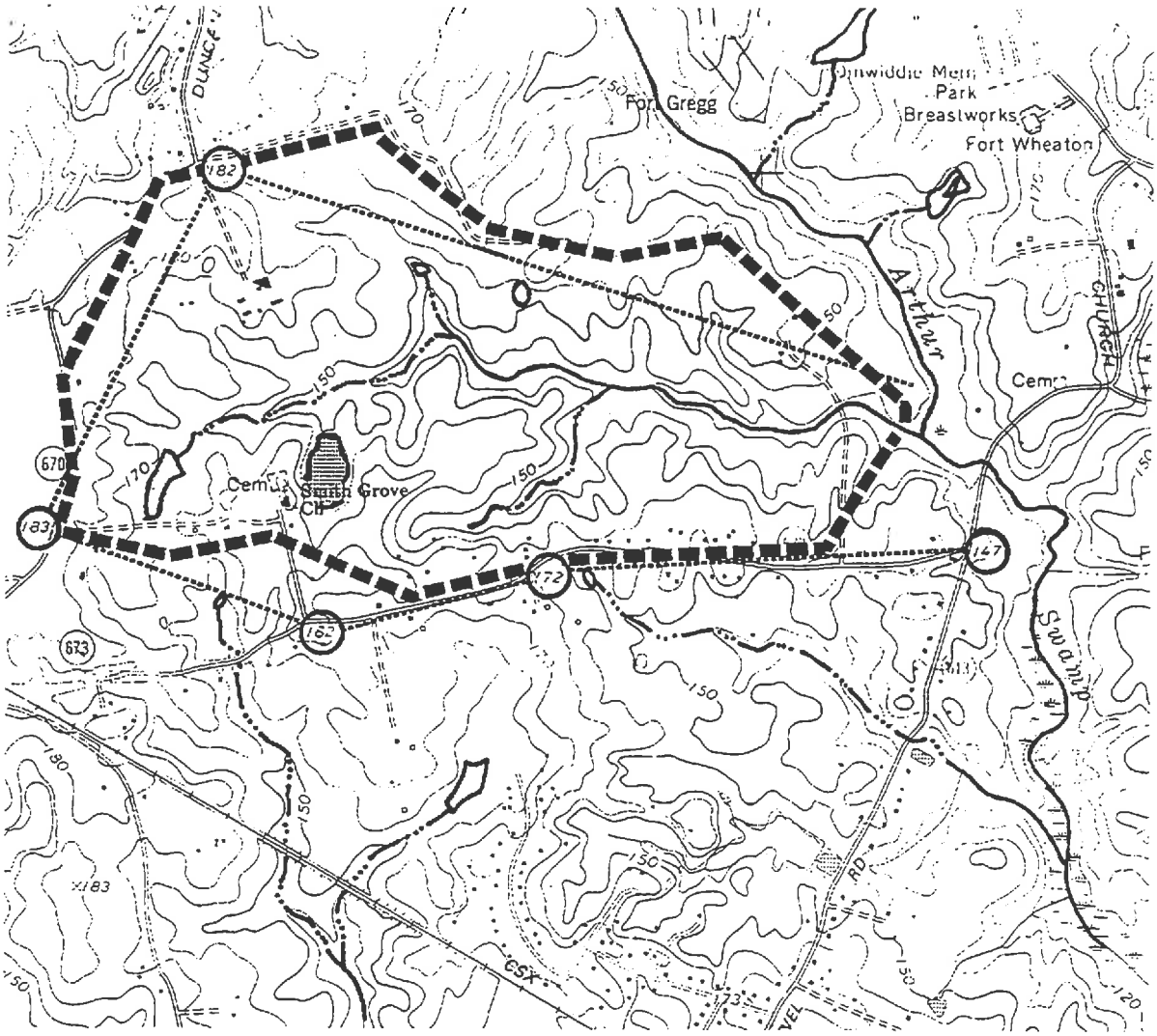
B. Identify Major Ridge Lines and Basins (see Figure E-2)

1. Locate high points -- USGS maps will sometimes give spot elevations on hill tops.
2. Connect the high points for a **preliminary** view.
3. Fine tune the boundary. Old roads frequently created or were located on ridge lines. Remember, water runs perpendicular to contour lines (down hill).

C. Identify Minor Basins within the watershed (often necessary when computer model ling) (see Figure E-3)

1. Identify smaller secondary streams and smaller ridge lines.
2. Delineate these "watersheds-within-watersheds" as the major basin was identified. Some areas will not flow into a smaller or tributary watercourse; they will flow directly into the main watercourse.

IDENTIFY MAJOR RIDGE LINES AND BASINS *FIGURE E-2*



APPENDIX F

TOLERANCE AND SUITABILITY OF ENVIRONMENTAL FEATURES TO DEVELOPMENT

Catagory	Feature	Description	Tolerance/Suitability	Development Policies		Methods and Techniques of Implementing Policies
				Permitted Associated Uses	Restrictions on Uses	
Land Soil and Topography	Wet soil	Soil with a high moisture content because of a high water table or poor drainage; often a seasonal problem.	Such soils perform an important water storage function; when septic tanks are used, water supply may be contaminated; foundations settle and crack; stagnant pools may exist during certain periods.	"Floating" or other specially constructed structures may be permitted when supplied with public water and sewerage.	No septic tanks; deep wells permitted but only where development can be tolerated and septic tanks are absent.	Subdivision and sanitary regulations requiring public water supply and sewage disposal.
	Impervious soil	Dense soil inhibiting the free flow of water; such soils usually have a high clay content.	Impermeability of soil may cause septic tanks to overflow and contaminate water supply; unsuitable for development without public water supply and sewerage.	No special development limitation with public water supply and sewerage.		
	Poor Load-bearing soil	Soils unable to support structures such as roads and buildings; usually easily compacted because of moisture content, particle size, or where excessive internal spaces or voids are present; filled lands, mineral or industrial wastepiles often have these characteristics.	Generally unsuitable for intensive development because of difficulty and cost of construction.	Certain types of light or flexible structures; recreation areas; agriculture.	Heavy structures must be anchored in bedrock.	Building code and grading ordinance prescribing development standards.
	Shrink/ swell soil	Soils with the potential to shrink or swell; often have a high clay content.	Generally unsuitable for foundations or beds of permenent structures such as buildings and roads.	Certain types of light or flexible structures; recreation areas; agriculture.	Heavy structures must be anchored in bedrock; replace with stable soils for roadbeds.	Building code and grading ordinance prescribing development standards.
	Flat land	Land with no significant slope; 0 - 2 percent.	Depending upon other conditions, flat land is highly suitable for and tolerant to development.	All uses.	Local code restrictions, pollution control (social, economic, technical, etc.) soil conditions may suggest other limitations.	Pollution control ordinances, land-use controls
	Low slope	Slope generally between 2 and 7 percent.	Fairly tolerant to development although excessive removal of ground cover may cause erosion; generally are good sites for residential development.	Residential development, intensive and extensive recreation, agriculture and grazing.	Densities may be fairly high with grading controls and limitations on vegetation removal and sedimentation.	Grading ordinance limiting terracing, topsoil and vegetation removal, etc.; subdivision controls with appropriate street and utility design standards; zoning to limit density of development.

Catagory	Feature	Description	Tolerance/Suitability	Development Policies		Methods and Techniques of Implementing Policies
				Permitted Associated Uses	Restrictions on Uses	
Land Soil and Topography (continued)	Promontory	A crag or point of high land jutting out over low land, usually associated with a body of water or valley; often associated with scenic views.	May have specific ecological role; may be unsuitable for development.	Selected development may need to be strictly controlled.	View protection	View protection regulations; other land use controls.
	Abrupt relief changes	Lines seperating distinctly different land forms; usually associated with piedmont-plains areas and with significant vertical displacement along fault lines.	Generally no special ecological roles although may be barrier to movement depending on geological formations; sometimes can have visual impact; faulted areas may be subject to earthquakes.	Uses limited to those which heighten the visual effect of the change; such open space uses as a row of trees can be effective (see also weak substructure, below).		Public purchase in fee or purchase of easements.
Land Rock	Area of weak sub structure	Underground formation incapable of supporting heavy loads; often associated with certain types of rock, e.g. cavernous limestone, compressible peats, etc., and dynamic characteristics, e.g. faulting, or with compressible or expansive sedimentary deposits and filled land.	Development may be hazardous because of possible subsidence or other earth movement, especially under eartquake condition.	Limited low-intensity, low-rise development.	Special construction methods to assure stability; areas with earthqualke potential require engineering design anaysis for protection against movement damage; in areas where such potential is great, no development should be permitted.	Zoning for low-density and low-rise development and to exclude areas of assembly and uses which would create serious hazards during earthqualkes; building codes prescribing special construction methods and materials.
Land Minerals	Mineral deposit	Site currently used or potentially available for extraction of minerals, including sand, gravel, limestone, rock, coal, etc.	Source of important mineral resources; other development may preclude extractive operations; however, requires special regulations to ensure compatibility with surroundings during and following completion of operations, and prevention of water-supply contamination.	Reservation for existing extractive operations	Open-pit operations require appropriate screening and performance standards to reduce noise, dust, etc.; cannot interfere with water quality; planned post-mining reclaimations for subsequent reuse.	Natural resource zoning including performance standards to prevent encroachment; performance bond to ensure site rehabilitation; preferential assessment.
Water Surface	Surface water and riparian land	Any body of water including lakes, rivers, streams, and oceans and their shorelines, estuaries (see next page) and tidelands.	Value for water supply, waste dispersion, transportation, recreation, power generation, source of food, scenic beauty; quality and quantity of water needs to be maintained.	Harbors, water/sewage treatment plants, recreation, marinas, water-dependent industry, public access points.	No non-water-dependent development; no development that will produce undersirable changes in surface or subsurface water quality.	Sanitary ordinance regulating use of septic tanks; water quality standards to restrict discharge of pollutants; water zoning to separate incompatible water users; zoning to restrict shoreline development to water-dependent uses; public works planning; PUD controls.

Catagory	Feature	Description	Tolerance/Suitability	Development Policies		Methods and Techniques of Implementing Policies
				Permitted Associated Uses	Restrictions on Uses	
Air	Air corridor	A term describing the path of movement of the air, generally bounded by valley walls; important in terms of microclimatic considerations and air pollution dispersal.	An analytical tool that helps determine development suitability depending on microclimate and location of polluters; may affect urban form, compatibility of uses and orientation of structures.	Depending on wind speed, air direction and other meteorological factors, sources and receptors of pollution should not be permitted in the same corridor; reforestation would help to relieve summer heat and humidity.	Highly restricted development of sources of pollution; preferably stringent source of controls.	Land-use controls restricting locations of pollutors upwind of receptors; source controls; performance standards in zoning ordinances.
Vegetation and Wildlife	Woodland	A tract of land dominated by trees but usually also containing woody shrubs, grasses, and other vegetation.	Where extensive, woodlands are intolerant to intensive development because of their role in the water cycle, oxygen replenishment, wildlife support, recreation, and as a source of raw materials; also have special aesthetic value in urban areas.	Depends largely on water-related role: dense forests can maintain housing of, say, one family per acre but only where abundent; well-managed commercial forestry; recreation.	Very limited development to maintain vital ecological role and aesthetic appearance; limited tree cutting for development or sustained commercial yield.	Forest conservation controls, e.g., zoning and subdivision controls limiting intensity of development, limiting destruction of vegetation, and setting standards for improvements; authorization for limited lumbering.
	Wildlife habitat	The natural environment of an animal species; usually associated with other features such as marshes or woodland.	Tolerance to development depends on species, some habitats should be maintained for scientific, recreational and educational purposes; destruction of habitat may affect other parts of the ecosystem.	Passive recreation including limited hunting and fishing, maintenance in a natural state to minimize disruption of animal communities; outdoor education laboratory.	In managed habitats, no development except access roads and recreation associated strucutres; cabins if widely dispersed.	Public purchase, or purchase of scenic, hunting, fishing easements; zoning limitations on surrounding areas; very low-density zoning for seasonal cottages and restrictions on access roads.
	Prime agricultural land	Fertile cropland producing a high-value yield , often of a generally scarce nature such as vineyards, orchards, and truck farms.	Of limited extent in some areas, development renders such land unsuitable for agriculture.	Agricultural uses only, except where such land is plentiful in a particular area.	Where other developable land is abundent, zoning for exclusive agricultural use (e.g. 25-acre minimum lots) is justifiable.	Exclusive agricultural zoning; preferential farmland tax assessment.
	Pasture land	Land use for grazing of domestic animals.	Depending upon slope, soil and subsurface conditions, this land is often tolerant to and suitable for development.	Development where land is plentiful; where scarce, it should be retained in open space.	No development in urban areas lacking sufficient open space.	Open-space zoning where appropriate.
Cultural and landscape	Unique remnant	Landscape feature of unusual or rare occurance, generally associated with previous epochs, such as stands of redwoods, geological outcrops, natural bridges, meteor craters, everglades, geysers, etc.	While many have no major ecological role, they should be preserved for historic, recreational, educational, and aesthetic reasons.	Low-density recreation; preservation for natural history, ecological education, and aesthetic purposes.	No development which would deteriorate the quality of the feature.	Public or private non-profit purchase; restrictive covenants or other restrictions; zoning and other limitations on surrounding areas.

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INFORMATION BULLETINS

Information Bulletin

Chesapeake Bay Local Assistance Department

July 1990 *Number 1*

Policy Guidance

The questions and issues below have been raised by Tidewater local governments concerning implementation of the Chesapeake Bay Preservation Act and regulations. The Chesapeake Bay Local Assistance Department has identified the salient questions and applicable statutory and regulatory requirements.

1. What are the obligations of local governments under the provisions of §§ 4.2.7.b. (reserve septic system drainfield criterion) and 4.3.B. (buffer area criteria) of the regulations ? Must local governments enforce these provisions, which appear to take effect on October 1, 1989, prior to local adoption of performance criteria, which are not required until September 20, 1990 ? If not, how are local governments to implement these regulations in the absence of local ordinances ?

Statutory and regulatory requirements:

- *The Chesapeake Bay Preservation Act provides that local governments must designate Preservation Areas not later than twelve months after adoption of criteria by the Board.*

- *The Chesapeake Bay Preservation Act expands local police powers to protect the quality of state waters.*

- *Adoption of performance criteria and designation of Preservation Areas must be accomplished concurrently.*

- *For on-site sewage systems, new construction on lots recorded after the effective date (October 1, 1989) will only require a reserve drainfield site after the locality has enacted an ordinance putting such requirement into effect.*

- *Lots recorded after the effective date must only incorporate a buffer area adjacent to other Resource Protection Areas if they are used, developed, or redeveloped after the locality puts such requirements into force by ordinance.*

Given these factors, the Department proposes the following guidance:

a. The provisions that these criteria do not apply or may be varied for lots recorded prior to October 1, 1989 does not require that they be currently imposed on lots recorded after that date. None of the criteria, including the reserve drainfield site and buffer area

The developer proposes to record the plat showing less than 50 foot buffers on the greater portion of the lots. He proposes that some language be included with the plat indicating that the purchaser will be required to install and maintain BMPs. The problem is that the extent of the BMPs is not stated, and the purchaser may well find it too expensive to install them.

The county has taken the position that each lot should "stand alone." That is, that each lot within the subdivision should show the reserve drainfield and full buffer, allowing the future owner to install BMPs as an option. The county is concerned that if approval is given to the plat as proposed, a number of lots may require exceptions. This problem may be especially acute given the fact that the developer expects these lots to be purchased for investment, idle for perhaps 5-10 years prior to development. As one can see, the prospect exists for these lots to change hands several times, with the potential for the BMP requirement to be confused or even forgotten.

In the absence of an ordinance enforcing the buffer area and reserve drainfield requirements, there is no legal reason why a locality cannot approve a subdivision plat which fails to provide for those features in full.

Given these factors, the Department provides the following guidance:

a. The county may place notations on the suspect parcels indicating that the lot may not meet future requirements. Use of the following language or its equivalent is suggested:

The marked lot(s) do not indicate the use of a 100 foot buffer area around Resource Protection Areas [and/or] a 100-percent reserve septic drainfield area in Resource Management Areas, as may be required under the Chesapeake Bay Preservation Area Designation and Management Regulations and local ordinances. Use of best management practices will be required to prevent the degradation of water quality. The county reserves the right to deny building permit applications for this lot unless it can be demonstrated that all use and development will comply with those regulations.

3. Do the regulations require provision of a reserve drainfield for dwellings or structures which exist at the time a local government designates Preservation Areas and adopts the performance criteria ? If not, may localities require it ? What limitations must the locality observe ?

Section 4.2.7.b. of the regulations requires a reserve drainfield for "new construction," unless the lot was recorded prior to the effective date and has insufficient capacity to accommodate the reserve field. (emphasis added)

Although the term "new construction" is not defined in the regulations, it does have a plain meaning. "Development," "redevelopment," and "substantial alteration" are defined, with the latter clearly being types of development.

practicable. It should be noted that the ability to accomplish such a requirement will be related to the workload of local sanitarian(s).

4. Does the Chesapeake Bay Preservation Act require a town to have a comprehensive plan, zoning ordinance, and subdivision ordinance ? If not, may the Department enforce other statutes which require them ? Should it ?

Must a town have a planning commission, or, in its absence, representation on the county commission ? What land use authority may a county properly assume on the part of a town ?

May the Department advise the Board to exercise discretion in determinations of consistency concerning local governments which have to make wholesale changes to, or develop for the first time, local ordinances and plans ?

These questions are raised with reference to a number of towns located in Tidewater Virginia, some in the Bay drainage basin and others draining to other river basins. Some of these towns have not yet developed town plans, zoning ordinances, or subdivision ordinances. Others possess town plans and zoning ordinances but lack subdivision ordinances. In addition, most if not all of the incorporated towns in question lack a planning commission or representation on the County's commission. These towns desire to implement a local program under the auspices of the Chesapeake Bay Preservation Act.

Statutory requirements:

- *The Chesapeake Bay Preservation Area Designation and Management Regulations are voluntary, not mandatory, in areas outside of the Chesapeake Bay watershed.*

- *Title 15.1 of the Code of Virginia requires local governing bodies to have comprehensive plans and subdivision ordinances and enables zoning ordinances.*

- *The Chesapeake Bay Preservation Act envisions the use of zoning, and requires it in Tidewater Virginia, but is silent regarding jurisdictions elsewhere which seek to develop water quality programs under its authority.*

- *Section 10.1-2109 of the Act requires that "all counties, cities and towns in Tidewater, Virginia shall have zoning ordinances . . . ." (emphasis added). Sections 10.1-2109 B and D, which require Tidewater counties, cities, and towns to incorporate protection of water quality in their comprehensive plans and subdivision ordinances, assumes that such localities already have comprehensive plans and zoning ordinances. Section 15.1-446.1 of the* ***Code of Virginia*** *requires "every governing body . . . [to] adopt a comprehensive plan . . . by July 1, 1980." Section 15.1-430(a) defines "governing body" to mean "the board of supervisors of a county or the council of a city or town." Section 15.1-465 provides that "the governing body of any county or municipality shall adopt an ordinance to assure the orderly subdivision of land and its development. Such ordinance shall be adopted by July 1, 1977." Reading these statutes together with § 10.1-2109 makes clear the legislative intent to use all three mechanisms to achieve the goals of the Chesapeake Bay Preservation Act.*

category. Others have proposed to include steep slopes with gradients exceeding 15 or 25 percent or streams indicated on maps to be intermittent but proven in the field to be perennial in their Resource Protection Area. Still others desire to designate all lands outside of the RPA as their Resource Management Area.

In some localities there appears to be strong justification for designating the entire jurisdiction based on the extent of sensitive natural resources and features. There may also be administrative justifications, "equal protection" issues, and a relationship to other local programs that are consistent with the normal planning and zoning decision-making process. For instance, the Virginia Institute of Marine Science (VIMS) proposed to the Board that the entire Chesapeake Bay watershed within each Tidewater Virginia jurisdiction be designated a Preservation Area because the entire watershed contributes to the water pollution load which enters the Bay. That proposal was considered scientifically sound, but it was also considered that requiring such an approach would exceed the Board's regulatory authority with respect to a cooperative state-local program. However, a finding or determination by a locality that all the lands of the Chesapeake Bay watershed have potential for causing significant water quality degradation could support a designation of the entire watershed as a Preservation Area. The VIMS report to the Board could be referenced as support for such a finding.

Since the Preservation Act Regulations are supplemental to other land use authorities, it is important that they be integrated into the fabric of local land use regulations in a coordinated and comprehensive manner. Because this integration process may blur the distinctions between authorities extended to localities by the Preservation Act and its Regulations as well as other programs, it might be perceived that a local program is exceeding the authority of the Preservation Act when, in fact, it is not. Such perceptions may occur where a locality plans to designate its entire jurisdiction as a Preservation Area.

It should be noted that the Preservation Act Regulations are not responsible for the impacts of other regulatory programs. For example, the Regulations require that localities identify sensitive wetlands, but then direct land users and developers to the agencies that actually regulate wetlands for the necessary permits prior to commencing land disturbance and construction. This identification and designation process has the benefit of heightening a land user's or developer's awareness that certain sensitive lands may call for careful evaluation and planning to ensure a project's feasibility.

Regulatory requirements:

- *Resource Protection Areas shall consist of sensitive lands at or near the shoreline that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may cause significant degradation to the quality of state waters. In their natural condition, these lands provide for the removal, reduction, or assimilation of sediments, nutrients, and potentially harmful or toxic substances in runoff entering the Bay and its tributaries, and minimize the adverse effects of human activities on state waters and aquatic resources. Land categories are directive.*

- *Resource Management Areas shall include land types that, if improperly used or developed, have a potential for causing significant water quality degradation or for diminishing the functional value*

Statutory and regulatory requirements:

- *Section 2.2 of the Regulations requires that local governments must designate Chesapeake Bay Preservation Areas within twelve months of the date that criteria are adopted by the Board. Adoption of the performance criteria must be concurrent with designation.*

- *The Virginia Registrar of Regulations uses Webster's New Collegiate Dictionary, Eighth Edition, as the standard for defining regulatory terms. That reference includes among its definitions of the word "concurrent" the following: (1) "operating at the same time;" (2) "acting in conjunction."*

- *Section 2.2.B. of the Regulations requires local adoption within 12 months of the adoption date [of the Regulations] of "performance criteria applying in Chesapeake Bay Preservation Areas that employ the requirements in Part IV." (Emphasis added.) The purpose of this provision is to begin protecting water quality by requiring the use of the criteria in Chesapeake Bay Preservation Areas as soon as such areas are required to be designated. This requirement is again stated in § 4.1.A: "These criteria become mandatory upon the local program adoption date."*

- *Final revisions to comprehensive plans, zoning ordinances, and subdivision ordinances must be accomplished not later than 24 months after Board adoption of the criteria.*

- *As determined from discussions with the sponsor of the Chesapeake Bay Preservation Act, the legislative intent was that locally adopted programs be enacted and made enforceable within 12 months following Board adoption of the Regulations.*

- *As expressed at public meetings, there was general agreement among members of the Chesapeake Bay Local Assistance Board during development of the Regulations that local programs be implemented so that the criteria were enforceable within 12 months following Board adoption of the Regulations. The additional 12 months was allowed by the Board to allow local governments to amend related ordinances and plans to make them consistent and the program comprehensive.*

- *Subsection B of § 2.2 does not require that the performance criteria be included in any particular ordinance. The local government may make the criteria enforceable any way it chooses. However, subsections C through G of § 2.2 contain more specific requirements for conforming the comprehen sive plan, zoning ordinance, subdivision ordinance, erosion and sediment control ordinance and plan of development process to the requirement of the regulation. Because changing these ordinances is time consuming, and some communities felt they had to be amended in a certain sequence, an extra year was provided for their amendment. Subsections D, E, and F require that within 24 months of adoption of the Regulations, the zoning, subdivision, and erosion and sediment control ordinances must require compliance with the criteria. Until that deadline, it is a local option as to what ordinance a locality uses to require compliance with the criteria.*

- *Section 10.1-2103.10 of the Act authorizes that Board to "[t]ake administrative and legal actions to insure compliance by counties, cities and towns with the provisions of" the Act. Section 6.2 of the Regulations concerns administrative proceedings, while § 6.3 concerns Board decisions on legal action.*

2 Information Bulletin

Chesapeake Bay Local Assistance Department

September 1990 Number 2

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT COMMENTS ON HOME BUILDERS ASSOCIATION OF VIRGINIA'S PROPOSED MODEL ORDINANCE

BACKGROUND ON HOME BUILDERS ASSOCIATION OF VIRGINIA'S ORDINANCE

In July, the Homebuilders Association of Virginia (HBAV) issued its "Chesapeake Bay Preservation Ordinance." While the Department is supportive of efforts to assist local governments in the implementation of the performance criteria, we wish to express concern about several provisions of the HBAV Ordinance which we feel are inconsistent with the Act and Regulations.

The Department has devoted the majority of this information bulletin to provide comment on those provisions of the HBAV Ordinance which confuse or contradict the requirements of the Act and Regulations. These comments follow the structure of the HBAV Ordinance.

Section 1.2 - Purpose and Intent

1. The language in this section purports to be consistent with the Act and Regulations. However, this section sets a goal of minimizing pollution, while the Act specifically calls for: *the prevention of any increase in pollution; the reduction of existing pollution; the protection of existing high-quality state waters; and the restoration of all other state waters.*

2. The section limits applicability of the ordinance to that portion of the lot or parcel within the CBPA. While this may be consistent with the Regulations, it is inconsistent with Section 2.3.D of the HBAV Ordinance which states that where a lot is partially within an IDA, the entirety of the lot is subject to the IDA performance criteria. In addition, from a practical standpoint local governments, property owners, and developers would likely find it difficult to administer or comply with performance standards on only part of a lot or parcel.

Section 1.3 - Definitions

3. The HBAV ordinance omits a definition for "agricultural lands." This omission could cause confusion as to the meaning of this term throughout the ordinance.

4. The definition for "best management practices" conflicts with the Regulations. The HBAV language replaces "the most effective, practical means" with "the greatest practical technology."

> *...I am of the opinion that an owner must comply with the reserve drainfield and buffer requirements on lots on which it is feasible to meet those requirements, even if the owner's rights to the use of the property might otherwise be vested under a traditional vesting analysis.*

Section 2.1 - CBPAs

13. The Regulations specify RPA non-tidal wetlands as having surface flow connection and being contiguous to tidal wetlands or tributary streams. HBAV replaces "contiguous" with "adjacent" - a term which was considered in the public hearing phase and found to be less satisfactory due to related rulings in case law. The term "contiguous" is considered stronger language regarding the state of being in actual contact with or adjoining an object. The term "adjacent" is defined with the emphasis on the fact of being nearby. Therefore, the use of "contiguous" is clearly more consistent with the intent of the Regulations.

14. This section does not include "other lands" as a category of RPA features. Therefore, it does not leave a local government with flexibility to include other resources having a significant impact on water quality.

15. The HBAV ordinance includes "tributary streams" as RPA features. The Department considered the inclusion of tributary streams as RPAs during the regulatory development process, but learned that local governments have no jurisdiction over subaqueous lands. The Commonwealth of Virginia owns and regulates activities on subaqueous lands. Therefore, inclusion of tributary streams may be ultra vires.

16. The section would establish an RMA of a standard linear distance from RPA features with additional area included where there are concentrations of floodplains and non-tidal wetlands (connected by surface flow and adjacent to nontributary streams). While there is greater local discretion in designating RMAs, the Regulations require that these designations be based on consideration of several land features. The section presumes that a local government should only designate a narrow band adjacent to the stream network. It precludes local designation based on other RMA land categories and designation based on subwatershed boundaries. The definition of RMAs as presented in this section is inconsistent with the Regulations.

Section 2.2 - Intensely Developed Area (IDA) Overlay

17. The section does not establish IDAs as areas where existing development is concentrated as of the local program adoption date. Although essentially verbatim from the Regulations, subsections A, B, and C are unnecessary as they represent guidance for local governments, <u>not</u> an applicant.

Section 2.3 - Adoption of CBPA Map and Incorporation of CBPA and IDA Boundaries into Zoning Ordinance

18. Subsection A places sole responsibility for site-specific delineation on the land owner. This may be burdensome for individual lot owners. Local governments may wish to include a provision for allowing the administrative authority to perform the delineation where appropriate.

the implementation of local water quality protection measures under Section 10.1-2103 of the Act. Further, the calculation procedure was made part of the Local Assistance Manual required under Section 5.2 of the Regulations.

27. Section 4.1.A(3)d should be amended as these options were directed at local governments and not property owners. Most local governments will choose option (i) in developing stormwater management regulations to comply with the Act and Regulations. Retaining this language should prove confusing to an applicant or property owner.

28. The exemption for maintenance and alteration of existing stormwater management structures does not appear to be subject to local determination as required by Section 4.2.8.b of the Regulations.

29. The provision requiring a BMP maintenance agreement may not be stringent and specific enough to be consistent with Section 4.2.3 of the Regulations. Since local governments must ensure the long-term functioning of BMPs, they must have the right to approve such agreements.

30. The requirement for a conservation plan on agricultural lands does not specify compliance with the Field Office Technical Guide which distinguishes water quality conservation plans from other erosion oriented plans.

31. It should be clarified to whom evidence of all wetlands permits required by law shall be submitted. The submittal of such evidence should be in conjunction with the required plan of development process.

32. Subsection B references the Subdivision Ordinance, where Section 4.2.4 of the Regulations cites Section 15.1-491(b) of the Code. This is not an appropriate substitution of references.

Section 4.2 - Additional Performance Criteria for RPAs

33. Subsection A establishes a legal standard (preponderance of the evidence) for meeting the conditions of water-dependent development. This standard may be overly ambiguous, particularly where the terms "minimum necessary" and "where possible" are involved. In addition, the required consistency with the local comprehensive plan is omitted.

34. The reference to Section 4.3A should be changed to 4.3 (all provisions of that section apply) and the reference to "erosion and sediment control requirements" be removed, since they are not addressed in that section. (See note 29 above.)

35. Subsection C omits the provision in the Regulations which allows local governments to require water quality impact assessments (WQIAs) in RMAs when deemed necessary. This omits some of the local discretion granted to local governments in the Regulations. Although local governments have flexibility in establishing specific requirements for the water quality impact assessment, the Department believes that a threshold of "one acre of land disturbance" is too large for the **minor** water quality impact assessment.

4 Information Bulletin

Chesapeake Bay Local Assistance Department
COMMONWEALTH OF VIRGINIA

March, 1991 Number 4

Redevelopment

What constitutes redevelopment? Is the term limited to the replacement of existing structures or impervious surfaces at the same site, or does it extend to an entire parcel if part of the parcel has been previously developed? May a proposed development be classified as a redevelopment if structures in one corner of the parcel are razed and new structures are erected at an opposite corner?

Regulatory requirements:

- *Section 1.4 of the Regulations (Definitions) defines redevelopment as "the process of developing land that is or has been previously developed."*

- *Section 1.4 of the Regulations (Definitions) defines development as "the construction, or substantial alteration of residential, commercial, industrial, institutional, recreational, transportation, or utility facilities or structures."*

- *Section 4.3.A of the Regulations states "[l]and development may be allowed [in RPAs] only if it (i) is water dependent or, (ii) constitutes redevelopment."*

- *Section 4.3.A.2 states "[r]edevelopment shall conform to applicable stormwater management and erosion and sediment control criteria in this part."*

- *Section 4.3.B.3 states "[r]edevelopment within Intensely Developed Areas may be exempt from the requirements of this subsection. However, while the immediate establishment of the buffer area may be impracticable, local governments shall give consideration to implementing measures that would establish the buffer in those areas over time in order to maximize water quality protection, pollutant removal, and water resource conservation."*

- *Section 4.5.A of the Regulations states:*
  "1. Local governments may permit the continued use, but not necessarily the expansion, of any structure in existence on the date of local program adoption. Local governments may establish an administrative review procedure to waive or modify the criteria of this part for structures on legal nonconforming lots or parcels provided that:

  a. There will be no net increase in nonpoint source pollutant load;

  b. Any development or land disturbance exceeding an area of 2500 square feet complies with all erosion and sediment control requirements of this part.

Based on these factors, the Department proposes the following as guidance:

a. A proposed development of land constitutes redevelopment only when there is observable, physical (not archeological) evidence of previous construction. The existence of impervious surface (asphalt, concrete, foundations, or other buildings or structures) generally means that the site has been previously developed.

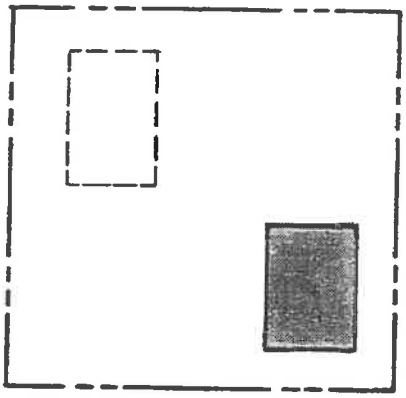
b. Local governments should clarify conditions for redevelopment in their ordinances or as policy.

c. Redevelopment must conform to all other local requirements, including zoning and subdivision regulations. Local use restrictions imposed by the zoning district are not superseded by classification as redevelopment.

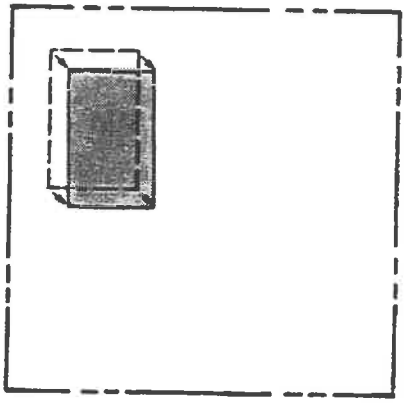
d. Although redevelopment is permitted in Resource Protection Areas, it must comply with all applicable performance criteria.

e. A redevelopment classification is established when the proposed redevelopment will replace existing structures or impervious surfaces. The proposed redevelopment must be shown to be in the same location as the previous development and have a similar (equal or lesser) area of impervious surface. In no case should redevelopment encroach further into the RPA.

f. Any redevelopment or portion of redevelopment which would increase impervious surface in the RPA should be treated as new development and must conform with all performance criteria for new development.



NOT ACCEPTABLE
The redevelopment is not in the same general location as the existing development.



ACCEPTABLE
The redevelopment is in the same general location as the existing development.

Figure 3

5 Information Bulletin

Chesapeake Bay Local Assistance Department

March, 1991 Number 5

Buffer Areas

When is the buffer area, for the purposes of a proposed development, established? Does shoreline accretion and erosion affect the location of the buffer? Is it adjusted over time to reflect physiographic changes in the shoreline? If a buffer is established for agricultural or forestal uses, does the buffer automatically apply to a subsequent use or development?

Regulatory requirements:

- *Section 3.2.B.4 includes a buffer area of at least 100 feet in width as a component of Resource Protection Areas.*

- *Section 2.2.A requires local governments to adopt a map delineating Chesapeake Bay Preservation Areas.*

- *Section 4.1.B provides for determining site-specific boundaries of Preservation Areas through the plan of development review process.*

- *Part IV. (Performance Criteria) applies to "any use, development, or redevelopment of land in Chesapeake Bay Preservation Areas." [§ 4.2]*

- *Section 4.3.B applies a buffer area, or a combination of a buffer area and Best Management Practices, to uses and developments adjacent to other RPA features.*

Buffer area delineations should be treated much the same as floodplain delineations or other zoning setbacks. Floodplains are typically revised when natural or man-made changes have occurred (erosion or accretion) or when more detailed studies are conducted. Zoning setbacks are determined on the basis of the local ordinance in effect at the time of development. Therefore, when a property owner wishes to change the use of a property, expand an existing use, or redevelop, the proposal must go through the plan of development process and the buffer area will be revised. Although redevelopment is an allowed use in the RPA, redevelopment is not exempt from the requirement of a plan of development process.

Based on these factors, the Department provides the following guidance:

a. Chesapeake Bay Preservation Area designation maps are planning tools for the purpose of indicating general locations of Chesapeake Bay Preservation Areas.

How to Measure the Buffer Area

1. **Determine landward edge of RPA feature:**

a. **Wetland** - *Perform wetland determination and delineation to establish landward extent of RPA wetland.* Check with the local government office coordinating the plan of development review process. In many cases, a local government representative might be able to help with the field delineation. In other cases, an environmental consultant must be contracted in order to adequately perform the delineation.

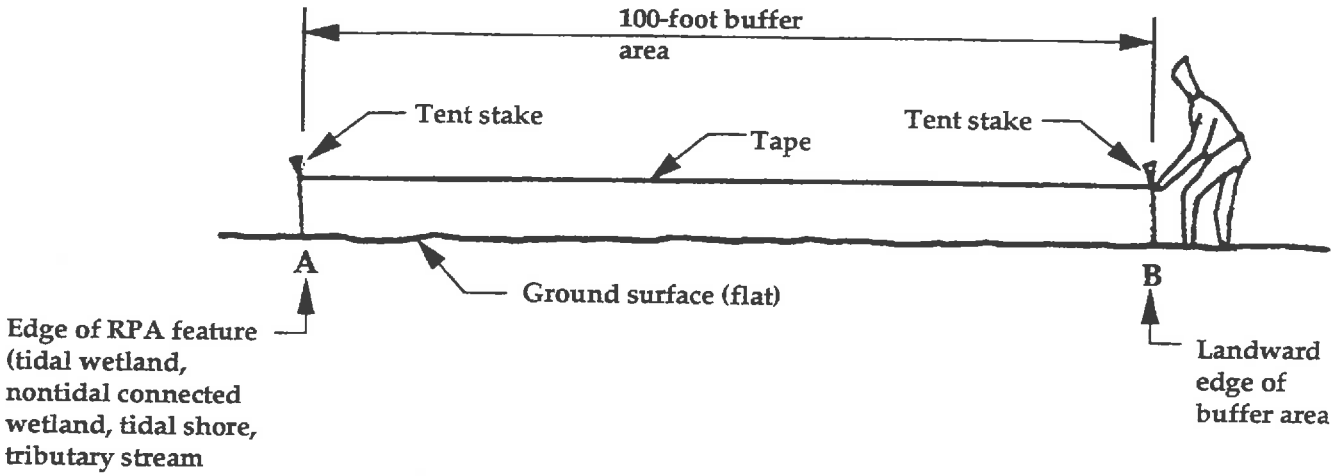
b. **Tidal shore** - *Determine the landward extent of the mean high water level.* In many cases, this determination can be made based upon observable evidence of the normal extent of mean high tide, such as debris lines or abrupt changes in vegetation.

c. **Tributary stream** - *Determine if the stream is an RPA tributary stream from the local government office coordinating the plan of development review process.* Determine from field observations the edge of ordinary high water or edge of defined streambed.

2. **Measure 100 feet horizontally from the edge of the RPA feature:**

NOTE: To insure that the landward edge of the buffer area runs parallel to the edge of the RPA feature, this procedure will have to be performed in at least two locations across the site. If the edge of the RPA feature runs straight across the property with no curves or deviations, then a measurement taken at each property line will be sufficient. However, if the edge of the RPA feature is curved or deviates in and/or out, then measurements will have to be taken at each point of devation along its entire length to establish an accurate line for the landward edge of the buffer area.

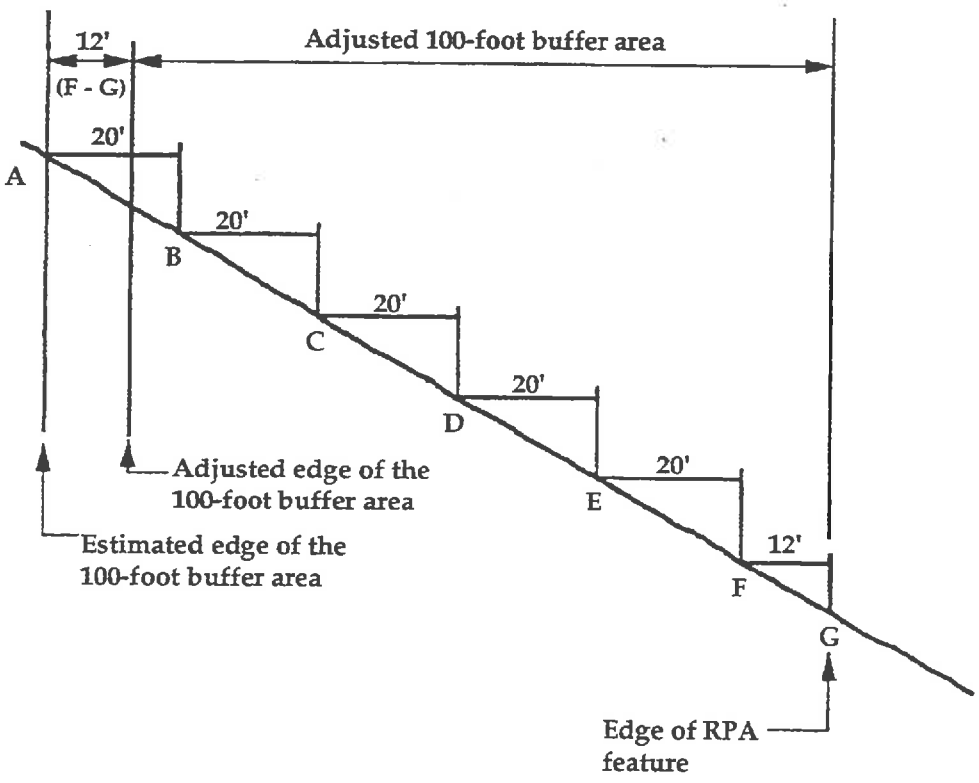
a. **Flat slopes** - Use a 25', 50', or 100' metal or fiberglass tape to measure **a horizontal** distance of 100 feet. In cases where a 25' or 50' tape is used, several measurements must be made in order to measure the full 100-foot buffer area. One person can do this task by staking down one end of the tape at the edge of the RPA feature **(A)**. Next, mark the extent of the 25', 50', or 100' increment with another tent peg or similar device .



SIDE VIEW

(2) When one person is available - First, from the edge of the RPA feature, estimate a **horizontal** distance of 100 feet up the slope. It is easier to determine the landward edge of the buffer area if a horizontal distance greater than 100 feet is estimated at first, since the final adjustment to the buffer width can be made by measuring downhill. Begin measuring downhill from the estimated landward edge of the buffer area **(A)** by staking down the uphill end of the tape and proceeding downhill to a point where you can comfortably hold the tape in a **horizontal** or level position. Mark this point on the ground in the same manner as described on page 2 for when two people are available. **Horizontally** measure the full 100-foot buffer area **(A - F)** and mark the point **(F)** with a tent peg or similar device. Next, determine the **horizontal** distance from the measured edge of the buffer area **(F)** to the edge of the RPA feature **(G)**. This distance **(F-G)** will need to be adjusted at the estimated edge of the buffer area **(A)**. As shown in the graphic below, this adjustment is made by measuring downhill from point **(A)** a distance equal to the distance **(F - G)**, which is **12'** in this example. If the **horizontally** measured 100-foot buffer area goes beyond the edge of and into the RPA feature, then the **horizontal** distance beyond the RPA feature will need to be adjusted at point **(A)** by **horizontally** measuring uphill an equivalent distance.

c. **Extreme slopes or cliffs** - When extreme slopes or cliffs are encountered, a certified land surveyor may be required to achieve an accurate 100-foot buffer measurement. Check with the local government office coordinating the plan of development review process. In most cases, a local government representative should be able to provide additional information for buffer layout in such extreme situations.



SIDE VIEW

6 Information Bulletin

Chesapeake Bay Local Assistance Department

March, 1991 Number 6

RPA Wetlands Designation

The inclusion of nontidal wetlands within the Resource Protection Areas is crucial and integral to meeting the criteria in the Chesapeake Bay Preservation Act Regulations adopted by the Chesapeake Bay Local Assistance Board. What is not completely clear to many concerned local governments and citizens is the question of where the line should be drawn between those nontidal wetlands that must be included within the RPA and other nontidal wetlands. Questions have been raised concerning the definitions of "contiguous" and "connected by surface flow" and the extent to which whole wetland systems meeting those criteria at some point must be included in RPAs.

The Local Assistance Manual (hereinafter referred to as the Manual), citing §§ 3.2.B.1 and 3.2.B.2 of the Regulations, states the following:

> *The designation of Resource Protection Areas (RPAs) requires the inclusion of tidal wetlands, as well as nontidal wetlands which are both contiguous and connected by surface flow to either tidal wetlands or tributary(perennial) streams.*

"Contiguous" is defined in *Webster's Ninth New Collegiate Dictionary* (established reference for terms in Virginia regulations) as follows:

> *1: being in actual contact: touching along a boundary or at a point; . . . 3: next or near in time or sequence; 4: touching or connected throughout in an unbroken sequence.*

Figure 1 is taken from the Manual. For the purposes of this interpretation, it is assumed to illustrate a contiguous nontidal wetland that meets the federal definition of a wetland established in the *Federal Manual For Identifying and Delineating Jurisdictional Wetlands* (1989, or as amended), hereinafter referred to as the *Federal Manual*. The fact that the wetland has been subdivided according to the U.S. Fish and Wildlife Service National Wetland Inventory (NWI) Classification system has no bearing on the contiguity of the wetland community in question. The small isolated wetland in the illustration, on the other hand, is *not* contiguous to the tributary stream but is separated by an area not classified as a wetland.

The phrase "surface flow" is interpreted on page III-24 of the Manual as "actual ground saturation or inundation." "Ground saturation" means *saturated to the ground surface.* In plain language, "surface flow" means observable moisture on the ground surface. This is different from and more exclusive than the hydrological parameter currently defined in the *Federal Manual* as inundation or saturation "within 18 inches of the surface dependent on the soil's permeability." In either case, the required hydrological condition must exist for a week or more during the growing season. The length

of the growing season varies for different regions of Tidewater Virginia. The hydrological "connection" may by characterized by the flow direction – that is, the flow moves *in the direction of* the tidal wetland or tributary stream.

Practically speaking, it may be difficult in the field to discriminate wetlands that meet the hydrological connection required by the Regulations from the larger group that satisfy the *Federal Manual* requirement, depending on the time of year the delineation is performed. The best available maps reflect the federal definition of wetlands. For that reason, local governments may have to rely on the federal definition to make their initial designations of Chesapeake Bay Preservation Areas. However, a landowner may request a reduction in the area of RPA wetlands on his or her property by presenting site-specific information that reflects the more exclusive requirements of the Regulations.

Regarding the extent of RPA designation, the point of delineation between those wetlands or portions of wetland systems that are mandatory RPA features associated with perennial tributary streams and optional wetlands associated with intermittent streams may be determined based on 1:24,000 scale USGS topographic quadrangle maps. These maps symbolize perennial streams as a solid blue line and intermittent streams as a dotted blue line. Perennial streams have flow in them all the time, not just during storm events or wet seasons. Optional field investigations of the streams in question may yield different but more accurate classifications. Intermittent streams and their associated wetlands are *not required* to be included in the RPA.

However, a wetland contiguous and connected by surface flow to an *intermittent* stream *may* be designated as an RPA feature under the "other lands" provision in § 3.2.A.4 of the Regulations, if the local government finds the particular wetland "has intrinsic water quality value due to the ecological and biological processes [it] perform[s] or [is] sensitive to impacts which may cause significant degradation to the quality of state waters" (§ 3.2.A). These wetlands typically provide significant groundwater recharge, flood control, and sediment and nutrient removal along with other values.

Figure 2 depicts a perennial stream with an intermittent stream running into it from the left side of the diagram. If the intermittent stream and its associated wetlands are *not* designated as RPA, the Department recommends the dividing point be based on the average width of the wetlands associated with the perennial stream as determined immediately on either side of the juncture of the two streams. A 100-foot wide vegetated buffer area must be included in the RPA landward of the RPA wetlands, crossing the intermittent channel as shown.

A similar situation involves a headwater area as shown at the top of Figure 2, where a perennial stream itself becomes intermittent in its upper reaches. Once again, the initial point of delineation may be determined by examining the USGS map. If the intermittent area is *not* designated as RPA, a 100-foot buffer area must be delineated along the dividing line, thus crossing the intermittent stream. As in the previous case, if a question arises concerning the accuracy of the point of delineation, a field investigation may be appropriate.

In conclusion, the Department recommends that all wetlands should be *considered* for inclusion within a Chesapeake Bay Preservation Area. Wetlands meeting the criteria established in § 3.2 of the Regulations as interpreted above, including association with perennial streams, ***must*** be designated as RPA features with a 100-foot vegetated buffer area located landward of those features as required by § 3.2.B.5 of the Regulations. Wetlands meeting the criteria in § 3.2 but associated with intermittent streams ***may*** optionally be included in RPAs according to the best judgement of the concerned locality.

7 Information Bulletin

Chesapeake Bay Local Assistance Department

March, 1991 Number 7

BMPs In Resource Protection Areas

Can water quality best management practices be built in Resource Protection Areas?

Regulatory Requirements:

Sections 4.2.8.a.1 and 4.2.8.a.2 of the Regulations state:

- *The following stormwater management options shall be considered to comply with [the stormwater management criteria] of these regulations: (1) incorporation on the site of best management practices that achieve the required control (and) (2) compliance with a locally adopted regional stormwater management program.*

- *[A] combination of a buffer area not less than 50 feet in width and appropriate best management practices located landward of the buffer area . . . at least the equivalent of the 100 foot buffer area may be employed in lieu of the 100 foot buffer.*

- *Exceptions . . . may be granted, provided that: (i) exceptions to the criteria shall be the minimum necessary to afford relief, and (ii) reasonable and appropriate conditions . . . shall be imposed as necessary so that the purpose and intent of the Act is preserved.*

This issue concerns structural water quality best management practices (BMPs). Could structural water quality BMPs be classified as water-dependent facilities and therefore be allowed by right in an RPA (as provided for by § 4.3.A.i)? The Regulations define water-dependent facilities as those "that cannot exist outside of the [RPA] and must be located on the shoreline by reason of the intrinsic nature of its operation [§ 1.4, emphasis ours]. BMPs can exist outside of the RPA. Most do not require flowing water to properly function, nor do they depend on the water bodies they're designed to protect. These generalities clearly make BMPs non-water-dependent.

Just as for any other structure, **the Regulations clearly allow for the placement of BMPs in the landward 50 feet of the buffer** with appropriate equivalency measures [§ 4.3.B.1].

But what about putting BMPs in the "seaward" 50 feet? Here again, as with any other proposed disturbance, **an exception must be granted for any disturbance in the seaward 50 feet of the buffer.** Poor candidates for such an exception are small, structural on-site water quality BMPs not a part of an approved stormwater management (SWM) program. Those BMPs generally only provide a small scale benefit, usually just for the site in question. On the other hand, large regional facilities provide the best,

8 Information Bulletin

Chesapeake Bay Local Assistance Department

January, 1992 Number 8

Agriculture Buffer Area Requirements

For a farmer to be permitted to reduce the buffer area to a 25-foot width, must he implement all three water quality protection elements (erosion control, nutrient management, and pest management) of his Soil and Water Quality Conservation Plan that has been approved by the local Soil and Water Conservation District (SWCD), or must he implement only that portion of the plan that demonstrates buffer equivalency?

Answer:

For an agricultural field adjacent to a buffer area, the buffer may be reduced to a 25-foot width if (1) *all three* water quality protection elements of the SWCD-approved conservation plan for the field are implemented, *and* (2) it can be demonstrated that, in the opinion of the SWCD Board, buffer equivalency is achieved.

Regulatory Requirements (§§ 4.2.9, 4.3.B.4):

Land upon which agricultural activities are being conducted, including but not limited to crop production, pasture, and dairy and feedlot operations, shall have a soil and water quality conservation plan. Such a plan shall be based upon the Field Office Technical Guide of the U.S. Department of Agriculture Soil Conservation Service and accomplish water quality protection consistent with the Act and these regulations. Such a plan will be approved by the local Soil and Water Conservation District by January 1, 1995.

On agricultural lands the agricultural buffer area shall be managed to prevent concentrated flows of surface water from breaching the buffer area and noxious weeds (such as Johnson grass, kudzu, and multiflora rose) from invading the buffer area. The agricultural buffer area may be reduced as follows:

> *. . . b. To a minimum width of 25 feet* ***when a soil and water quality conservation plan, as approved by the local Soil and Water Conservation District, has been implemented on the adjacent land****, provided that the portion of the plan being implemented for the Chesapeake Bay Preservation Area achieves water quality protection at least the equivalent of that provided by the 100 foot buffer area in the opinion of the local Soil and Water Conservation District Board. Such plan shall be based upon the Field Office Technical Guide of the U.S. Department of Agriculture Soil Conservation Service and accomplish water quality protection consistent with the Act and these regulations. . .* (emphasis added).

10 Information Bulletin

Chesapeake Bay Local Assistance Department

November, 1992 Number 10

Buffer Area Modifications

Can the minimum 100-foot buffer area required under the Regulations be reduced to a uniform width of 50 feet as long as best management practices are implemented that provide equivalent water quality protection?

No, the landward 50 feet of the 100-foot buffer area may be reduced only the minimum amount necessary to site a water quality BMP or, on lots or parcels recorded prior to October 1, 1989, to provide a reasonable buildable area for a principal structure and necessary utilities. Any other buffer reduction is only permitted through an exception granted by the local government.

Regulatory requirements:

§ 4.3.B of the Regulations allows buffer area modifications within the landward 50 feet as long as the following specific conditions are met: (i) appropriate best management practices (BMPs) must be employed landward of the remaining buffer area; (ii) the BMPs employed must achieve water quality protection, pollutant removal, and water resource conservation at least the equivalent of the 100-foot buffer area; and (iii) the applicant must comply with the additional performance criteria in subdivisions 1 through 4 of § 4.3.B.

In particular, § 4.3.B.1 states that vegetation may be removed from the buffer area only to provide for reasonable sight lines, access paths, general woodlot management, and best management practices. Also, § 4.3.B.2 of the Regulations allows buffer modifications on lots or parcels recorded prior to October 1, 1989 in the landward 50 feet without employing water quality BMPs, but **only** the minimum amount necessary to achieve a reasonable buildable area for a principal structure and necessary utilities.

The Local Assistance Manual (pp. IV-46, IV-50, and IV-51) provides further quidance on this issue, as follows:

> *Once the Buffer area is established, the Regulations provide for certain modifications to the composition of the buffer area in order to maintain its long-term functional quality and accommodate personal use. In situations where modifications* ***are necessary*** *in the buffer area, the Regulations set out additional performance criteria that shall apply.* (emphasis added)
>
> # # #
>
> *In certain instances, the landward fifty feet of the buffer area* ***may be*** *used for the installation and maintenance of best management practices appropriate for the site. The buffer width* ***may be*** *reduced with the use of BMPs under two different circumstances:*
>
> - *The developer needs to install BMPs in the landward 50 feet of the buffer as part of a BMP system that satisfies the stormwater management criteria for the entire development;* (Note: this assumes that

11 Information Bulletin

Chesapeake Bay Local Assistance Department

January, 1993 Number 11

Silvicultural Operations in Chesapeake Bay Preservation Areas

Are silvicultural operations in Chesapeake Bay Preservation Areas (CBPAs) exempt from local CBPA ordinance requirements? Who is responsible for overseeing silvicultural operations in CBPAs? What local CBPA ordinance requirements are applicable to silvicultural operations if they are not exempt?

Silvicultural activities in Chesapeake Bay Preservation Areas are exempt from the local Bay Act requirements only if they adhere to the water quality protection procedures prescribed by the Department of Forestry (DOF) in its "Best Management Practices Handbook for Forestry Operations."

Regulatory requirements:

§ 4.2.10 of the Regulations charges the DOF with the responsibility to oversee and document the installation of silvicultural best management practices. Following site inspections, the DOF foresters will notify local governments when they determine that silvicultural operations are not adhering to the guidelines. Once the DOF notifies a locality of a violation, the locality must enforce the CBPA ordinance requirements. Landowners are legally responsible for such violations and correction of any problems associated with them.

Once a locality has been notified of a violation, the only CBPA ordinance requirements that would apply are the buffer area criteria. The CBPA ordinance requirement for erosion and sediment controls (ESC) on land disturbances greater than 2,500 square feet is not applicable because silvicultural operations are exempt as a land disturbing activity under the state ESC law and associated local ESC ordinances. The plan of development review requirement and the rest of the CBPA ordinance performance standards are not applicable because they are tied specifically to development and/or land disturbance.

§ 4.3.B of the Regulations states:

> *To minimize the adverse effects of human activities on the other components of the Resource Protection Area, state waters, and aquatic life, a 100-foot buffer area of vegetation that is effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff shall be retained if present and established where it does not exist.*

Complying with the buffer area requirements means that the landowner would have to establish and revegetate, if necessary, the full 100-foot wide buffer area along all waterbodies designated as Resource Protection Areas (RPAs) by the local government.

One of the silvicultural best management practices (BMPs) applicable along all perennial streams is the streamside management zone (SMZ). The SMZ is similar to the CBPA buffer zone although it is

B. Stabilization of all ruts, skid trails, haul roads, and bare soil areas within the buffer area using water control structures, seeding, and other BMPs with appropriate fertilization, liming, seeding, and mulching practices. If appropriate, silt fencing, mulching and excelsior blankets should be used to stabilize critically eroding areas.

C. Revegetation of all disturbed areas including initial soil stabilization and overstory tree replacement as well as long term revegetation of all layers of the vegetation strata (overstory, understory, shrub, and groundcover). Use of locally grown native vegetation similar to the species removed or those indigenous to the area should be encouraged. Trees should be planted at the rate and size specified by the local government. Protective measures such as tree shelters should be used.

D. A maintenance schedule to evaluate the stabilization and revegetation procedure and ensure its effectiveness. This should stress keeping people out of the buffer area until the vegetation is established.

E. Cost of the stabilization and revegetation procedure.

The landowner will be notified in writing, after coordination and review by the local government and the DOF whether the stabilization and revegetation plan has been approved or denied, including recommendations for correcting any deficiencies in the proposed plan. Implementation should occur immediately upon approval of the stabilization and revegetation plan by the local government.

Many local government CBPA ordinances require replacement trees to be a minimum size of three and one-half inches caliper at the time of planting. However, planting trees this size may cause more disturbance than has already occurred. Also, smaller caliper trees planted at a greater ratio to those removed may have a greater chance for survival in these cases. Therefore, local governments may wish to waive or grant exceptions to the tree size and replacement ratio requirements in their CBPA ordinances and use the DOF recommended size and ratio in silvicultural situations.

The local government should require that a maintenance agreement be signed by the landowner to ensure the effectiveness of the stabilization and revegetation effort. This agreement should include provisions for keeping people and equipment out of the buffer area and for long-term establishment and/or re-establishment of vegetation in the buffer area.

A completion letter should be written to the landowner by the local government following notification by the DOF of successful site stabilization.

This two-part framework will allow efficient and effective site remediation to occur while allowing flexibility to work within the existing natural system.

12 Information Bulletin

Chesapeake Bay Local Assistance Department

April, 1993 Number 12

Agricultural Activities Within Resource Protection Areas

What agricultural activities do the Regulations allow in Resource Protection Areas? Are ponds used for agricultural purposes allowed in Resource Protection Areas?

Agricultural activities are not allowed by right in the buffer area component of Resource Protection Areas (RPAs). However, certain agricultural activities are allowed in other components of the RPA as long as they comply with all other state, federal, or local programs. Examples include prior converted and/or farmed wetlands where cropping is allowed to continue on nontidal wetlands that were drained and cropped prior to December 23, 1985. On these fields the buffer area is established at the edge of the field closest to the water.

Ponds used for agricultural purposes, as well as other agricultural activities, are not permitted in the buffer area. However, the buffer area can be modified in accordance with § 4.3.B.4 of the Regulations and agricultural activities may be conducted up to the edge of the modified buffer. The Department has also provided guidance that livestock grazing may be allowed in pastured buffer areas, provided that the buffer area performance criteria in § 4.3.B of the Regulations are maintained. Otherwise, any agricultural activity that does not qualify under one of the provisions listed below, including a pond, must receive an exception from the local government before it can be allowed in the unmodified portion of the buffer area.

Regulatory requirements:

- *Section 4.3.A of the Regulations prohibits development activities other than water-dependent facilities or redevelopment from occurring in the RPA.*

- *Section 4.3.B of the Regulations requires a 100-foot buffer area of vegetation effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff to be retained if present and established where it does not exist.*

- *Section 4.3.B.1 of the Regulations allows vegetation to be removed from the buffer area only to provide for certain activities, including access paths, general woodlot management, best management and shoreline stabilization practices.*

- *Section 4.3.B.4 allows the agricultural buffer area to be reduced to 50 feet if a best management practice approved by the local Soil and Water Conservation District Board is implemented on the adjacent land, and to 25 feet if a Soil and Water Quality Conservation Plan approved by the local Soil and Water Conservation District Board has been implemented on the adjacent land.*