STATE OF MARYLAND
Shore Erosion Task Force

FINAL REPORT
January 2000

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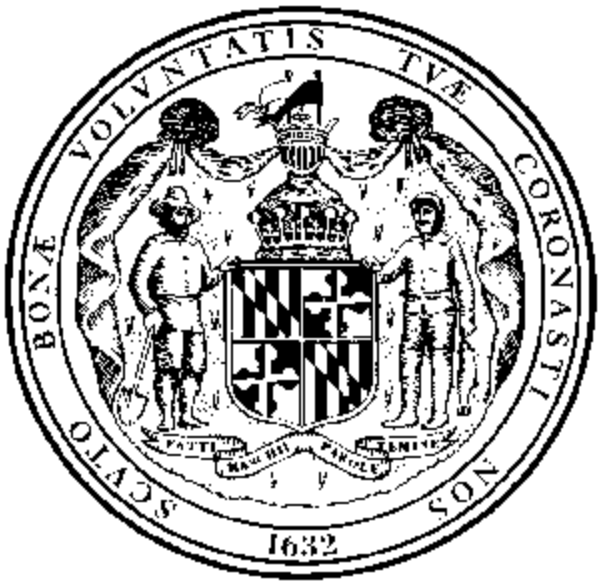

Parris N. Glendening, Governor
Kathleen Kennedy Townsend, Lt. Governor

FINAL REPORT
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For information or additional copies, please contact:

Maryland Department of Natural Resources
Shore Erosion Control
Tawes State Office Building, E1
580 Taylor Avenue
Annapolis, MD 21401
Toll Free: 877-620-8DNR
or:410-260-8531
Website:www.dnr.state.md.us

or

Maryland Department of Natural Resources
Coastal Zone Management Division
Tawes State Office Building, E2
580 Taylor Avenue
Annapolis, MD 21401
Toll Free: 877-620-8DNR
or:410-260-8730
Website:www.dnr.state.md.us

Cover: Offshore, segmented breakwater system with sand fill and marsh plantings. Project designed and constructed with funding from DNR's Shore Erosion Control program for the Town of Rock Hall, Kent County, Maryland. July, 1990. Photo: Shore Erosion Control Staff.

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Chairman Rudolph C. Cane, Delegate
Legislative District 37
House of Delegates

Richard F. Colburn, Senator
Legislative District 37
Maryland Senate

Verna E. Harrison, Assistant Secretary
Chesapeake Bay/Watershed Program
Maryland Department of Natural Resources

Mary P. Marsh
Sierra Club Maryland Chapter

Gary Setzer, Administrator
Wetlands & Waterways Program
Maryland Department of the Environment

J. Court Stevenson, Ph.D.
Professor, Horn Point Laboratory
University of Maryland

Michael E. McCormick, Ph.D.
Research Professor of Civil Engineering
The Johns Hopkins University

William H. Street, Restoration Manager
Chesapeake Bay Foundation

Joseph G. Coyne, President
Dorchester County Resource Preservation & Development Corporation

Hagner R. Mister, Deputy Secretary
Maryland Department of Agriculture

Anthony P. Vajda, Chairperson
Save Our Shore Committee

Alternates who served, either full-time or part-time, on the Task Force are: Jenn Aiosa, Staff Scientist, Chesapeake Bay Foundation; Jeff Horan, Deputy Director, Forest, Wildlife & Heritage Service, Maryland Department of Natural Resources; Buddy Bowling, Special Assistant to the Secretary, Maryland Department of Agriculture; and Therese McAllister, Ph.D., the Johns Hopkins University .

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EXECUTIVE SUMMARY

Shoreline erosion is one of the most significant problems facing Maryland's diverse coastal environment. Approximately 31 percent of Maryland's 4,360 mile coastline, which encompasses the Chesapeake Bay, the Coastal Bays, and the Atlantic coast, is currently experiencing some degree of erosion. While the range and magnitude of erosion varies both within and among the State's physiographic regions, the problem affects all 16 coastal counties along the Chesapeake Bay and the Coastal Bays watersheds. Consequently, shore erosion poses a significant threat to property owners, the public, and the natural resources, both terrestrial and aquatic, of our State's coastal zone. For example:

- The State of Maryland loses approximately 260 acres of tidal shoreline to erosion each year, resulting in a loss of public and private property, historic and cultural sites, recreational beaches, productive farmland, and forested areas.

- Each year erosion carries approximately 5.7 million pounds of nitrogen and 4.2 million pounds of phosphorus into the Chesapeake Bay, significantly degrading water quality.

- Each year erosion contributes approximately 11 million cubic yards of sediment into the Chesapeake Bay, intensifying the need for navigational dredging and diminishing water quality due to increased turbidity.

- Accelerating rates of sea level rise combined with increased development along Maryland's coastline tend to prolong and exacerbate shore erosion problems.

The State's involvement in shore erosion matters has a lengthy history, beginning in 1929 with the establishment of a Waterfront Commission to "recommend plans and policies for protection of waterfronts from erosion." In 1964, the State established the Shore Erosion Control Program, an independent agency whose sole mission was to conduct an expanded educational and operational program to control shore erosion. Today, numerous public and private organizations work to control shore erosion in Maryland. However, involvement among organizations varies significantly with respect to agency mandates, jurisdictional boundaries, and level of activity. Because the activities of these organizations are not coordinated through a comprehensive shore erosion control plan, response efforts suffer from fragmentation, duplication of effort, poor cost-effectiveness, and an inability to tailor activities to regional needs.

In response to citizen concerns over the State's capacity to control shoreline erosion, the Maryland General Assembly passed Resolution 13 during the 1999 legislative session, requesting that the Governor establish a Shore Erosion Task Force to: (1) identify shore erosion needs by county, (2) clarify local, State, and federal roles, (3) establish five and ten year shore erosion control plans, and (4) review contributing factors to shore erosion. With staff support from the Maryland Department of Natural Resources, Task Force efforts began in

August 1999, upon appointment of its membership by Governor Parris N. Glendening.

The Task Force concludes that shore erosion is one of the most significant problems facing Maryland's diverse coastal environment. The Task Force also concludes that, despite interest and involvement by numerous local, state, federal, and private parties, Maryland lacks the institutional, organizational, and fiscal resources to adequately respond to shore erosion. Therefore, pursuant to its mandate under Resolution 13, the Shore Erosion Task Force identified the need to address the following nine shore erosion issues:

1. immediate response capacity
2. regional shore erosion control strategies
3. project review and implementation criteria
4. cooperative management and implementation
5. standards and practices
6. utilization of available dredged materials
7. public outreach
8. information and data needs
9. long-term funding needs and resources

Based on the examination of these issues, together with a synthesis of public comments solicited through six regional meetings, the Shore Erosion Task Force recommends that Maryland take the necessary steps to implement the following nine recommendations.

Recommendations

- Establish an immediate response capability to provide the necessary planning and technical means to initiate development of a Comprehensive Shore Erosion Control Plan; emergency assistance for critical shore erosion control needs; and, interim financial assistance for structural shore erosion control measures.

- Identify and analyze areas subject to shore erosion, sea level rise, and environmental sensitivity to prioritize and target shore protection activities through the establishment of regional shore erosion control strategies.

- Develop project review and selection criteria to guide the implementation of regional shore erosion control strategies.

- Improve coordination of shore protection activities among various entities and individuals in order to encourage the implementation of cooperative regional projects.

- Conduct technical evaluations of new shore protection products and methods, evaluate the need for minimum engineering standards, and review industry practices.

- Encourage the beneficial use of dredged materials in both individual and regional scale projects.
- Conduct public outreach on technical matters, funding resources, and environmental issues related to shore erosion control.

- Pursue projects to fill identified data and information needs to support the development of a Comprehensive Shore Erosion Control Plan.

- Identify overall funding needs and potential funding resources, and develop a financial strategy to implement a Comprehensive Shore Erosion Control Plan.

These recommendations, along with their key elements, represent a broad spectrum of solutions to the issues identified by the Task Force and form the framework of a Comprehensive Shore Erosion Control Plan for the State of Maryland. Furthermore, the recommendations account for regional variations in shore erosion needs and foster the cooperative relationships necessary to make efficient and effective decisions.

Recognizing that all of these activities cannot be implemented effectively in isolation from one another, the Task Force recommends that (1) each recommendation be implemented as part of a broader Comprehensive Shore Erosion Control Plan, and (2) the State establish an immediate response capability for a period of two years while the plan is developed.

The development of a Comprehensive Shore Erosion Control Plan for Maryland is a substantial endeavor that will take commitments of time and financial resources. However, the Task Force firmly believes that such a plan is imperative, and, that it is a need that only the State of Maryland can fulfill, a conclusion also reached by the U.S. Army Corps of Engineers Chesapeake Bay Shoreline Erosion Study. The Task Force estimates that completing the Comprehensive Shore Erosion Control Plan and establishing an immediate response capability will require approximately $2.6 million over the next three fiscal years.

Commitment on the part of the State, along with activities of numerous other public, private, and non-profit entities, has advanced our understanding of the scientific aspects of shore erosion and diminished the degree of its impact. However, continued commitment, guided by the recommendations described in this report, is essential to the State's ability to respond adequately to shore erosion.

In light of the tremendous benefits and values that Maryland's shoreline imparts to the environment, economy, and culture of the State's vital coastal region, the development of a Comprehensive Shore Erosion Control Plan not only is a prudent investment, it is long overdue as well.

INTRODUCTION

In response to citizen concerns over the State's capacity to control shoreline erosion, the Maryland General Assembly passed Resolution 13 during the 1999 legislative session requesting that the Governor establish a Shore Erosion Task Force (herein "Task Force") representing state and local government, the scientific community, and citizens at large. The Resolution noted that because the State lacked a comprehensive shore erosion action plan, the Task Force should, among other things, identify shore erosion needs by county, clarify local, state, and federal roles, establish five and ten year shore erosion control plans, and review contributing factors to shore erosion.

With Resolution-mandated staff support from the Maryland Department of Natural Resources, Task Force efforts began in August 1999, upon appointment of its membership by Governor Parris N. Glendening. This report presents the findings of that Task Force effort. The report is divided into five sections:

Section One (Introduction) describes the environmental and institutional context of shore erosion in Maryland, including a summary of the genesis of Resolution 13;

Section Two (Implementing Maryland Resolution 13) describes how the Task Force was organized to fulfill its mandate and involve the public in its work;

Section Three (Issues and Recommendations) presents nine recommendations designed to address erosion issues and provide a broad spectrum of solutions, as prescribed in Resolution 13;

Section Four (Implementation Strategy) describes an organizational, institutional, and fiscal strategy to implement these recommendations as part of a statewide Comprehensive Shore Erosion Control Plan; and

Section Five (Conclusion) summarizes the most important Task Force findings.

A Reference Section and Appendix are attached to the body of this report. The Reference Section includes a listing of materials utilized in the production of this report, and a list of the major studies and publications regarding shore erosion in the State of Maryland. The Appendix presents public comments collected as part of the Task Force effort, as well as information provided to the Task Force by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

Shore Erosion in Maryland

The Task Force concludes that shore erosion is one of the most significant problems facing Maryland's diverse coastal environment. With a very high ratio of coastline to total area, the cliffs, bluffs, barrier beaches, wetlands, and sandy beaches that make up the Maryland shoreline are a vital part of the State's environment, culture, and economy. Yet studies estimate that 31 percent of Maryland's 4,360 miles of tidal shoreline currently experience some degree of erosion, affecting all 16 coastal counties along the Chesapeake Bay and Coastal Bays watersheds (See Table 1).

Table 1: Summary of Erosion Rate by County

COUNTY	EROSION RATE 0 - 2 ft/year	EROSION RATE 2 - 4 ft/year (miles)	EROSION RATE > 4 ft/year (miles)	TOTAL ERODING SHORELINE (miles)	TOTAL COUNTY SHORELINE (miles)
WESTERN					
Anne Arundel	78	18	11	107 (25%)	432
Baltimore	34	10	5	49 (23%)	209
Calvert	45	9	4	58 (41%)	143
Charles	44	11	1	56 (31%)	183
Harford	30	11	5	46 (33%)	140
Prince Georges	18	1	0	19 (43%)	44
St. Mary's	61	9	17	87 (29%)	297
SUBTOTAL	**310**	**69**	**43**	**422 (29%)**	**1,448**
EASTERN					
Caroline	9	1	0	10 (15%)	66
Cecil	39	5	0	44 (22%)	200
Dorchester	186	46	36	268 (54%)	498
Kent	64	12	2	78 (29%)	268
Queen Anne's	62	20	13	95 (29%)	323
Somerset	117	24	14	155 (25%)	619
Talbot	91	25	23	139 (31%)	442
Wicomico	13	6	1	20 (22%)	89
Worcester	74	26	10	110 (27%)	407
SUBTOTAL	**655**	**165**	**99**	**919 (32%)**	**2,912**
TOTAL	**965**	**234**	**142**	**1,341**	**4,360**

(Source: U.S. Army Corps of Engineers, 1990)

Although erosion is a natural process, it can create significant problems for property owners,

businesses, and the public, especially when inappropriate planning and design activities either increase natural erosion rates or compound the impact of natural erosion processes. These problems have long been recognized by the State. The Maryland Geological Survey (MGS) first began to quantify the problem in 1914, documenting major reductions in the sizes of Sharps, James, and Tilghman Islands (Singewald *et al*., 1949). Today, Sharps Island, originally 438 acres, is gone; James Island has shrunk from 976 acres to 92 acres; and erosion has reduced Tilghman Island from 2,015 acres to 1,302 acres.

In 1949, MGS conducted the first comprehensive survey of coastal erosion in Maryland and concluded that over 90 years the State suffered a net loss of 24,712 acres just from islands in the Chesapeake Bay (Singewald *et al*., 1949). Another MGS study, completed in 1975, calculated erosion along approximately 1,600 miles of Chesapeake Bay (and tributary) shoreline and found that approximately 84% of the shoreline measured was eroding (MGS, 1975).

Today, MGS is updating and revising the historical erosion rate maps produced in 1975 to support research and management in areas such as nonpoint source pollution, buffer areas of critical concern, and threats to life and property in coastal areas prone to flooding, storms, and hurricanes (Hennessee *et al.*, 1997). Clearly, such data are critical to the effectiveness of any comprehensive shoreline erosion control plan.

Environmental Context

The entire length of natural shoreline within Maryland's tidal zone consists of unconsolidated sands, silts, and clays. This geology contrasts, for example, with the hard rock shores characteristic of much of New England. Consequently, it is relatively easy for water to erode the unconsolidated sediments in Maryland's coastal plain. Apart from this generalization, however, it is important to realize that the challenges posed by shoreline erosion in Maryland reflect the unique combination of natural and man-made conditions affecting a particular shoreline region. Natural conditions include weather, soil composition, topography, bathymetry (water depth), fetch (the distance across water affected by wind and, hence, wave energy), and surface water and groundwater conditions. Shores consisting of very fine or unconsolidated silts and clays, or lighter organic materials (such as marshes) are particularly at risk, especially when exacerbated by unfavorable weather, wave energy, and soil drainage conditions.

Anthropogenic factors affecting shore erosion include: surface water and ground water usage, land use, and shoreline reinforcement activities. Buildings, roads, and other infrastructure not constructed with short- or long-term erosion control objectives in mind can increase erosion (and reduce their life span, as well as increase operation and maintenance costs) by loosening soil and altering drainage patterns. One man-made source of shoreline erosion is the very structures erected to prevent erosion. Poorly designed, located, or constructed shore erosion control projects can increase erosion problems by removing the local source of sand that supplies adjacent

beaches, reducing the shore's natural ability to dampen wave action, or otherwise disrupting natural avenues for sediment distribution.

Sea level rise is another factor contributing to shore erosion in Maryland. Sea level rise contributes to erosion by influencing and exacerbating on-going coastal processes, making coastal areas ever more vulnerable to extreme events. For example, as sea level rises, storm surges and waves will extend further into the coastal zone, flooding homes, businesses, and roadways. Measurements in the Chesapeake Bay and Mid-Atlantic region show rates of sea level rise that are nearly double the global average; in Maryland a result probably due to substantial land subsidence due to post-glacial crustal movement, sediment loading, and tectonic activity. The potentially large effect of sea level rise on erosion rates thus merits careful consideration of this factor in any comprehensive shoreline erosion control plan.

Not surprisingly, the conditions and associated erosion problems described above vary widely across the State and even within particular counties and municipalities. Problems tend to be greatest where:

- sediments are unconsolidated
- fetch is greater than one mile
- upland areas generate significant runoff or saturated soils
- adjacent shorelines are hardened with protective structures.

Nevertheless, particular reaches of shoreline must be evaluated on an individual basis to determine the relative effects of each factor, as well as appropriate protection measures that account for potential adverse impacts to adjacent shorelines, the immediate nearshore zone, and the larger ecosystem.

Impacts of Shore Erosion

The costs associated with shoreline erosion include the direct loss of land and its economic, cultural, and ecological values and offsite impacts caused by increased sediment and nutrient loading to the State's water resources.

A primary motivation for shore erosion control is the threat to structures, utilities, and roads. Without appropriate measures, improvements such as houses, driveways, sewer pipes, or roads can be damaged or destroyed. Since Maryland's shorelines are 96 percent privately owned, these improvements are normally protected through private investment. However, unprotected land in susceptible areas also produces a range of economic and social costs born by the public. Such costs include:

- lower tax revenue from reduced property values
- capital budget expenses to repair or replace lost infrastructure
- loss of historic properties or cultural sites
- loss of recreational beaches

- loss of productive farmland and forest, the basis for a sustainable rural economy and culture.

Direct costs can go beyond damage from the loss of land. Shorelines form the ecotone or border area between the upland and water, regions with high species diversity and unique habitat. By definition, shoreline erosion affects these particularly sensitive and important natural resources. Such resources include sandy beaches, a rare resource in Maryland; naturally vegetated shoreline buffers that provide habitat and improve water quality; and tidal wetlands, which provide invaluable aquatic habitat and nursery areas for many species (including economically important fisheries), as well as water quality protection.

In addition to direct economic, environmental, and cultural impacts, shore erosion has important off-site impacts; the most obvious and pervasive being the deposition of sediment into the State's tidal waters. According to the U.S. Army Corps of Engineers, erosion from upland sources contributes approximately 11 million cubic yards of sediment into the Chesapeake Bay (Maryland and Virginia portions combined) per year (ACOE, 1990). In comparison, the amount of riverine sediment flowing into the Bay each year is estimated to be 4.3 million cubic yards. This translates into approximately 5.7 million pounds of nitrogen and 4.2 million pounds of phosphorus introduced into the waters of the Chesapeake Bay each year because of shore erosion (260 acres eroded/year, averaging 22,000 lbs/acre N and 16,000 lbs/acre P).

This sediment degrades water quality and aquatic resources by increasing turbidity, which blocks sunlight needed for submerged plant growth and impairs visibility for sight-feeding fish. Sediment that remains suspended in the water column clogs the gills of aquatic organisms, which is particularly dangerous to the survival of very young and juvenile fish. Additional impacts follow as eroded sediment and debris drop out of the water column and are deposited on the bottom. These impacts include smothered oyster bars and submerged aquatic vegetation beds, increased dredging costs, and impaired commercial and recreational navigation. Sediment also releases nutrients into the water, thereby robbing water of dissolved oxygen essential to other aquatic life by accelerating the growth and decay of algae.

Approaches to control shore erosion are commonly divided into the categories of "structural" and "non-structural." Structural shore erosion control methods are best defined as those applicable to higher rates of erosion, employing principally traditional methods of shoreline stabilization. In most cases, these projects result in barrier type structures and the "hardening" of the shoreline. Within this category are steel bulkheads, timber bulkheads, concrete walls, stone masonry walls, stone revetments, stone reinforcement, stone breakwaters, jetties and groins. Non-structural shore erosion control projects are those that use bioengineering to create protective vegetative buffers. Non-structural projects along tidal shorelines are usually accomplished by placing clean sand fill in the intertidal zone and stabilizing it with tidal marsh grasses. Placement of some stone may also be necessary to protect the newly created marsh.

Costs for generally used erosion control practices average between $125/foot for non-structural

approaches and $350/foot for structural solutions. While the cost of erosion control practices are high, the price of inaction is significantly higher. State sponsored shore erosion control projects (structural and non-structural) in the Chesapeake Bay watershed from 1985 to1999 are estimated to have prevented the annual release of 196,700 cubic yards of sediment, 231,400 lbs of nitrogen, and 153,900 lbs of phosphorus. The U.S. Army Corps of Engineers estimates that for every dollar spent to control erosion, as much as $1.75 is returned to the economy in the form of improvements to resources, including submerged aquatic vegetation, fish, benthic organisms, shellfish, and wetland habitat (ACOE, 1990).

Institutional Context and the Call for Maryland Resolution 13

As mentioned previously, shore erosion in Maryland has long been recognized by the State as a significant problem. The first report commissioned to address shore erosion was presented by Governor Albert C. Ritchie to the General Assembly in 1933. Apart from an improved understanding of the extent of the shore erosion problem, little statewide progress was made until 1961, when a special committee appointed by Governor Millard Tawes recommended that "an independent agency be established and charged solely with conducting an expanded educational and operational program on shore erosion and its control." Subsequently, a Shore Erosion Control Program (SEC) was authorized in 1964 and a state financial assistance program for protective projects funded in 1967. The current incarnation of the SEC was initiated in 1970 through major amendments to the existing program that provided 25 year, interest free loans for the establishment of shore erosion control projects.

Due to budget constraints, however, from 1992 to 1996 the Department of Natural Resources gradually discontinued financial assistance to property owners to build structural erosion controls (e.g., bulkheads, concrete walls, stone revetments, jetties, breakwaters), instead favoring the use of matching grants for non-structural projects (i.e., combinations of soils, gravel, stone, etc. with biodegradable protective materials and plants). From 1971 to 1996, the SEC helped fund 535 structural projects while, since 1985 the program has completed 330 non-structural projects. Approximately 1,100 property owners, along 70 miles of eroding shoreline, have received project management, financial, and technical assistance through the SEC program.

DNR's site-by-site approach has proceeded along side of shore erosion activities implemented by a host of federal, state, local, and non-governmental interests. The U.S. Army Corps of Engineers conducts shore erosion control (including substantial research) on an *ad hoc* basis in conjunction with its responsibilities to maintain commercial harbors and navigational channels, and construct and operate civil works projects. The National Oceanic and Atmospheric Administration (NOAA) administers the Coastal Zone Management Act through state coastal management programs, which include efforts to mitigate coastal hazards (including erosion). The U.S. Environmental Protection Agency and NOAA have partially funded the SEC through the Chesapeake Bay Implementation Grant.

In addition to the SEC, numerous other State programs in the Departments of Natural Resources and Environment also conduct various regulatory, conservation, planning, and research activities either directly or indirectly related to shoreline erosion control. Shore erosion control projects require both State and federal permits. The permit review process is coordinated among a myriad of State and federal agencies including the Maryland Department of the Environment, the Maryland Department of Natural Resources, the Maryland Historical Trust, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The process entertains both individual and regional projects, based on an individual application.

At the local level, Departments of Public Works, and Permits and Inspections conduct activities that address shoreline erosion issues, as do Soil Conservation Districts, and non-profit organizations, such as Maryland's Resource Conservation and Development Councils, the Chesapeake Bay Foundation, and the Chesapeake Bay Trust.

Clearly, without appropriate coordination, there is a potential for substantial inefficiency, conflicting (and overlapping) mandates, as well as duplication of effort associated with such an array of individual actors and activities. When coordinated effectively these same actors and activities represent an important opportunity for comprehensive, cost-effective management of Maryland's shore erosion problems. The value of a comprehensive plan to address shore erosion was documented in the *Chesapeake Bay Shoreline Erosion Study*, prepared by the U.S. Army Corps of Engineers in 1990. However, the development of such a plan was not pursued by the Corps, as it was deemed the responsibility of State government.

Maryland Resolution 13 provides the opportunity to meet this challenge by calling for a comprehensive, integrated approach to the environmental, organizational, and institutional problems affecting shoreline erosion.

IMPLEMENTING MARYLAND RESOLUTION 13

Resolution 13 reflects growing citizen concerns about an increasingly important problem. Key geographic regions of the State, particularly along the shores of Dorchester, Talbot, Calvert, and St. Mary's Counties, remain subject to severe erosion problems, while citizens continue to express concern over the vanishing islands of the Chesapeake Bay. In addition, damage from Hurricane Fran (1996), a severe Nor'easter (1998), and Hurricanes Dennis and Floyd (1999) have highlighted the shoreline's vulnerability to erosion hazards. And from an organizational and institutional perspective, the Resolution reflects:

> (1) the need to begin advanced planning for relative sea level rise,
>
> (2) the reduced capacity by the Department of Natural Resource's to fund structural shore erosion protection projects (starting in 1997), and
>
> (3) a renewed interest by the U.S. Army Corps of Engineers in shoreline erosion and environmental restoration.

In response to these factors, the Resolution was introduced in the February 1999 legislative session. After favorable votes by the House Committee on Environmental Matters and the Senate Committee on Economic and Environmental Affairs, Resolution 13 was signed on May 27, 1999 by the Speaker of the House and the President of the Senate.

The purpose of the Resolution was to create a Task Force appointed by the Governor to investigate shore erosion in Maryland, its causes and effects, effective solutions, available resources, and recommend a comprehensive plan of action. Governor Parris N. Glendening appointed the members of the Task Force on August 25, 1999 which, in accordance with the Resolution, included membership from State government, the Maryland Senate and House of Delegates, the University of Maryland Center for Environmental and Estuarine Studies, non-profit organizations, as well as individuals with interest or experience with shore erosion issues.

In framing the Task Force mission, Resolution 13 noted that (1) the shorelines of the Chesapeake Bay are subject to high level wind and water erosion, (2) Maryland loses approximately 260 acres of land per year to erosion, (3) citizens have expressed the desire for ongoing intervention to prevent shore erosion and clarify government roles, and (4) shore erosion control is essential to protecting the economy and environment, ensuring safety, and maintaining quality of life and economic well being.

Having provided this background on the shore erosion problem in Maryland, Resolution 13 charged the Task Force with identifying shore erosion needs by County, reviewing factors that contribute to shore erosion, providing a broad spectrum of solutions, clarifying government roles, recommending a comprehensive action plan, establishing five and ten

year plans with target dates and review, and reporting its findings to the Governor, Senate, and House of Delegates.

With these duties in mind, the Task Force met four times to develop recommendations. The first meeting focused on discussing the Task Force charge, reviewing a briefing document that DNR staff had prepared to assist the Task Force in responding to its duties, and identifying the issues that needed to be addressed. During the second meeting, the Task Force elaborated on specific details regarding the issues tentatively identified at the previous meeting and began identifying alternative solutions. Upon further discussion of alternative solutions during the third meeting, the Task Force formulated preliminary recommendations and a public meeting strategy.

After the third Task Force meeting, DNR staff began a series of six widely publicized public meetings to explain the Resolution, present draft recommendations, and solicit public comments. After the last public meetings were adjourned on November 22, 1999, staff collected and compiled both verbal and written comments on the Task Force effort and forwarded this information to Task Force members in preparation of their final meeting on December 10, 1999. A summary of the public comments is contained in the Appendix of this report. During this final meeting, the Task Force reviewed public comments and draft language for the final Task Force report.

Based on final Task Force recommendations, DNR staff prepared the present findings for distribution to the Governor, House of Delegates and Senate. What follows are the Task Force's specific recommendations, as well as its recommended strategy for their effective implementation.

ISSUES AND RECOMMENDATIONS

Issue One: Immediate Response Capability

The Task Force recommends establishing an immediate response capability for shore erosion protection in Maryland. Consistent with the implementation strategy described in Section Four, this capability would provide for the activities and resources needed to meet two critical needs over the next two years. First, resources are needed to carry out the remaining Task Force recommendations as part of a statewide Comprehensive Shore Erosion Control Plan. Second, changes to current State shore erosion programs are needed to provide interim technical and financial assistance while the plan is being developed. These interim changes entail two phases: (1) short-term reactivation of existing structural control funding, which can be accomplished immediately without altering existing statutes and regulations, and (2) subsequent modifications to funding mechanisms (as soon as existing authorities can be amended), as well as other changes to improve current programs during a two-year interim period while the comprehensive plan is being developed.

During the development of the comprehensive plan, these interim changes will be evaluated and modified to ensure compatibility with the plan's long-term strategy to deliver financial assistance to parties to respond to shore erosion control needs.

Findings:

Technical, Planning and Operational Needs

Financial resources will be needed to initiate and implement the recommendations of the Task Force presented in this report. As discussed in more detail in Section Four, these recommendations must be implemented as part of a Comprehensive Shore Erosion Control Plan for the State of Maryland to prevent further fragmentation, duplication of effort, and other inefficiencies in shore protection activities. Therefore, the State's ability to pursue the technical and operational components of this planning process is highly contingent on the immediate allocation of financial support.

Emergency Assistance Mechanism

The State has no emergency response program to address critical shore erosion hazards on private properties or provide immediate protection of threatened public infrastructure. Maryland's coastline is highly vulnerable to storm events such as nor'easters, tropical storms and hurricanes, particularly storms lasting 24 to 48 hours with high winds and storm surges occurring over several high tide cycles. Protective beaches and marshes are inundated and upland areas receive the brunt of the destructive wave energy, resulting in damage to aging shoreline stabilization projects and severe erosion to land masses. Although these events are not frequent, given the highly developed character of Maryland's coastal areas, the potential for catastrophic damage is always present.

The existing response mechanism is limited to providing technical assistance to affected public and private property owners and the exchange of information with Federal and State emergency management agencies to determine the potential for Federal disaster funds. No institutional mechanism or funding source exists to mitigate storm damage to private or public property or provide immediate protection for public infrastructure.

Federal Project Match Requirements

The U.S. Army Corps of Engineers is the primary federal agency responsible for shore erosion control. Corps activities are conducted either under specific Congressional authority, which usually involves a large study area and significant financial expenditures, or through one of several Continuing Authorities programs. A substantial number of studies and large shore erosion control projects have been accomplished in Maryland under various Corps authorities. These efforts include the Chesapeake Bay Shore Erosion Study (1990) and the construction of the Ocean City Beach Nourishment Project (1991). Corps involvement in shore erosion control is dependent on requests by local or state sponsors and the availability of funds for cost-share purposes. To date, the State has not optimized the use of Federal funds to construct shore erosion control projects because no coordinating entity is available to actively pursue projects. In addition, state cost-share funds often are not available for the requisite match to authorize Federal expenditures.

Shore Erosion Control Program

Despite a need for public assistance, current financial assistance programs for shore erosion control projects are inadequate. Due to a major reorganization of the Department of Natural Resources, budgetary constraints limited the departments's structural erosion control program to technical assistance for private and public property owners in Fiscal Year (FY)1997. Since stopping the assistance provided for structural projects, the state program has focused on non-structural projects using bio-engineering methods for shoreline restoration, with a corresponding reduction in project funding and personnel. Non-structural shore erosion control projects are generally suitable in areas experiencing less than 2 feet of erosion per year. Today, there are approximately 376 miles of shoreline with erosion rates between 2 and 16 feet per year. During the past four years, the Department of Natural Resources has been unable to provide financial assistance to control shore erosion along these severe erosional areas where some form of structural shore erosion control practice is the only viable solution.

Existing Authorities

Providing immediate or emergency assistance to mitigate shoreline erosion problems implies having effective laws, regulations, policies and procedures streamlined and focused for that purpose. Implementing the recommended interim shore erosion control activities may require modification of

existing statutory authorities. Therefore, existing authorities at the federal, state and local level should be reviewed and modified as needed to facilitate effective and consistent short-term implementation of shore erosion control efforts.

Recommendation One: Establish an immediate response capability to provide the necessary planning and technical means to initiate development of a Comprehensive Shore Erosion Control Plan; emergency assistance for critical shore erosion control needs; and, interim financial assistance for structural shore erosion control measures.

The following key elements have been identified as critical to establishing an immediate response capability that allows the State to develop a Comprehensive Shore Erosion Control Plan and respond to shore erosion control needs during an interim two year period. The Task Force recognizes that the primary elements of the immediate response capability can only be initiated after funding commitments are made and carried out over the next two years.

Key Elements:

1.1 Initiate the following immediate actions by April 2000:

A. Initiate the shoreline data mapping effort that would combine shoreline erosion, sea level rise, and environmentally sensitive area information.

B. Prepare the scope of work, procure services, issue contracts, and complete the predictive model for sea level rise impacts.

C. Hire staff to support the planning, engineering and scientific efforts of DNR.

D. Establish a fund to receive emergency assistance and Federal project match opportunities and devise criteria that would trigger the disbursement of emergency funding.

E. Actively pursue viable projects conducted by the U.S. Army Corps of Engineers which would leverage Federal funds for shore erosion control in Maryland, taking into consideration projects identified in the U.S. Army Corps of Engineers *Chesapeake Bay Shoreline Erosion Study*.

F. Reinstate the structural project component of the Shore Erosion Control Program to establish an immediate capacity to provide financial assistance for structural shore protection projects to local governments and special taxing districts, established for communities or groups of property owners. The intent of this recommendation is to provide financial assistance for shore erosion control measures in areas where non-structural techniques alone are infeasible and would be ineffective. Projects, however, may consist of a combination of non-structural and structural techniques, as in off-shore breakwater systems.

1.2 While immediate actions are being taken under existing law, evaluate and modify existing authorities to improve the delivery of financial assistance for shore protection projects during the remaining two-year period. Such changes also will be considered as the foundation for the long-term financial assistance mechanism for shore protection projects on private properties (See Recommendation Three). Some of the authorities requiring examination and modification are listed below.

A. *Priority System.* The priority system for providing financial assistance as prescribed in the Shore Erosion Control Law (Natural Resources Article, Section 8-1001 through 8-1008) needs to be enhanced to encompass not only the physical factors encountered at the site, but also environmental concerns and socio-economic issues.

B. *Low Interest vs. Interest-free Loans*. The existing Shore Erosion Control Law provides financial assistance to public and private entities in the form of interest-free loans repaid over a maximum of 25 years. Legislation should authorize the State to issue loans to private property owners, charging simple interest ranging from 1% to 4%, while retaining the existing statute's interest-free provision.

C. *Interest Rates Based on Financial Need*. The State needs statutory authority to vary the interest rate for loans to private property owners according to financial needs. Regulations should establish the criteria guiding the specific assignment of interest rates.

D. *Loans vs. Grants*. The current Shore Erosion Control Law allows matching grants only for non-structural projects. Matching grants should be available for structural projects, applicable to local government requests for assistance where Federal funds can be leveraged.

1.3 Use departmental staff and resources as the foundation for an immediate response capability. The Task Force recognizes that with its coastal oriented programs, the Department of Natural Resources (DNR) has taken the lead in shore erosion control

activities in Maryland. At the request of the Task Force, DNR has initiated several actions to support the establishment of an immediate response capability, which include:

A. Identifying staff that could serve in or support the activities of the various groups formed under the proposed Implementation Strategy.

B. Obtaining a NOAA Coastal Services Center Fellow to support comprehensive planning efforts between August 2000 and July 2002.

C. Determining staff and funding needs to implement an immediate response capability.

D. Initiating a review of applicable laws and regulations requiring potential modifications to support the Task Force recommendations.

E. Initiating discussions regarding the capabilities, methodology, and cost of producing shoreline data maps and sea level rise predictive models.

1.4 Actively pursue funding commitments for both planning and project implementation to be appropriated over three years, as follows: FY-2000, $732,000; FY-2001, $1,069,000; and FY-2002, $826,500. These funds could be appropriated from a combination of general funds, general obligation bonds, and State special funds (see Implementation Strategy, Preliminary Funding Requirements).

Issue Two: Regional Shore Erosion Control Strategies

Approximately 31% of Maryland's 4,360 mile coastline is currently experiencing some degree of erosion. Given the diversity of the steep cliffs, bluffs, barrier beaches, wetlands, marshes, and sandy beaches that together comprise the State's coastline, the rate of erosion and subsequent environmental and economic impacts vary significantly between geographic regions of the State. In addition, options for shore protection and project viability also varies from location to location and depends primarily on the physical site characteristics (i.e., fetch, bank type) of a given site. To date, resources have forced the State to utilize a site-by-site approach to shore erosion control, lacking as it does the capacity both to evaluate comprehensively regional shore erosion control needs and develop regional shore protection priorities or strategies.

Findings:

Shore Erosion Impacts

Erosion poses a significant threat to Maryland's coastal environment by placing land, communities, and valuable habitat at risk. Primary impacts of erosion include land loss, threats to dwellings and public infrastructure, loss of historic and cultural sites, loss of wetlands and beaches, degradation of aquatic and terrestrial habitats, diminished water quality, and an increased need for navigational dredging. The State's involvement in shore erosion control is based on the need to mitigate such adverse impacts. Assessing the range, magnitude, and impacts of shore erosion is the first step towards developing shore erosion control strategies and will enable the State to begin evaluating regional shore erosion needs. Research conducted by the Maryland Geological Survey and the U.S. Army Corps of Engineers provides valuable and useful information on both historic and current erosion trends along the State's coastline. However, this research needs to be compiled, updated, and evaluated to establish regional shore erosion control needs and priorities in the State of Maryland.

Regional Differences

Given the diversity of Maryland's coastal environment, it is not surprising that the range and magnitude of erosion along the coastline varies from region to region. Geology, topography, bathymetry, fetch, surface/ground water conditions, man-made features, sea level rise, and the frequency and intensity of storm events, all contribute to the specific amount of erosion over time at any given location. Historic shoreline position maps, prepared by the Maryland Geological Survey, provide a graphic representation of shoreline erosion on a geographic basis for the State of Maryland. State planners can use these maps in combination with other resources to assess state-wide and regional shore erosion trends.

Sea Level Rise

Sea level rise is a significant factor contributing to shoreline erosion in the State of Maryland. Tide gauge measurements in the Chesapeake Bay and the Mid-Atlantic indicate that the average rate of sea level rise along Maryland's coastline has been 3-4 mm/yr, or approximately one foot per century. What is alarming is that these rates, which are nearly twice those of the global average, are expected to accelerate in the future due to global warming. Scientists predict that sea level may rise as much as two to three feet along Maryland's shores by the year 2100. One of the most severe impacts of sea level rise along Maryland's coastline is and will continue to be coastal erosion. Sea level rise influences and exacerbates on-going coastal processes, making coastal areas more vulnerable to both chronic (on-going) erosion and episodic events (e.g., Nor'easters, tropical storms, hurricanes). Therefore, consideration should be given to the vulnerability of specific coastal areas due to past, present and future trends in sea level rise.

Erosion as a natural coastal process

Discussions about shore erosion often focus on its detrimental impacts (e.g., loss of land, damage to infrastructure). However, it is important to remember that erosion is a process that occurs naturally in the coastal environment. Erosion is primarily driven by wind and wave action, which act together to transport sediment on, off, and along the shore (longshore drift). Material which has eroded from one site often is the source of sediment for another site within a drift sector. In addition, erosion benefits certain organisms by providing the proper type of substrate and carrying into the estuarine system, essential nutrients required by phytoplankton and aquatic plants. Although 31% of Maryland's shoreline may be eroding, it may not be environmentally beneficial or fiscally possible to control erosion in all locations. In fact, each region of the State contains areas where erosion of the shoreline is necessary to sustain long term sediment supplies and to allow for natural inland migration of the shoreline as sea level rises. Designating and preserving such areas will ensure the long-term existence of viable nearshore and aquatic habitats.

Environmentally sensitive areas

Shoreline erosion can significantly impact priority living resource areas and other environmentally sensitive areas, which provide valuable aquatic and terrestrial habitats. Losses from erosion of uplands, intertidal marshes, sandy beaches, dunes, and other naturally vegetated shoreline buffers substantially reduces valuable terrestrial and aquatic habitats. Over time, as increased amounts of sediments and nutrients enter the water column, water quality and, in turn, aquatic resources also are adversely impacted. Therefore the State should evaluate priority living resource areas and other environmentally sensitive areas as potential targets for shore protection and restoration.

Recommendation Two: Identify and analyze areas subject to shore erosion, sea level rise, and environmental sensitivity to prioritize and target shore protection activities through the establishment of regional shore erosion control strategies.

The elements of this recommendation focus on the need to gather and assess data to enhance the State's ability to identify, prioritize, and target areas for regional shore protection and restoration activities (e.g., technical and financial assistance). Prioritization should be based on: (1) the magnitude of erosion; (2) the environmental impact; (3) the impacts to public and private infrastructure; and (4) the potential impact of sea level rise. Evaluating trends in shore erosion, areas subject to sea level rise, and environmentally sensitive areas provides the information needed for a prioritization scheme that targets those shore erosion problems which, when addressed through the State program, provide the most benefits from a given level of funding. The elements of this recommendation lay out the steps of such a prioritization process, which ultimately will result in the development of regional shore erosion control strategies.

Key Elements:

2.1 Define regional planning units based on a combination of: (1) spatial boundaries; (2) jurisdictional boundaries; (3) physiographic characteristics; and (4) coastal sectors. Spatial boundaries include divisions such as the Coastal Bays, Western Shore, Lower Eastern Shore, Upper Eastern Shore, while jurisdictional boundaries are based, logically, along county boundary lines. Physiographic characteristics can be divided by shoreline type, such as coastal plain, wetlands and marshes, cliffs and bluffs, barrier islands, and inland bays, or by geographic reference (e.g., Chesapeake Bay, Coastal Bays, Atlantic Coast, tidal rivers). Coastal sectors include coastal circulation cells, comprised of individual drift sectors or specific reaches of shoreline, and are potentially the smallest unit envisioned for the purposes of regional planning efforts.

2.2 Identify and analyze areas subject to shore erosion, sea level rise, and environmental sensitivity, collectively.

A. Update historic erosion rate maps and quantify the range and magnitude of land loss on a regional geographic basis.

B. Identify priority living resource areas and other environmentally sensitive areas on a geographic basis.

C. Identify and analyze areas vulnerable to sea level rise, utilizing existing data and information on sea level rise (e.g., tide gauge data, historic erosion data,

wetland/marsh loss data). This exercise will require high-resolution topographic data to be acquired for specific coastal areas.

D. Overlay, synthesize and analyze data layers.

2.3 Prioritize shore protection and restoration activities. Prioritization should be based on: (1) the magnitude of erosion; (2) the environmental impact; (3) the impacts to public and private infrastructure; and (4) potential impact of sea level rise.

2.4 Develop regional strategies to direct implementation of shore erosion control activities. Strategies should include a range of solutions to address shore erosion issues within a given region, such as the designation of: (1) areas suitable for non-structural and structural shore protection and restoration activities; (2) areas to target for regional and cooperatively sponsored (e.g., federal, state, local) projects; (3) specific reaches of shoreline as natural shore erosion areas; (4) areas within county boundaries where erosion-based setbacks should be implemented; and (5) areas to target for land conservation practices through such programs as Greenways, Rural Legacy, Forest Legacy, Program Open Space, and the Conservation Reserve Enhancement Program.

2.5 Develop regional strategies that are both supportive and integrally linked with on-going or proposed Chesapeake and Coastal Bays enhancement efforts. For example, strategies could compliment habitat restoration goals by: (1) maximizing the beneficial use of dredged materials, (2) targeting areas for the growth of submerged aquatic vegetation, (3) identifying areas suitable for oyster reef construction, and (4) focusing shore erosion control efforts in areas with the greatest amount of suspended sediment.

Issue Three: Project Review and Implementation Criteria

There are two components to the development of regional shore erosion control strategies. The first, as outlined in Recommendation Two, is to gather and assess data for the purposes of identifying, prioritizing and targeting regional shore protection activities. The second is to establish the actual criteria to guide the review, selection and implementation of both private and publicly sponsored projects. There are numerous physical, environmental, social, and economic factors to consider when evaluating proposed shore protection activities. The establishment of criteria which balance such factors will provide the necessary guidance and framework to comprehensively review, select and implement a range of shore protection alternatives within a given region.

Findings:

Impact of Shore Protection Projects

Shore erosion control projects erected to prevent erosion at one location can, unfortunately, have an adverse impact on neighboring properties. Erosion is primarily driven by wind and wave action, which act together to transport sediment on, off, and along the shore (longshore drift). Sediment is therefore a by-product of erosion and as it is transported in both an offshore and longshore direction, it provides a vital sediment supply to adjacent shore areas. The installation of a shore erosion control project can remove the local source of sand and result in the starvation of beaches along adjacent stretches of shoreline. Similarly, erection of a shoreline structure perpendicular to the shore, such as a groin or jetty, can interrupt the movement of sand along the shore and may also "starve" adjacent beaches. The potential impacts of proposed projects to both neighboring properties, the immediate nearshore zone, and the regional ecosystem must be carefully considered.

Individual Project Review

Maryland's Tidal Wetlands Act, Section §16-201, gives property owners the right to protect their property from the effects of shore erosion on an individual basis. A property owner must obtain several permits and approvals at the federal, state and local level in order to implement a shore protection project. Commonly, individual applications are filed and projects are subsequently reviewed on a case-by-case basis. Permitting agencies primarily base the need for a shore protection project on the severity of the erosion problem at a specific location and give "preference" to the installation of non-structural measures.

The permit review process, coordinated among State and federal agencies, evaluates both individual and regional projects based on an individual application. While regional factors including the location of existing structures, wave climate, wind direction, fetch, and physical and biological

characteristics are taken into account during the permit review process, the lack of regional plans to guide the review process can result in a scattering of small and uncoordinated shore erosion control projects.

Financial and Technical Assistance

Implementation of shore erosion control projects along Maryland's coastline is often predicated on the availability of technical and financial assistance from federal and State sources. Since 1971, the Shore Erosion Control Program, operating under authority of Natural Resources Article, Section 8-1001 through 8-1008, of the Annotated Code of Maryland, has been the primary non-regulatory entity administering both technical and financial assistance for the design, construction, and administration of erosion control projects. The Shore Erosion Control Law establishes a priority system for providing public assistance. This priority system is based primarily on the rate of erosion and the amount of siltation occurring at a site and to a lesser extent on other factors such as the amount of public benefit derived from the project, land use, and the date of application. Additionally, the Law restricts the amount of financial assistance available to any single property owner, while authorizing groups of property owners to establish Shore Erosion Control Districts exempt from such loan limitations. Although, the activities of the Shore Erosion Control Program are currently limited (effective FY 1997) to providing technical assistance to property owners and financial assistance for non-structural projects, fund allocation remains tied to the priority system established under the Law. The allocation of financial assistance for protection projects is one of the most important issues regarding the State's shore erosion control program. Therefore, it is imperative that the State align any criteria for fund allocation with the development of regional shore erosion control strategies.

Recommendation Three: Develop project review and selection criteria to guide the implementation of regional shore erosion control strategies.

This recommendation focuses on the guidance necessary to implement effective regional shore erosion control strategies. Such guidance requires two sets of criteria. The first set guides the evaluation of publicly or privately initiated shore protection projects to ensure compatibility with regional shore erosion control objectives. These criteria should be incorporated into State and local regulatory review processes and may require modification of existing statutes and regulations. The second set of criteria relates specifically to the allocation of financial resources for the implementation of individual, joint, State, and co-sponsored shore protection projects.

Key Elements:

3.1 Develop project review criteria to ensure that a proposed project is compatible with the objectives established for a given physiographic region. Criteria should address new construction, reconstruction, repair, and maintenance of existing structures and include provisions to evaluate potential impacts of proposed projects on neighboring properties, the immediate nearshore zone, and the regional ecosystem.

A. Actively work with local governments to develop policies and procedures that incorporate criteria into land-use permitting processes. Mechanisms may include: (1) requiring the review of regional impacts from proposed shore erosion control projects; (2) implementing erosion-based setbacks; and (3) designating specific reaches of shoreline as natural shore erosion areas.

B. Evaluate and, where applicable, modify existing State statutes and/or regulations, including the Tidal Wetlands Act and the Critical Area Law to assure consistency with the criteria developed.

3.2 Develop tools and criteria to allocate financial resources and target implementation of shore erosion control projects at the regional level.

A. Current authorities, criteria and priority systems for fund allocation should be aligned with regional shore erosion control strategies.

B. Evaluate and amend interim measures (e.g., priority system, sliding interest rates, interest based financial need, loan program for structural controls), established under Recommendation One, to ensure compatibility with the long-term objectives of the Comprehensive Shore Erosion Control Plan.

Issue Four: Cooperative Management and Implementation

Numerous public and private organizations are involved in shore erosion matters. Involvement among organizations varies significantly with respect to agency mandates, jurisdictional boundaries, and level of activity, whether through regulation, technical assistance, or project implementation. Organizations also vary in their ability to support projects, either through staff or direct financial assistance. Agencies need to maintain existing working relationships and develop new partnerships among the various groups to ensure successful implementation of coastal projects.

Findings:

Site-by-site implementation

Currently shore erosion control projects are designed and constructed on a site-by-site basis without the benefit of a regional plan. Although environmental impacts, including the impact to adjacent properties, are considered during both the design and permit review process, off-site impacts can not always be avoided. Off-site impacts can be significant, and include increased erosion and loss of land along nearby shorelines. Site-by-site project implementation results in a fragmented approach to shore erosion management and does not provide the most effective or environmentally beneficial method of shoreline protection.

Cost effectiveness of large-scale and regional projects

Based on economies of scale, larger projects which encompass long, continuous stretches of shoreline are more cost-effective than several unconnected projects covering the same total distance. Costs of project design, site analysis, equipment mobilization, transportation, and project construction are lower for one larger site with one set of associated conditions compared to two or more smaller sites and sets of conditions. In addition, larger scale projects, which often are designed to reflect regional conditions, also reduce potential negative impacts to adjacent shorelines.

Cooperative inter-agency guidance and coordination

A wide variety of federal, state and local governmental agencies, as well as private contractors and landowners, may be involved with implementing a given project. A considerable amount of coordination exists already among governmental agencies in the review and issuance of permits. Unfortunately, project review by these different offices is not directed by plans that target resources and coordinate activities according to regional needs. The absence of regional plans leads to uncoordinated project planning and resource allocation. Opportunities exist for improved

coordination and consolidation of protection efforts which would increase the effectiveness of all programs involved in the process.

Recommendation Four: Improve coordination of shore protection activities among various entities and individuals in order to encourage the implementation of cooperative regional projects.

The following key elements will promote and encourage further cooperation, better communication, and improved distribution of information among all entities involved in shore erosion matters. These changes will improve project review and implementation by making efficient use of financial and technical expertise among federal, state and local governmental agencies.

Key Elements:

4.1 Develop regional strategies which promote implementation of large scale group projects through improved coordination among federal, state, and local governmental agencies.

A. Work with local governments to actively solicit implementation of group projects, especially in areas experiencing severe erosion.

4.2 In cooperation with ongoing efforts by the Chesapeake Bay and Coastal Bays Programs, provide clear guidance to the local governments and the public regarding shore erosion control procedures for project review and approval through print media, the Internet, and directories of pertinent governmental offices and contacts.

4.3 Improve interagency and inter-office coordination with regard to project and permit review and approval. Consolidate activities where feasible.

Issue Five: Standards and Practices

Shoreline protection projects are not subject to specific building code requirements. Minimum standards and specifications do not exist to direct their design and installation. Furthermore, new shoreline protection products and practices introduced into the marketplace are not consistently evaluated for technical efficacy. The development and availability of minimum construction standards, specifications, and information on new products and practices for shore protection need to be thoroughly analyzed. A considerable amount of research and reference data regarding shoreline protection has been conducted and produced by various government agencies.

Various groups have published shore erosion control design manuals, shore protection guidelines for waterfront property owners, contractors, and engineers, and numerous other studies. However, this information is neither systematic nor comprehensive in scope and tends to be technical in nature, difficult to understand, and not readily accessible to the public.

Findings:

Specific building code requirements, minimum standards and specifications

Most proposed shoreline protection projects in Maryland require various federal, state and local governmental permits and approvals. Although permitting agencies perform a general review of proposed erosion control practices, reviews are geared primarily towards navigational and environmental issues. Since minimum standards, specifications, and building code requirements do not exist for proposed shore protection projects, project review both lacks detailed, consistent assessment criteria to determine whether a proposal is technically sound and provides only minimum direction for project design and construction. In some cases, individual waterfront property owners predicate the installation of shoreline protection projects on the availability of low-cost materials and installation costs. Unfortunately, this approach can compromise the level of protection, limit project life expectancy, result in structural failure, and thus, increase environmental degradation.

The American Society of Civil Engineers (ASCE) is in the late stages of developing a national comprehensive standard for shore protection systems. The purpose of this standard is to provide guidance to shoreline property owners, design professionals, and government regulatory agencies, for the successful planning, design, construction, monitoring, and maintenance of shore protection systems. This standard, once completed, may be a critical tool in a Comprehensive Shore Erosion Control Plan for Maryland.

Technical Assistance

DNR's Shore Erosion Control Program is charged with providing technical assistance to waterfront property owners, contractors, engineers, and local government officials who request assistance with shoreline and streambank erosion problems. However, since resources are limited, it is not feasible for the SEC program to respond to all requests for technical assistance. Property owners also rely heavily on professionals, such as civil and coastal engineers and marine contractors, for appropriate designs and proper construction of shoreline protection projects. Competent and experienced engineers and contractors with a good understanding of coastal processes are capable of solving a given shoreline erosion problem. Finally, property owners may rely on the technical assistance provided by the Maryland Department of the Environment during the permit application review process.

With the variety and complexity of available methods, materials and products, the services of a professional engineer, with experience in estuarine and coastal processes may be needed. A competent engineer can determine the proper protection method and design effective solutions that account for a range of budgetary constraints and land use variables. In fact, most federal, state and local governments require professional and licenced engineers to design and certify structural erosion control projects.

New shore protection materials, products and methods

Shore erosion controls employ a variety of traditional and non-traditional materials and products. Available materials include: timber, steel, aluminum, plastics, concrete, stone, recycled materials, geo-textiles, sand, natural fibers, and vegetation. Available products include: creosote and copper, chromate, arsenate (CCA) treated timber, plastic lumber, geo-textile tubes, sand bags, filter fabrics, wire gabion cages, pre-cast concrete units, coconut fiber logs, stabilization blankets, and artificial seaweed. Careful consideration must be given in selecting traditional or innovative methods, materials, and products, because not all of these have been sufficiently tested in the marketplace and may be either incompatible when used together or not exchangeable for the same application. For example, non-structural vegetative erosion control techniques cannot be successfully employed along many shorelines on the Chesapeake Bay, because water depth, fetch, and wave climate dictate more substantial methods and materials. Also, some materials and products are not compatible and may chemically react to each other, resulting in corrosion and deterioration of materials, and possible structural failure.

New materials, products, and methods introduced into the marketplace need to be demonstrated, monitored, and evaluated over time to determine whether performance, structural integrity, and intended functional requirements warrant full-scale implementation.

Recommendation Five: Conduct technical evaluations of new shore protection products and methods, evaluate the need for minimum engineering standards, and review industry practices.

The key elements listed below should be carried out to implement this Task Force recommendation. These elements will provide the necessary tools and direction for waterfront property owners, designers, contractors, and local governments to properly implement effective shoreline protection projects.

Key Elements:

5.1 Enhance existing shore erosion control information by collecting, evaluating, and incorporating recent findings on shore protection products and methods, making information on alternatives more understandable and readily available to the public.

5.2 Designate the Department of Natural Resources, Shore Erosion Control Program as the primary agency to collect information, make evaluations, serve as the central public repository on all technical shoreline erosion matters, and provide mandated technical assistance.

5.3 Facilitate public accessability to information and provide direction to waterfront property owners, engineers, local governments, and contractors to improve the planning, design, and implementation of shore protection projects.

5.4 Consider the ASCE Standard For Shoreline Protection Systems, the U.S. Army Corps of Engineers' Shore Protection Manuals and studies, and the DNR Shore Erosion Control Program's current project standards and practices in developing the Comprehensive Shore Erosion Control Plan for Maryland.

5.5 Routinely collect information on new shore protection materials, products, and methods.

5.6 Consider requiring the pilot-testing of new shore protection materials, products, and methods on actual projects through a minimum three year monitoring and evaluation period to assess their technical sufficiency and potential environmental impacts.

5.7 Consider requiring that new shore protection materials and installation comply with the existing testing agencies, such as ASTM, ASHTO, ACI, and AISC, etc.

5.8 Encourage the construction of low cost, affordable projects where appropriate. Low cost shore erosion control should be an option available to property owners.

5.9 Examine the need and feasibility of a marine contractor's licensing and certification program to ensure working knowledge of coastal processes and sensitivity to environmental issues.

5.10 Discourage the construction of the least desirable structural shore erosion control practice (i.e., timber, steel and concrete bulkheads), limiting their use to those areas where: (1) deep water is present, (2) the waterway is constricted, (3) specific business applications are evident, or (4) municipal improvements are necessary.

Issue Six: Utilization of Available Dredged Materials

Maryland must increase its efforts to use materials dredged from its waterways for beneficial projects. Materials removed from navigation channels are a mixture of sand, clay, silt, and organic sediments. Traditionally these materials were labeled "spoil". Often, however, "clean" sediments that are not contaminated with toxic chemicals or heavy metals are derived from dredging projects and can be used as fill for construction projects. If compliant with strict environmental and engineering standards (determined during sediment testing and project design), dredged sediments used for shore protection projects may provide environmental and economic benefits to both dredging and shore erosion control activities.

Findings:

Ongoing Dredging Needs

Dredging activities are required for certain economic and recreational purposes. For example, the Port of Baltimore depends heavily on ongoing maintenance and, in some cases, improvement of navigation channels for large, ocean-going vessels. In addition to large shipping channels, smaller, non-federal channels provide safe passage to commercial fishing fleets, charter boats, and thousands of private recreational vessels that utilize Maryland's waters. Revenues generated through the use of these vessels add significantly to the State's economy. Over time, navigation channels fill with sediment which eventually must be removed to maintain useful channel depths. Maryland boaters also rely on channel maintenance to prevent vessel damage and provide access to docks, marinas, and other coastal facilities.

Costs of Disposal

The use of upland disposal sites is often constrained by single-site capacity limits and disposal costs. In order to receive approval for a dredging project, the local sponsor (usually the county) must identify an appropriate disposal site. Dredging contractors may place only small amounts of material in a landfill. However, most dredging projects require fill placement in an upland disposal site which is designed specifically to accept and promote de-watering of dredged materials. These sites require a permit by the Maryland Department of the Environment to ensure compliance with environmental laws. Special confined disposal facilities, such as Hart-Miller Island, also provide disposal opportunities for dredge materials. Still, developing, constructing, and maintaining this type of facility requires millions of dollars. Because of their high costs, therefore, the use of such facilities is reserved for contaminated materials.

Reducing Shore Protection Costs

Dredge materials can reduce the overall cost of some shore protection projects. Project costs can range from $50 to $500 per foot of shoreline, depending on the local site conditions and the type of solution and materials selected. Most shore protection projects require some amount of "fill" material to be placed at the project site either as part of a structural solution or an element of a non-structural solution. There are two primary reasons why utilizing locally dredged, uncontaminated materials may reduce the cost of acquiring fill material needed for shore erosion control projects. First, using materials from nearby dredging activities can reduce transportation costs. Second, the use of dredged materials eliminates the dredging contractor's need to locate and pay for disposal of the dredged materials.

Recommendation Six: Encourage the beneficial use of dredged materials in both individual and regional scale projects.

Stabilizing the shoreline through beneficial use projects may reduce the need for or frequency of dredging activities in a given area. Such projects can reduce the need to both dredge, as well as find disposal sites for uncontaminated dredged sediments. The key elements listed below will provide the basis for statewide coordination between dredging activities and shore erosion control, to the benefit of both of these important activities.

Key Elements:

6.1 Work with the U.S. Environmental Protection Agency's Chesapeake Bay Program and the Maryland Coastal Bays Program to develop an information database of projected and planned near shore dredging projects, containing suitable, uncontaminated dredged materials, for use by federal, state, local and private coastal planners and managers.

A. Provide access to the information database *via* DNR, the Maryland Department of the Environment, the Maryland Port Administration, the U.S. Army Corps of Engineers, the Chesapeake Bay Program, and the Coastal Bays Program websites.

6.2 Regional shore erosion control strategies should include provisions to encourage and promote the use of uncontaminated dredge material in shore protection projects, reducing the need to find project fill from other sources.

6.3 In cooperation with ongoing efforts by the Chesapeake Bay and Coastal Bays Programs, coordinate federal, state, local, and private dredging and shore erosion control efforts to reduce the cost and duration of both activities, as well as enhance their environmental benefits. The dredging database (described above) and project schedules established by regional strategies can enhance the efforts of dredging and shore erosion control managers by promoting the coordination of needs and resources.

Issue Seven: Public Outreach

The public is not well informed about the causes, effects, and remedies associated with shoreline erosion. Advances in technologies and research findings are not widely known or well understood by the general public. In addition, information regarding project design, approval, and implementation, including governmental contact numbers and addresses, are not readily available.

Findings:

Buffer Management and Land-Use Practices

The public lacks an adequate understanding of how buffer management practices can be used to retard shore erosion. Enhanced buffers along the shoreline stabilize soil along the land/water interface, reduce the strength and speed of water runoff, and trap sediment before it reaches a larger water body. Conversely, other land use practices, such as excess impervious surfaces, reductions in vegetative cover, and poor storm water management, exacerbate the extent and rate of shoreline erosion. The public should be aware of which land-use practices contribute to shore erosion and those practices that enhance natural shoreline protection.

Information Outreach

Information is not readily available to the public regarding shore erosion processes, control options, and environmental impacts. Although observers have documented coastal erosion and land loss in Maryland since the 1600's, changes in the coastline are not always apparent to the casual observer. And while people living near the coast are more aware that erosion is occurring, they may not understand its many causes or mitigation options. The State and its partners must improve the general information on shore erosion it provides to citizens, as well as the ways in which citizens contact appropriate agencies to initiate shore erosion control projects.

Technical information exchange

Individuals and groups urgently need improved technical information to assist with the design and installation of shore erosion control measures. The variety of factors which can affect the occurrence and extent of shore erosion, including soil type, bank height, fetch, currents, and boat traffic, vary not only according to location but also over time (both seasonally and from year to year) in the same location. To assist public officials in identifying problems and implementing solutions, citizens need to understand these locational differences. Therefore, sound technical assistance is critical to designing and constructing effective shore erosion control solutions.

Recommendation Seven: Conduct public outreach on technical matters, funding resources, and environmental issues related to shore erosion control.

Informing the public is critical to the effectiveness of any strategy to control shore erosion in Maryland. Given the range of shore erosion issues presented in this report, the public must be informed of the causes, effects, and remedies of shoreline erosion. The key elements listed below will provide landowners with the necessary tools to reduce, control, and remedy the loss of shoreline along Maryland's coast.

Key Elements:

7.1 Provide information regarding the benefits and importance of vegetated buffers in public and private development along the coastline.

A. Develop and make available information on vegetated buffers in print and digital format (*via* the Internet).

B. Organize and conduct workshops for landowners which describe the benefits of and parameters for installing functional vegetated buffers.

7.2 Provide general information on erosion issues and causes in Maryland.

A. Develop and make available information on erosion issues and causes, including the impact of sea level rise, in print and digital format (*via* the Internet).

7.3 Provide governmental contact and funding assistance information for initiating and implementing shore erosion control projects.

A. Develop and make available information on erosion control agency contacts and funding assistance information in print and digital format (*via* the Internet).

B. Provide guidance on coastal information and technical assistance to landowners through print media, digital format *(via* the Internet), and site visits.

C. Organize and conduct workshops which provide information on funding, governmental contacts, coastal information and technical assistance to both private and public landowners.

Issue Eight: Information And Data Needs

The collection and availability of pertinent data is essential to effective and efficient control of shore erosion in Maryland. While researchers have made significant progress towards understanding general coastal processes, much of this research points to additional questions or requires further refinement. By targeting the questions most important to program managers, researchers can better delineate the myriad cause and effect relationships surrounding particular shore erosion control factors and, hence, control practices. Therefore, only a strategic research and data collection agenda linked explicitly to the broader objectives of the comprehensive shore erosion control effort can generate the insights that planners and engineers need to implement the most appropriate protection projects.

Findings:

Boat Wakes

Boat wakes have been determined to increase shore erosion under certain conditions. Boat speed, distance between the traveling boat and shore, number of boat passes within a given time period, and water depth are some factors that affect erosion rates. The varying weights and the variety of combinations of such factors determine how boat wakes affect a given stretch of shoreline. Since current trends in boating activity in Maryland show a steady increase since 1980, the potential impact of boat wakes on shoreline integrity also will continue to increase. Additional information and analysis of existing data are needed to identify areas which are particularly susceptible to increased erosion due to boat wakes.

SAV and Shore Erosion

Submerged Aquatic Vegetation (SAV) is used regionally and nationally as an important indicator of aquatic system health. SAV benefits the aquatic ecosystem in many ways, including sediment trapping, protecting crab, fish and other species from predators, food, and nutrient uptake. In lower wave energy areas, SAV may provide some shore stabilization effects, especially when used in conjunction with marsh creation and/or restoration projects. Since SAV occurs in shallow water areas, shoreline erosion can adversely affect it through physical removal by wave action, reduced light penetration from suspended sediments, and innundation by sediment deposits. Information on the impact of erosion on SAV and the role SAV may play in reducing shore erosion will assist decision-makers with the process of developing regional shore erosion control strategies.

Updated Land Loss Information

The Maryland Geological Survey (MGS) has conducted several studies aimed at assessing the magnitude and location of shore erosion. The most comprehensive study (Conkwright, 1975) was done in the 1970's, using historical shorelines compiled from U.S. Coast and Geodetic Survey charts dating from 1841 to 1942. Recession and accretion rates were calculated for 1,594 miles of shoreline along the Chesapeake Bay and its tributaries. Further analysis of the data extended the assessment to the entire 4,360 miles of tidal shoreline in Maryland and classified the data by county and erosion rate (See Table 1). MGS currently is updating and revising historical shoreline position maps produced in 1975. To date, shoreline positions (between the years 1841 and 1976) have been converted from print to digital format. Digital shorelines data derived from orthophotography conducted from 1988 to 1994 also have been produced for approximately one-third of Maryland's coastline. Once recent shoreline positions have been acquired for the remaining two-thirds of the State, MGS will be able to quantify both linear, areal, and volumetric rates of shoreline erosion for specific reaches of shoreline. The State then can use this data to analyze and update land loss information, which (along with current information on environmentally sensitive areas) enables planners to target areas for shore protection and restoration activities.

Sea Level Rise Predictive Model

In order to develop a meaningful plan for shoreline erosion control activities, analysts must factor historical shoreline changes into models and other decision-making tools. Shoreline processes, including sea level rise, will affect the location and extent of shore erosion processes. The development of a predictive model which includes sea level rise projections will provide important information for long-term decision making and resource allocation for shore erosion control efforts. This exercise will require the use of existing data and information (e.g., tide gauge data, historic erosion data, wetland/marsh loss data), in addition to high-resolution topographic data for specific coastal areas.

Regional benefit-cost models

An analysis of regional needs, associated costs, and resulting benefits is needed to evaluate and compare shore protection alternatives. Benefit-cost models based on local needs and conditions allow officials to prioritize areas in need of shore erosion control projects. High priority areas represent a high ratio of beneficial outcomes in relation to costs (including non-monetary benefits and costs). The use of such models at the regional level would provide a planning tool to direct

efforts and funding toward the most beneficial projects, avoiding case-by-case project design and selection.

Recommendation Eight: Pursue projects to fill identified data and information needs to support the development of a Comprehensive Shore Erosion Control Plan.

The key elements listed below will provide the necessary information and background knowledge needed to develop an effective and efficient Comprehensive Shore Erosion Control Plan. The collection, analysis, and use of such data will establish a sound scientific basis and help direct funding efforts toward those areas with the greatest need.

Key Elements:

8.1 Collect and analyze new and existing data and information on localized boat wake impacts and identify areas which are susceptible to increased erosion due to boat wakes.

8.2 Collect and analyze new and existing data and information on the role of SAV in aquatic systems with reference to shoreline erosion issues.

8.3 Update historic erosion rate maps and quantify the range and magnitude of land loss according to geographic region.

8.4 Develop a predictive model to identify areas potentially vulnerable to increased erosion due to sea level rise and other on-going coastal processes.

8.5 Develop regional benefit-cost models to evaluate and compare shore protection alternatives for the purposes of developing and prioritizing regional shore erosion control strategies.

8.6 Determine data gaps which need to be filled prior to developing regional strategies and the Comprehensive Shore Erosion Control Plan. Fill gaps as necessary.

Issue Nine: Long-Term Funding Needs and Resources

Current funding mechanisms and investment levels do not reflect shore erosion control needs, either for implementing shore protection projects or planning and management activities. Because particular projects and activities can be identified and implemented only as part of a Comprehensive Shore Erosion Control Plan for Maryland, it is not feasible to specify long-term funding needs or appropriate financing mechanisms prior to the initiation of this planning effort. Therefore, effective and consistent long-term strategies must include a thorough assessment of existing fiscal commitments, future funding requirements, and appropriate financing mechanisms.

Findings:

Current Funding Sources

Funds currently available for shore erosion control in Maryland are derived from several sources: federal, state, and local governments, non-profit organizations, communities, and individual property owners. Among these entities, participation in project management and implementation varies substantially, depending on agency mandates, jurisdictional boundaries, amount of dedicated resources, type of activity, ownership characteristics, and ability to secure project funding.

Although federal and state governmental agencies can secure some project financing, funding levels and authorization procedures vary dramatically according to both the agency and time period in which funding is sought. Local governments, non-profit groups, communities, businesses, and individual waterfront property owners frequently have little or no funding for shore erosion control projects.

Funds derived from these different sources may have different criteria and specific project limitations based on the source's mandates and requirements. Projects funded from numerous sources often are difficult to manage as requirements often conflict with or overlap each other. For example, in most cases federal funding can be used only for projects on public lands, while only two State funding sources can be used to fund projects on private lands: the DNR Shore Erosion Control Program and the MDE Water Quality Revolving Loan Fund. Most importantly, available funding is currently inadequate to conduct necessary shore erosion control activities. Considering that private property accounts for 96% of Maryland's shorelines, this is especially true for public assistance programs.

Existing Funding Mechanisms

Funding mechanisms determine how funds are generated and provided for use in shore erosion control activities. The State of Maryland finds itself in the difficult position of pursuing funding opportunities, while at the same time serving as the primary source of financial assistance to citizens, groups, and communities. The State obtains federal shore erosion control funds primarily through partnerships with the U.S. Army Corps of Engineers and, to a lesser extent, with the U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration. As mentioned in Recommendation One, Maryland has not optimized the funds it could receive from the U.S. Army Corps of Engineers through specific Congressional authorizations or its Continuing Authority programs, because there is no coordinating entity to actively pursue projects and State funds are not readily available for the federal cost-share match.

State funds for shore erosion control activities come from sources such as the Waterway Improvement Fund, the Program Open Space Fund, the Shore Erosion Control Revolving Loan Fund, General Obligation Bonds, and General Funds requiring budgetary authorization either through the capital or operating budgets. Financial assistance is provided through a variety of partnerships with public and private property owners, often requiring an owner to share project costs. Loan caps for both low-interest and no-interest loans vary depending on whether a project entails structural or non-structural control. In addition, the portion of the total project cost provided through loans also depends on ownership characteristics.

One of the most effective funding mechanisms for the continuity of shore erosion control activities is a revolving loan fund. Yearly appropriations of new funds need to be made only for an initial number of years for the fund to become self-sufficient, since loan repayments and any interest are continuously returned for re-dispersal. To achieve self-sufficiency, the fund must remain dedicated for the mandated activities.

Financial Needs

Financial needs depend on the goals and objectives of shore erosion control activities in Maryland. A comprehensive approach to stabilizing the State's eroding shorelines requires targeting areas for protection, specifying a timeline to accomplish the desired stabilization, and securing funds to implement project needs through the life of the plan. In practice, this process will involve balancing a number of objectives, including the severity of the erosion problem, cost-effectiveness, and the need to address problems across all regions of the State. While much of the necessary information awaits implementation of the appropriate Task Force recommendations, some preliminary data is available.

For example, available shoreline erosion information has established three levels of erosion in Maryland: 142 miles of shoreline are eroding at more than 4 feet per year; 234 miles of shoreline are eroding between 2 feet and 4 feet per year; and 965 miles of shoreline are eroding at less than

2 feet per year. Costs for providing basic shore erosion control in Maryland also have been derived from recent projects. Although many variables affect individual project costs, the design and construction of structural shore erosion control practices (bulkheads, revetments, breakwaters) cost an average of $350 per linear foot ($1,848,000 per mile). Non-structural practices (beach fills, marsh creation/stabilization) cost about $125 per linear foot of shoreline protected ($660,000 per mile). However, it should be noted that structural methods generally arrest shoreline erosion rates greater than 2 feet per year (376 miles), while non-structural methods are limited to erosion rates below 2 feet per year (965 miles).

Recommendation Nine: Identify overall funding needs and potential funding resources, and develop a financial strategy to implement a Comprehensive Shore Erosion Control Plan.

Finally, the financial needs of shore erosion control programs are not limited to project implementation, but require program and project management staff to coordinate and administer the overall effort. Staff also are needed to review and update the comprehensive plan by conducting on-going planning activities, as well as various scientific and financial analyses. The elements listed below are important to establishing a financial strategy that will provide the resources to implement a Comprehensive Shore Erosion Control Plan for Maryland.

Key Elements:

9.1 Evaluate interim measures (e.g., sliding interest rates, interest based financial need), established under Recommendation One, to ensure compatibility with long-term objectives of the Comprehensive Shore Erosion Control Plan.

9.2 Determine adequate funding levels for structural shore erosion control practices after the 2-year interim period (See Immediate Response Capability, Recommendation One).

9.3 Consider the continuation of long-term funding for the Emergency Assistance/Federal Project Match Fund and determine adequacy of current $250,000 funding level.

9.4 Designate the Department of Natural Resources as the lead State agency for implementing shore erosion control projects and pursuing funding from federal governmental sources.

9.5 Determine long-range operating budget and staffing needs to carry out program and project management under the comprehensive plan.

9.6 Leverage more private cost-share funds by providing better incentives for property owners to initiate shore erosion control projects.

9.7 Optimize availability of federal funds for shore erosion control by developing a strong working relationship with the U.S. Army Corps of Engineers, building upon findings and recommendations of the 1990 *Chesapeake Bay Shore Erosion Study*.

9.8 Review the applicability of funding mechanisms for shore erosion control recommended in the 1994 Governor's Blue Ribbon Panel Report, *Financing Alternatives for Maryland's Tributary Strategies*.

9.9 Use cost-benefit models, developed under Recommendation Eight, to conduct analyses and demonstrate need for specific funding levels.

9.10 Establish different scenarios for the stabilization of eroding shorelines, taking into consideration the three levels of erosion (discussed above), the desired stabilization efforts, a timeline for implementation and the resulting funding needs.

9.11 Explore the concept of a shoreline protection strategy which targets the use of joint federal/state funds for off-shore projects with a regional focus (i.e., offshore breakwaters); and the use of private funds, with State assistance, for individual projects in near-shore environments.

9.12 Pursue pending federal legislation to assist States with estuarine environments within their boundaries (H.R. 701 and H.R.1775).

9.13 Identify, and, where appropriate, resolve obstacles hindering the application of federal funds for the construction of private shore protection projects in the State of Maryland. Attention should be given to federal public access requirements in light of the consideration of public benefits (i.e., reduced sediment and nutrients input) derived from projects accomplished to protect private lands.

9.14 Review and modify existing authorities to facilitate funding for the implementation of a Comprehensive Shore Erosion Control Plan. Some of the authorities requiring review include:

A. *Funding Alternate Efforts.* The existing Shore Erosion Control Law channels financial assistance to the design and construction of shoreline stabilization projects and should be expanded to include other shore erosion mitigation efforts, such as relocation of structures or infrastructure items in *lieu* of shore stabilization projects, as well as other on-land practices guided by environmental considerations and cost effectiveness.

B. *Liens vs. Tax Bills*. Loans provided for projects on private property are secured by liens recorded against the benefitted property. These liens often interfere with other financial transactions involving the property and discourage participation. Explore possibility of having county governments collect the yearly repayments of the State loans through the real estate tax bill system. This billing process would remove a barrier to establishing shore erosion control projects on private property.

C. *Special Tax District Law*. Implementing this Law, which establishes a process to allow members of a community or a group of property owners to voluntarily tax themselves to finance a shore erosion control project with the involvement of county governments, takes too long and is too difficult for land owners to form the requisite shore erosion control district. Removing this obstacle to the timely establishment of districts and related shoreline stabilization projects would maximize opportunities to obtain funding commitments and insure the accomplishment of larger regional projects.

D. *Tax Credit Law*. The existing law allowing local governments to provide tax credits to establish shore erosion control projects may be more effective as an incentive to property owners by designating the State government as the grantor of credits, thus encouraging a greater participation and investment of funds from the private sector.

IMPLEMENTATION STRATEGY

The first section of this report highlighted the environmental, organizational, and institutional problems affecting shoreline erosion in Maryland. In response, the third section presented nine Task Force recommendations, along with a series of key elements, designed to address these problems. These recommendations may be summarized as follows:

1. immediate response capacity
2. regional shore erosion control strategies
3. project review and implementation criteria
4. cooperative management and implementation
5. standards and practices
6. utilization of available dredged materials
7. public outreach
8. information and data needs
9. long-term funding needs and resources

This section provides a strategy to implement these recommendations in accordance with the principle that what is done to address immediate needs often has a critical impact on what can be done in the future.

Immediate Needs and Long-Term Planning

It is clear that the first Task Force recommendation is critical, not only to providing property owners with minimum technical and financial assistance (e.g., emergency response capabilities after major storm events), but also to implement successfully the other eight recommendations. In particular, the program improvements and financial resources called for in the first recommendation are needed to implement the remaining recommendations as part of a statewide Comprehensive Shore Erosion Control Plan. The Task Force believes that without a coordinated planning effort, any piecemeal or *ad hoc* efforts to carry out their recommendations will contribute to additional fragmentation of the human, technical, and financial resources available for controlling shore erosion (resulting in further duplication of effort, inefficiency, and gaps in program coverage). This need was recognized not only by the Task Force, but by citizens providing comments on the Task Force effort, as well as in the U.S. Army Corps of Engineers study, *Chesapeake Bay Shoreline Erosion Study*.

Thus, although the recommendations contain the separate elements of a comprehensive plan, a concerted effort must be made to assure that they are not implemented in isolation from, but rather, inform one another, according to the particular role that each plays in relation to the others. For example, the plan will assure compatibility between mechanisms that target regional protection priorities (Recommendation Two) and criteria for reviewing, selecting, and implementing projects from among those priorities (Recommendation Three). In addition, given that the recommendations stress the importance of controlling shore erosion through regional approaches, a statewide comprehensive plan must allocate financial and technical resources across regions so that progress is made throughout the State. Perhaps most important, a statewide plan is needed to assure that shore erosion control activities at least are consistent with (and, optimally, reinforce, and compliment) other statewide programs, goals and milestones, e.g., for protecting water quality, wildlife habitat, green infrastructure, and wetlands.

The Task Force believes it is neither appropriate nor feasible for the Task Force itself to develop such a plan, given that the plan must reflect thorough environmental, economic, and engineering assessments at the state, regional, and project level, as well as ongoing participation by a host of local, state, and federal actors. As discussed later in this section, the Task Force recommends completion of the comprehensive plan within two years, after various coordination, funding, and data collection mechanisms have been established. In other words, only after a certain amount of individual progress is made towards implementing the recommendations is their consolidation into a comprehensive plan either useful or possible.

Instead of writing the State plan, the Task Force has prepared an implementation strategy first to achieve this initial progress and later to integrate recommended actions into a Comprehensive Shore Erosion Control Plan for Maryland. In addition to assessing the human, technical, and financial resources necessary to begin the planning process (and, in the meantime, to provide a

minimal State program capability), the strategy presents a series of organizational, institutional, and fiscal proposals. These proposals are designed to answer overarching implementation questions such as: who should carry out which recommendations, how can long-term funding needs be determined, and when should each recommendation, as well as the comprehensive plan itself, be completed. Together, these proposals constitute the integrated blueprint of short and long term actions needed to fulfill the promise of Resolution 13.

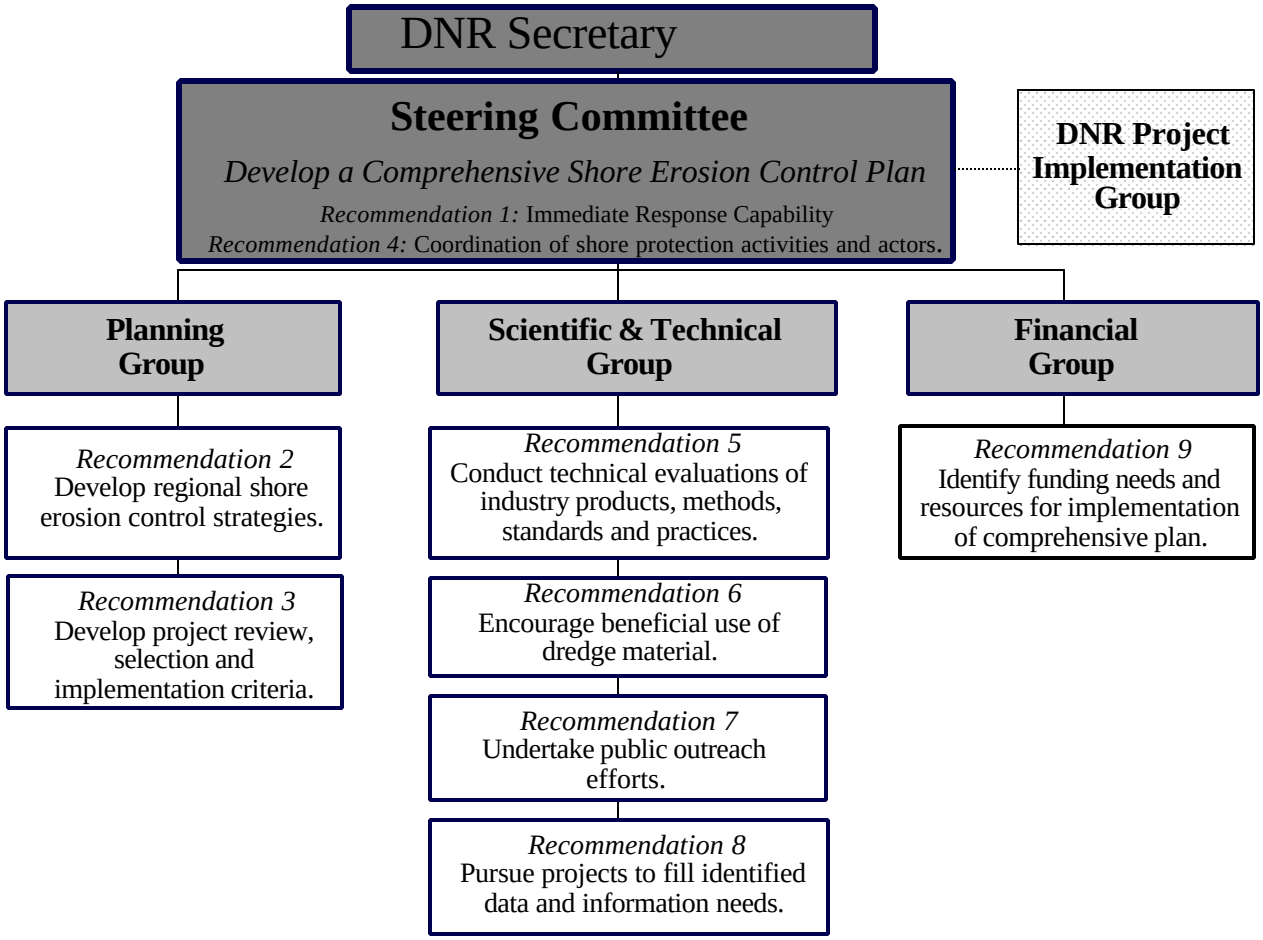
An Institutional Structure

As discussed in the first section, shore erosion problems affect and are affected by a host of actors and activities, including numerous federal, state, and local governmental agencies, private citizens, businesses, and non-profit organizations. And depending on the particular situation, each group has both a unique interest affected by the problem itself and how it is resolved, as well as distinctive contributions to make toward characterizing and ameliorating the problem. With this important lesson in mind, the Task Force proposes that the shore erosion control strategy outlined in this report be coordinated through a multi-agency Steering Committee chaired by the Secretary of Natural Resources and staffed by DNR personnel. (See Figure 1) The Steering Committee would have four primary responsibilities: (1) publish the State's Comprehensive Shore Erosion Control Plan; (2) assume the lead role for implementing Task Force Recommendation One, to establish an immediate response capability and Recommendation Four, to improve inter-agency coordination and encourage cooperative regional projects; (3) evaluate and modify existing authorities under Recommendation's One and Nine; and (4) oversee the work of three groups charged with implementing the other Task Force recommendations. These groups are discussed below.

The Planning Group, with staff support from DNR's Chesapeake and Coastal Watershed Services Unit, would oversee the implementation of Recommendation Two, to establish regional shore erosion control strategies, and Recommendation Three, to develop review, selection, and implementation criteria. The Scientific and Technical Group, staffed by the Maryland Geological Survey and the Shore Erosion Control program (both part of DNR), would oversee implementation of Recommendations Five through Eight. Recommendation Five calls for technical evaluations of industry products and methods, assessing the need for minimum engineering standards, and reviewing industry practices. Recommendation Six requires encouraging the beneficial use of uncontaminated dredged material in both individual and regional scale projects and Recommendation Seven calls for public outreach on technical matters, funding resources, and environmental issues related to shore erosion control. Recommendation Eight requires the pursuit of projects that fill identified data needs. Finally, a Financial Group staffed by DNR Shore Erosion Control personnel would implement Recommendation Nine, which calls for the investigation and identification of funding needs and resources, as well as the development of a long-term financial strategy for implementing the Comprehensive Shore Erosion Control Plan.

The composition of the Steering Committee and underlying implementation groups will consist of members of the Task Force, as well as individuals professionally associated with the problem of shoreline erosion. In addition, representatives of the Departments of Natural Resources, Agriculture, and the Environment; the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency; and, selective members of local governments and non-profit organizations, will be included.

Figure 1: Institutional Structure



Organizing the Process

The Steering Committee and subgroups must organize and carry out their responsibilities according to an efficient and logical schedule that guides the stepwise implementation of the recommendations and their subsequent incorporation into a comprehensive plan. To this end, the Task Force has projected a ten year timeline (see Figure 2) for shore erosion control activities.

Immediate actions include DNR's establishment of the Steering Committee and subgroups described above, as well as the identification of initiatives for the 2000 legislative session. In addition, the Steering Committee will review agency budgets for FY 2000 and determine that year's appropriation needs. Finally, the Committee will develop a financial strategy for preparing the comprehensive plan. Within the first year the Committee will initiate the development of the comprehensive plan and establish interagency coordinating mechanisms. The Scientific and Technical Group will update and analyze historic erosion rate maps and overlay land loss information with sea level rise and sensitive area data. It also will evaluate the need for minimum engineering standards and review industry practices.

During the second year, the Planning Group will prioritize and target areas for regional shore protection activities using the data generated by the Scientific and Technical Group. It also will establish project review, selection, and implementation criteria. This information will foster the development of shore erosion control strategies tailored to particular regions which, along with the initiation of large-scale cooperative protection projects, will allow the Steering Committee to complete the State's Comprehensive Shore Erosion Control Plan. During this same period, the Financial Group will work in concert with those developing the plan to finalize a financial strategy for its implementation. Ongoing activities during these first two years include public outreach and technical evaluations of shore protection products and methods.

By the fifth year of activity, the plan, including the priorities identified in each regional strategy, should be in full implementation. In addition, large scale regional projects will be initiated to demonstrate the beneficial use of dredged materials. At both five and ten year intervals, independent parties should review and evaluate the plan and the effectiveness of its various implementation activities, while the adequacy of existing financial resources also should be assessed.

Figure 2: Implementation Timeline

***Immediate Actions*:**

- DNR establishes Steering Committee.
- Planning, Scientific/Technical, and Financial Implementation Groups convened.
- Develop a financial strategy for the preparation of the *Comprehensive Plan*.
- Review FY2000 agency budgets.
- Identify FY2000 Legislative Session Initiatives.
- Establish annual fund appropriation for FY2000, FY2001 and FY 2002.

***Within First Year*:**

- Initiate development of the *Comprehensive Plan*.
- Establish means for inter-agency coordination.
- Update and analyze historic erosion rate maps.
- Overlay land loss information with sea level rise and sensitive area data.
- Address outstanding data and information needs.
- Identify overall funding needs and potential funding sources.
- Evaluate the need for minimum engineering standards and review industry practices.

Within Second Year:

- Prioritize and target areas for regional shore protection activities.
- Establish project review, selection and implementation criteria.
- Formulate regional shore erosion control strategies.
- Initiate implementation of cooperative regional projects.
- Develop financial strategy for implementation of the *Comprehensive Plan*.
- Complete *Comprehensive Plan*.

On-Going:

- Conduct public outreach through public workshops, education materials, and effective website information.
- Conduct technical evaluations of new shore protection products and methods.
- Continue to engage in inter-agency coordination of shore protection activities.

5-Year Plan:

- Full implementation of the *Comprehensive Plan*.
- All regional strategies and project implementation underway.
- Construct regional projects to demonstrate the beneficial use of dredge materials.
- Review adequacy of funding/financial resources.
- Independent review and evaluation of the *Comprehensive Plan.*

10-Year Plan:

- Overall review of the effectiveness of the *Comprehensive Plan* for the State of Maryland.
- Review adequacy of funding/financial resources.

Preliminary Funding Requirements

While establishing a long-term funding strategy is possible only through the development of a Comprehensive Shore Erosion Control Plan (see Recommendation Nine), estimates of more immediate funding requirements are possible. Such funds are needed over the next two years to (1) support the implementation of Task Force recommendations as part of a comprehensive plan , and (2) establish a minimal interim capacity for DNR and its partners to assist Maryland property owners affected by shoreline erosion, while the comprehensive plan is being developed.

Technical, Planning and Operational Needs

The State's ability to pursue the technical, planning, and operational components of the comprehensive planning process, discussed in this report, is highly contingent on allocation of financial support. A substantial number of shoreline miles need protection from high erosion rates, as well as sea level rise impacts. A critical need exists to quantify what areas of Maryland's shoreline are and will be impacted by these two factors. Accurate shoreline positions and elevation data are needed to forecast the scope and extent of damages to public and private infrastructure from different sea level rise scenarios. Environmentally sensitive areas need to be identified and used, together with shoreline and sea level rise impact maps, to prioritize individual and regional projects. The following data summarize the minimum funds necessary to perform these assessments and analyses, as well as provide general administrative support to the overall planning process.

	FY-2000	FY-2001	FY-2002
Shoreline Data Mapping			
Staff (Technical – 2)	$ 25,000	$ 25,000	$ 0
Equipment/Software	$ 10,000	$ 0	$ 0
Shoreline Data	$ 50,000	$ 15,000	$ 0
Sub-total	$ 85,000	$ 40,000	$ 0
Predictive Model			
Sea Level Rise Impacts	$350,000	$ 150,000	$ 0
Sub-Total	$350,000	$ 150,000	$ 0
Planning & Data Analysis			
Staff (Planner)	$ 25,000	$ 50,000	$ 25,000
Staff (Fellow)	$ 0	$ 15,000	$ 7,500
Sub-total	$ 25,000	$ 65,000	$ 32,500
Financial Analysis	$ 0	$ 20,000	$ 0
Sub-total	$ 0	$ 20,000	$ 0

TOTAL	**$460,000**	**$ 275,000**	**$ 32,500**

Emergency Assistance/Federal Match Fund

These funds are necessary to provide immediate emergency financial assistance to mitigate damages incurred from major storms and to provide the necessary funding match for Federal cost-shared projects administered by the U.S. Army Corps of Engineers.

	FY-2000	FY-2001	FY-2002
Project Design and Construction	$ 0	$ 250,000	$250,000
TOTALS	**$ 0**	**$ 250,000**	**$250,000**

Monies are to be retained in a dedicated fund with a sustained level of $1,000,000. Financial assistance would be issued as loans and grants for structural and non-structural projects on public and private lands.

Reinstatement of Structural Shore Erosion Program

Immediate financial assistance would be provided to local governments and special taxing districts, established for communities or groups of property owners, for structural shore protection projects. Additionally, interim financial assistance for the design and construction of structural projects located on public and private lands through a 15-year, sliding-interest-rate loans of 1 percent to 4 percent, as well as interest-free loans or grants, would be provided to individuals and groups, once existing statutes and authorities have been modified. Reinstatement of the structural shore erosion control program on an interim basis will require minimum funding as shown below:

	FY-2000	FY-2001	FY-2002
Staff (Civil Engineer)	$ 22,000	$ 44,000	$ 44,000
Project Design and Construction	$250,000	$ 500,000	$500,000
TOTALS	**$272,000**	**$ 544,000**	**$544,000**

Total Funding Need

The total funding need for both planning and project implementation over three fiscal years is as shown:

FY-2000	**FY-2001**	**FY-2002**
$732,000	**$1,069,000**	**$826,500**

Sources for these funds have not been identified, although it is expected that they could be derived from a combination of general funds, general obligation bonds and special funds (e.g., Waterway Improvement funds).

CONCLUSION

Shore erosion is an urgent environmental and economic problem for the growing number of citizens and businesses who call Maryland's coastal region "home." Accelerating rates of sea level rise combined with the increasing pace of development along the State's coastline promise to intensify shore erosion rates in the absence of a proactive and strategic response to the problem. Currently, hundreds of acres of irreplaceable shoreline are washed away every year, affecting thousands of lives in the process. Property values, recreation, public safety, water quality, wetlands, habitat, economic development, and cultural values all are held hostage to the relentless forces at work on at least one-third of what is perhaps Maryland's most fragile area: the coastal borders between the State's terrestrial and aquatic resources. Unfortunately, the State currently lacks the institutional, organizational, and fiscal resources necessary for a comprehensive response.

In the face of growing concerns among local, state, and federal governments, as well as private citizens, a wide array of largely autonomous and site-specific responses to shore erosion emerge. Despite the involvement of so many parties, the adverse impacts of shore erosion continue to increase. As Maryland moves into the twenty-first century, it is clear that these environmental and institutional problems require a comprehensive and coordinated set of solutions; a proactive plan of action to control shore erosion that anticipates the many challenges that lie ahead. Pursuant to its mandate under Resolution 13, the Maryland Shore Erosion Task Force believes that the nine recommendations presented in this report provide the framework for such an approach.

These recommendations, along with their key elements, represent a broad spectrum of solutions that account for regional variations in shore erosion needs and foster the cooperative relationships necessary to make efficient and effective decisions. While implementing these changes will require an investment of time and resources, failure to take action will be much more costly.

First, the Maryland Department of Natural Resources needs the time, resources, and authority to initiate the development of a Comprehensive Shore Erosion Control Plan and establish the interim program activities that provide minimum financial and technical assistance while the plan is being developed. A central part of the planning process requires developing a framework for prioritizing and targeting shore protection activities within distinct regions of the State. Within each region, as well as at the State level, institutional mechanisms are needed to coordinate various decision-making processes and to promote the implementation of large-scale projects. Such projects require consistent criteria to guide their review, selection, and successful implementation.

A long-term funding strategy is needed not only to pay for the planning and implementation of specific projects, but also for the administrative system to oversee and coordinate the

process, as well as provide support for the necessary research activities. The State also should conduct technical evaluations of industry practices and new shore protection products and methods, as well as evaluate the need for minimum engineering standards.

The comprehensive plan also must promote the beneficial use of uncontaminated dredged materials in both individual and regional shore erosion control projects. Finally, public outreach and research activities must proceed in concert with the planning, review, and evaluation of individual projects, as well as compliment the plan's more strategic functions.

Recognizing that all of these activities cannot be effectively implemented in isolation from one another, this report presents an implementation strategy that identifies a series of institutional, organizational, and financial proposals to assure that (1) each recommendation is implemented as part of a broader Comprehensive Shore Erosion Control Plan and (2) interim measures are in place to assure an immediate response capability for a period of two years while the plan is being developed.

The development of a Comprehensive Shore Erosion Control Plan for the State of Maryland is a substantial endeavor. The Task Force estimates that its completion and the establishment of an immediate response capability will require approximately $2.6 million dollars over the next three fiscal years. In light of the tremendous benefits and values that Maryland's shoreline imparts to the environment, economy, and culture of the State's vital coastal region, not only is this effort a prudential investment, it is long overdue as well.

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Legislation:

Shore Erosion Control Law: Natural Resources Article,§ 8-1001 - § 8-1008

Special Tax District Act Law: Article, 25, § 167A - 167F

Tax Credit Law: Tax Property Article, § 9 - 217

Wetlands and Riparian Rights: Environment Article, § 16-101 - § 16-503

Chesapeake Bay Critical Area Protection Program: Natural Resources Article, § 8 -1801 - § 8 -1817

APPENDIX

SUMMARY OF PUBLIC COMMENTS

Public Meetings: Hughesville, Chestertown, Havre de Grace,
Cambridge, Annapolis, Princess Anne

November 15, 17 and 22, 1999

164 Attendees
40 Written Statements Received

Funding and Financial Assistance (46 comments)

- Immediate funding needed, especially emergency situations, for shore erosion control.
- The DNR, Shore Erosion Control loan program needs to be reinstated.
- State budget surplus should be used for shore erosion control.
- Encourage and simplify special tax districts.
- Develop incentives, such as tax credits, matching funds and interest-free loans for property owners to properly abate shore erosion.
- Develop financial strategy and priority criteria for fair distribution of funds.
- Need to aggressively pursue availability of federal funds for shore erosion.

Shore Erosion Action Plan (31 comments)

- Waterfront property owners need help/action now.
- Need to move fast on Shore Erosion Task Force recommendations.
- Establish short term goals that align with long term recommendations.
- Ensure accuracy in establishing priorities and equal private and public protection needs.
- Property owners and local governments should be included in developing regional plan.
- The comprehensive regional plan must be backed-up by definite action plan.
- Task Force recommendations should align with government agencies established. regulations, policies and recommendations.

Data and Information Needs (30 comments)

- Up-date erosion maps and amount of shoreline protected.
- Take advantage of existing Corps of Engineers' studies identifying critical eroding areas.
- The differences between linear and volumetric erosion rates should be considered.
- Address impacts of boat wakes on shoreline erosion.
- Learn what other states are doing to abate shore erosion.
- Investigate the disappearance and erosion control effectiveness of SAV's.
- Analyze the cost of erosion protection vs the cost of dredging.
- Research the effects of dredging and ice conditions on causing erosion.
- As an initial effort, identify top projects in each county.

Policy Issues (27 comments)

- Sufficient attention must be given to the effects of sea level rise.
- The issue of subsidizing private property owners should be addressed.
- Individual and community requests require a rapid response.
- Environmental factors must be included in determining priorities for projects.
- Need a collective agreement of all groups that the solutions are the right solutions for now and in the future.

Site Specific Erosion Problems (24 comments)
- 21-requests for shore erosion control projects in 7-counties.
- 4-Anne Arundel, 3-Baltimore, 1-Calvert, 6-Dorchester, 2-Kent, 1-Queen Anne's and 4-St. Mary's

Agency Coordination (16 comments)
- There needs to be more coordination among state, federal and local agencies to accomplish and fund shore erosion projects.
- There are too many agencies to go to in seeking help, should be one place to go.
- There are too many agencies involved in the shore erosion control process.

Dredging (13 comments)
- Dredged materials must be valued as a resource which can be recycled and put back in a positive way.
- A clearing house approach should be set up by the State to bring together dredged. material availability with material needs for projects with potential great benefit.
- Need to make use of dredge material on shore erosion projects – it would be a service to the State and COE for providing spoil sites.

Shore Erosion Practices (9 comments)
- Structures are erected to protect individual properties without concern of impact upstream and down stream.
- Shore erosion standards are necessary and softer approaches should be promoted where applicable.
- Need effective methods, that take sea level rise into account and will protect our investments now.
- There is a technique developed and used in Wisconsin that grows beaches.

Education & Information (9 comments)
- Shore Erosion Task Force information needs to be made available to citizens.
- Information on installation of effective shore erosion control measures needs to be made available to property owners.
- Information on point of contact for shore erosion control assistance must be made. available to the public and government agencies.

- Buyers of shoreline real estate should become informed on potential erosion problems.
- Place emphasis on education concerning building setback from the shoreline.

Support of Task Force Recommendations (9 comments)

- How can property owners support the efforts of the Task Force.
- The Dorchester Preservation Group supports the development and implementation of a comprehensive environmental plan.
- Aberdeen Proving Grounds environmental personnel have extensive technical and financial resources and want to assist Task Force efforts.
- We are available to your staff as a resource regarding information on Baltimore's shoreline.
- Would like to help on both policy and technical aspects of the shore erosion control issues.

ENVIRONMENTAL PROTECTION AGENCY'S PRESENTATION SUMMARY

The Maryland Shoreline Program
Good Tactics in Need of a Strategy

Presented by:
Jim Titus
Environmental Protection Agency

October 29, 1999

Tactics in Need of a Strategy

- Soft engineering favored over hard
- Funding for seaside parks
- Progressive use of revetments to protect ecosystems
- Ultimate right to armor entire shore
- Actual access diminishing
- No specific objective regarding acceptable long-term loss

Right to Hold Back the Sea

- Maine Dune Rules – structures assumed moveable
- Massachusetts Statute
  - Armored much of shore
  - Post 1978 houses – no armoring
- Rhode Island – no armoring in designated conservation areas
- Oregon – regularly lets houses fall into the sea
- Typical
  - Armoring allowed on bays and prohibited on oceans
  - No right to hold back the sea
- Maryland – includes Right to Hold Back the Sea

Maryland's Statutory Right To Hold Back the Sea

Maryland Code – Environment § 16-202(a): "A person who is the owner of land bounding on navigable water is entitled to … make improvements into the water in front of the land to … protect the shore of that person against erosion. After an improvement has been constructed, the improvement is the property of the owner of the land to which the improvement is attached."

Options

- Tactical
- Strategic Vision (Strawman)

- Long-Term Master Planning Study

Tactical Options
- Program Open Space/Rural Legacy purchase easements
- Mitigation policies credit for landward migration
- Discourage infrastructure in very low areas unless State has made commitment to protect
- Increase separation requirement for new septic tanks
- Keep access when issuing bulkheads/revetment permits
- Consider wetland mitigation for shoreline armoring
- MDE re-instate reporting practices for shoreline armoring of Board of Public Works

Strawman Vision of Where We End Up

Designate areas where:
- State subsidizes shore protection
- Private owners can armor or nourish
- Private owners can nourish but not armor
- Property will not be protected from rising sea
- State and local subsidizes landward migration

Strawman Vision – Subsidized Shore Protection
- Ocean City – State's only urban ocean resort
- Smith Island et al. – historic and this is compensation for decline of Bay
- One or more public bay beach community in every coastal county

Strawman Vision – Where Can Private Owners Protect?
- Grandfather existing development
- Track critical area designation in undeveloped areas
- Legislature amends § 16-201 to delegate authority to DNR to develop guidelines on where nourishment is feasible enough to prohibit armoring, and vice versa
- Public access along the shore retained along 25-50 per cent of future armored shores

Strawman Vision – Property Not Protected
- Wildlife Refuges, Reserves, etc.
- Areas adjacent to Refuges, etc. (e.g. buy rolling easement)
- Some portions of the lightly developed critical area
- Areas were public and private protection so infeasible that we might as well give the market signal now so that real estate investors will redirect investments elsewhere
- Other key areas where natural shore important

Strawman Vision – Flexibility Mechanisms

- Private-sector environmental programs can ensure greater protection in any area by purchase (rolling easement, no-bulkhead easement, no-development easement, etc.)
- System of transferable shore protection rights

Strawman Planning Study Outline (DNR and Bay Program)

- Projections of future shores
- State specifies options
- County case studies
  - Studies
  - Hearings
  - Specifies which areas will be armored, nourished, natural
- DNR and Bay Program assemble comprehensive maps
- State specifies alternative draft plans if more or less protection desired
- Analysis of the costs and benefits of those plans
- Hearings and technical review
- DNR recommends Master Shoreline Plan to Legislature
- Legislature enacts shoreline policy, giving counties and/or private parties flexibility to meet performance standards

State Needs a Comprehensive Shoreline Policy

- Most states have ocean shoreline policies
- Maryland only has about 8 miles of non-federal ocean shores, but thousands of miles of estuarine shores
- Shoreline is state-owned so state can make policy as property owner rather than as regulator

U.S. ARMY CORPS OF ENGINEERS' PRESENTATION SUMMARY

Erosion Control Authorities

Presented by:
Wes Coleman
Phil Hager

October 29, 1999

Planning Assistance to States
- Authorized by Section 22 of the Water Resources Development Act of 1974.
- Federal share may not exceed $500,000 per state.
- Allows the Corps to assist states, local governments, and other non-federal entities in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources.

Emergency Streambanks and Shoreline Erosion
- Authorized by Section 14 of the 1946 Flood Control Act.
- Federal share may not exceed $1 million for each project.
- Allows emergency streambanks and shoreline protection for public facilities, such as roads, bridges, hospitals, schools, and water/sewage treatment plants, that are in imminent danger of failing.

Hurricane and Storm Damage Reduction
- Authorized by Section 103 of the 1962 River and Harbor Act.
- Federal share may not exceed $2 million for each project.
- Provides for protection or restoration of public shorelines by the construction of revetments, groins, and jetties, and may also include periodic sand replenishment.

Shore Damage Attributable to Federal Navigation Works
- Authorized by Section 111 of the 1968 River and Harbor Act.
- Federal share may not exceed $2 million for each project.
- Provides for the prevention or mitigation of erosion damages to public or privately owned shores along the coastline of the United States when these damages are a result of a federal navigation project.

Aquatic Ecosystem Restoration
- Authorized by Section 206 of the Water Resources Development Act of 1996.
- Federal share may not exceed $5 million for each project.

- The focus is on aquatic ecosystem restoration projects that will improve the quality of the environment, are in the public interest, and are cost-effective.

Beneficial Uses of Dredged Material
- Authorized by Section 204 of the Water Resources Development Act of 1992.
- Work under this authority provides for the use of dredged material from new or existing federal projects to protect, restore, or create aquatic and ecologically related habitats, including wetlands.

Chesapeake Bay Environmental Restoration and Protection Program
- Authorized by Section 510 of WRDA 1996.
- Establishes a pilot program to provide environmental assistance to non-Federal interests in the Chesapeake Bay watershed.
- Currently being utilized for the shoreline protection project for Tylerton, Smith Island.

General Investigations Projects
- Projects require Congressional authorization.
- A previous effort was the Chesapeake Bay Shoreline Erosion Study.
- Ongoing efforts in the Chesapeake Bay include watershed studies for the Patuxent River, the Lower Potomac River, the Baltimore Metropolitan area, the Eastern Shore of Maryland and Delaware, and Smith Island.

Chesapeake Bay Shoreline Erosion Study
- Reconnaissance Study completed in 1986.
- Of the Bay' s total shoreline of 7,325 miles, 135 miles were identified for more intensive analysis (94 miles in MD and 41 miles in VA).
- They include all types of shorelines, lands in both public and private ownership, and exposure to differing wind and wave climates. A full range of possible solutions was examined, including some innovative erosion control measures not previously used in the Chesapeake Bay.
- Feasibility study was completed in 1990.
- A reevaluation prior to the feasibility study resulted in the identification of 15 sites, covering 9.3 miles of shoreline, to be considered in the feasibility phase.
- Three projects were constructed under the Section 14 authority.
- Two projects were feasible but lacked non-Federal support.

Eastern Shore MD & DE Water Resources
- Authorized by a Senate Resolution on June 5, 1997.
- It authorizes the Corps to conduct water management studies in the interest of navigation, flood control, hurricane protection, erosion control, environmental restoration and wetlands protection in the study area.

- Reconnaissance was initiated in February 1999 with a targeted completion date of early 2000.
- Feasibility initiation is anticipated in early to mid 2000.