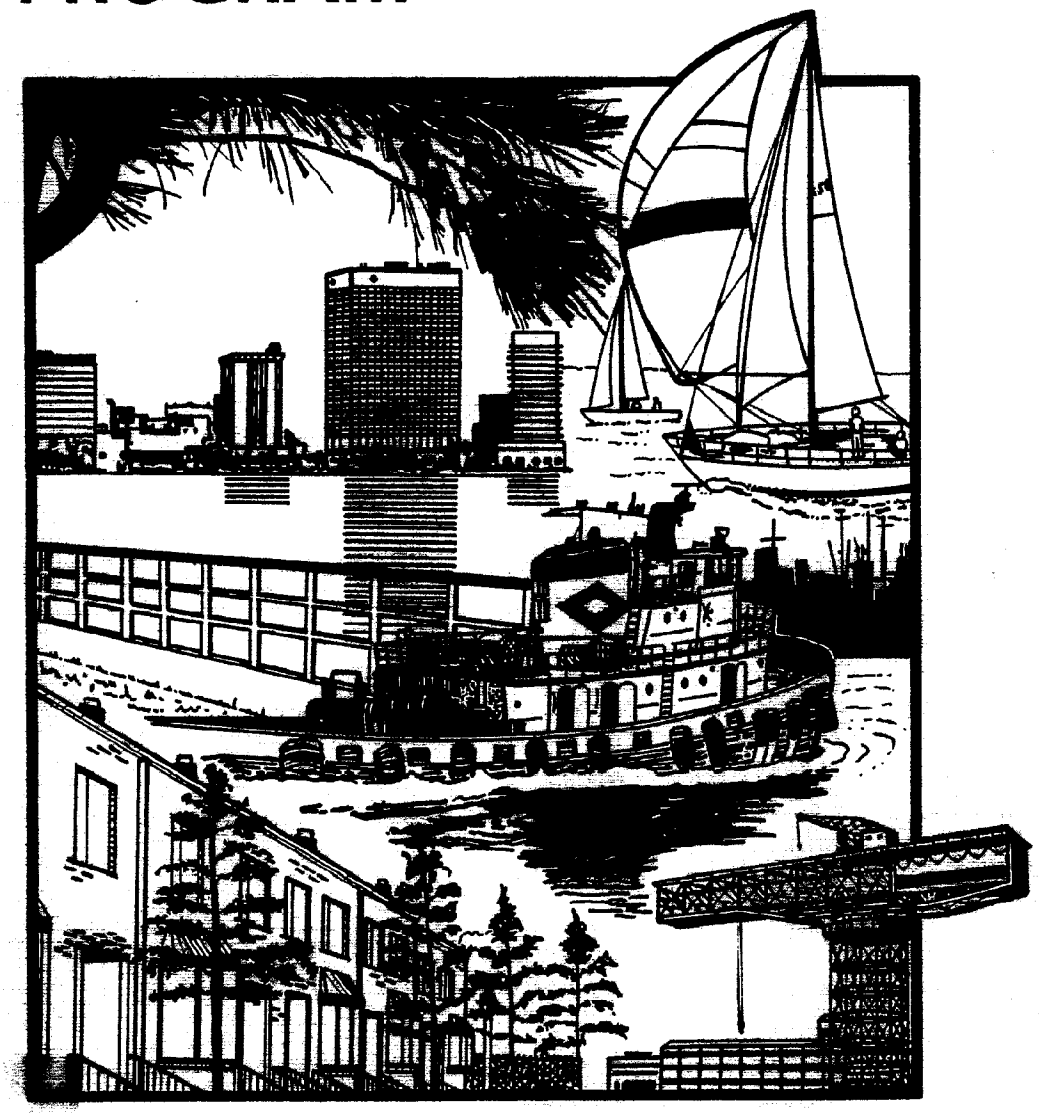
FINAL REPORT
Elizabeth River Basin
Environmental Management Program
SVPDC
Grant No. NA87AA-D-CZ092

ELIZABETH RIVER BASIN ENVIRONMENTAL MANAGEMENT PROGRAM



PREPARED BY SOUTHEASTERN VIRGINIA PLANNING DISTRICT COMMISSION
WITH THE HAMPTON ROADS WATER QUALITY AGENCY
MAY 1989

QH
105
.V8
E58
1989

Virginia Coastal Zone Management Program

COASTAL ZONE
INFORMATION CENTER

SOUTHEASTERN VIRGINIA PLANNING DISTRICT COMMISSION

CHESAPEAKE

- ▸ DR. WILLA S. BAZEMORE
- NORA W. DAVENPORT
- JAMES W. REIN

FRANKLIN

- ROBERT E. HARRELL
- ▸ JOHN J. JACKSON

ISLE OF WIGHT COUNTY

- ▸ MYLES E. STANDISH
- RICHARD L. TURNER

NORFOLK

- ▸ DR. MASON C. ANDREWS
- DAVID CLARK, IV
- ELIZABETH M. HOWELL
- JAMES B. OLIVER, JR.
- G. CONOLY PHILLIPS

PORTSMOUTH

- JACK P. BARNES
- ▸ GEORGE L. HANBURY, II
- L. LOUISE LUCAS

SOUTHAMPTON COUNTY

- ▸ ROWLAND L. TAYLOR
- C. HARRELL TURNER

SUFFOLK

- ANDREW B. DAMIANI
- ▸ JOHN L. ROWE, JR.

VIRGINIA BEACH

- ALBERT W. BALKO
- ROBERT W. CLYBURN
- ▸ REBA S. MCCLANAN
- MEYERA E. OBERNDORF
- AUBREY V. WATTS, JR.

▸EXECUTIVE COMMITTEE MEMBER

PROJECT STAFF

ARTHUR L. COLLINS	EXECUTIVE DIRECTOR/SECRETARY
JOHN M. CARLOCK	CHIEF PHYSICAL PLANNER
WILLIAM P. WICKHAM	PHYSICAL PLANNER
PAUL E. FISHER	HRWQA PROJECT DIRECTOR
JOYCE M. COOK	SECRETARIAL SUPERVISOR
FRANCES D. HUGHEY	WORD PROCESSOR II
DANA F. SHEARER	WORD PROCESSOR II
ROBERT C. JACOBS	CHIEF OF GRAPHICS
JEANNE L. MUNDEN	GRAPHICS TECHNICIAN II
MICHAEL R. LONG	GRAPHICS TECHNICIAN I
RACHAEL V. PATCHETT	REPRODUCTION EQUIPMENT TECHNICIAN

Southeastern Virginia Planning District Commission
The Regional Building
723 Woodlake Drive
Chesapeake, Virginia 23320
(804) 420-8300

ENVIRONMENTAL MANAGEMENT PROGRAM

FOR

ELIZABETH RIVER BASIN

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

This report was produced, in part, through financial support from the Virginia Council on the Environment, pursuant to Coastal Resources Program Grant No. NA-87-AA-D-CZ092 from the National Oceanic and Atmospheric Administration.

Preparation of this report was included in the SVPDC Program for Fiscal Year 1988-89, approved by the Commission at its Executive Committee Meeting of March 16, 1988.

Property of CSC Library

Prepared by the Staff of the
Southeastern Virginia Planning District Commission
with the
Hampton Roads Water Quality Agency

QH105.V8 E58 1989
20261392
NOV 24 1997

MAY 1989

TABLE OF CONTENTS

LIST OF TABLES iii
LIST OF FIGURES iii
EXECUTIVE SUMMARY iv

INTRODUCTION 1

BACKGROUND
- Historical Studies 5
- Implementation Status 7

WATER QUALITY CONDITIONS
- System Characteristics 9
- Historical Conditions 10
- Current Conditions 10
- Nonpoint Source Evaluation 11
- Point Source Pollution 13

GOALS COMPATIBILITY ANALYSIS
- River Use/Character Goals 16
- Water Quality Goals 17
- Local Development Goals 18
- Compatibility Analysis 19

REGULATORY ANALYSIS
- Institutional Structure 22
- Regulatory Framework 26
- Review of State Programs 28
- Compatibility Analysis 29

CRITICAL MANAGEMENT AREA
- CERWQMP:PMR Recommendation 31
- Reevaluation 32
- Chesapeake Bay Preservation Act 32

SPECIAL STUDIES
- Stormwater Management Strategy 34
- Hazardous Waste Activities 35
- Water-Dependent Facilities 37
- Information Needs 38

TABLE OF CONTENTS
(Continued)

IMPLICATIONS FOR MANAGEMENT PROGRAM
- Historic Recommendations 41
- Water Quality Conditions 41
- Goals Compatibility 41
- Institutional and Regulatory Framework 42
- Critical Management Area Concept 43
- Stormwater Management Strategy 43
- Hazardous Waste Activities 44
- Water-Dependent Facilities 44
- Conclusion 44

ENVIRONMENTAL MANAGEMENT PROGRAM FOR THE ELIZABETH RIVER BASIN
- Institutional 47
- Critical Management Area 50
- Point Sources 51
- Nonpoint Sources 54
- Waterfront Development 57
- Solid and Hazardous Waste Management 59
- Air Pollution 61
- Information System 61
- Public Education 62
- Monitoring and Future Studies 63

ENDNOTES 66
BIBLIOGRAPHY 68

APPENDICES ..... VOLUME II

LIST OF TABLES

1 Water Quality Condition by River Branch 14

2 Existing Institutional Structure for Environmental Management - Elizabeth River Basin 23

LIST OF FIGURES

1 Elizabeth River Watershed 2

2 Elizabeth River Watershed Annual Nonpoint Source Pollutant Loads Compared to Existing Army Base, Lamberts Point and Pinners Point STPs Operating Levels 15

3 Summary - Goals Compatibility Analysis 21

4 Waterfront Land Use 40

EXECUTIVE SUMMARY

The Elizabeth River Basin Environmental Management Program has been developed by the SVPDC through a Coastal Resources Management Program grant from the Virginia Council on the Environment. It is the primary product of The Elizabeth River Watershed Special Assistance Project, developed cooperatively by the two agencies, to permit continued local government participation in water quality planning for the River. The Hampton Roads Water Quality Agency provided technical assistance on several facets of the project. Specific project objectives were:

- To protect critical aquatic resource areas from impacts typically associated with land development and conversion.
- To promote continued aesthetic attractiveness of the Elizabeth River.
- To provide reasonable pollution control options to local development review authorities and the private sector for potential development activities within the watershed.
- To develop a comprehensive regional stormwater management strategy for the Elizabeth River, which is coordinated with the strategy for the remainder of Southeastern Virginia.
- To coordinate and integrate other land use and environmental management efforts as they may impact on local governments and the Elizabeth River.

In accomplishing these objectives, the Project was to evaluate, finalize and facilitate implementation of the Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations (CERWQMP: PMR), developed in 1986 by the Hampton Roads Water Quality Agency and the SVPDC.

METHODOLOGY

The Elizabeth River Watershed Special Assistance Project included a series of technical studies. Several of these entailed a follow-up to analyses conducted during preparation of the CERWQMP: PMR. These technical studies are documented in detail in the Appendices to this report (Volume II). Specific technical studies completed during this project include:

- Review of the Implementation Status of the CERWQMP: PMR Recommendations - Appendix A.
- Goals Compatibility Analysis - Appendix B.

- Regulatory and Institutional Analysis - Appendix C.
- Review of State Land Use and Natural Resource Programs - Appendix D.
- Reevaluation of Proposed Elizabeth River Critical Management Area - Appendix E.
- Elizabeth River Basin Stormwater Management Strategy - Appendix F.
- Identification of Hazardous Waste Sites and Activities in the Elizabeth River Basin - Appendix G.
- Review of Water-Dependent Facilities and Shoreline Planning Requirements - Appendix H.
- Identification of Information System and Data Management Needs - Appendix I.

The Environmental Management Program (Volume I) summarizes and integrates the conclusions of these studies. A comprehensive implementation program is recommended.

FINDINGS

Thirty-four specific recommendations were included in the CERWQMP: PMR. Many of them have been or are being implemented by local governments, state and regional agencies and the private sector. At least some of the improvements that have occurred to water quality in the Elizabeth River are attributable to these implementation activities. Progress at the local level has been particularly noteworthy.

Water quality in the Elizabeth River has improved over the last decade, especially with respect to conventional pollutants, such as Suspended Solids and Biological Oxygen Demand. However, Toxics and Nutrients represent continuing water quality problems. These are attributable, in large part, to nonpoint source pollution. Historic activities are also implicated. Because of the natural character of the River and its watershed, management programs are required if conditions are to improve in the future.

There are a number of instances of potential conflict between environmental quality and development goals. This appears to be true at all levels of government. Cases of direct conflict or complete compatibility between goals are relatively few. Generally, it appears that management programs can minimize the degree of conflict between these sets of adopted and/or generally accepted goals.

A complex institutional structure to manage development and environmental quality in the Basin is in place. Historically, local government has emphasized land use and state agencies have stressed water quality in their environmental management activities. Local institutions have become more streamlined and state organization has become more complex over the last three years. Also, the lines of program emphasis have blurred, as agencies at both levels increase their attention to activities which have been the traditional focus of the other.

A wide range of regulatory programs are in place to manage this complex environment. However, there are areas of potential conflict within many of them. It appears that these potential conflicts are inherent in the nature of government and the regulatory programs. Only careful decision-making can achieve the balance necessary to resolve them. Techniques are available to enhance regulatory tools to assist in this effort.

It appears that a watershed-wide approach to environmental management is the most technically and scientifically defensible one. It is sufficiently flexible to accommodate the critical management area concept required by the Chesapeake Bay Preservation Act.

Nonpoint source pollution is a primary contributor to the water quality problems of the Elizabeth River. As Basin population and employment continue to grow, land use and development intensity will also increase. Concurrently, nonpoint source pollution will continue to be a significant and increasing component of water quality problems in the River, unless management programs are instituted. A variety of techniques are available to manage the adverse impacts of nonpoint source pollution. Implementation of many of them will enable local governments to satisfy the requirements of recent state and federal stormwater and land use management initiatives.

Many of the current water quality and living resource problems in the Basin are attributable to hazardous materials and wastes. The results of historic activities will continue to create environmental problems. Incidents involving the use and handling of these materials are increasing. Specific management programs are necessary to overcome the legacy of past disposal practices and to prevent future problems from occurring.

There is a need for increasing consideration of water- dependent and other shoreline uses. Local planning efforts will be required by state and federal programs. The remaining parcels of vacant waterfront land as well as those parcels that will be redeveloped provide the opportunity to accommodate water-dependent land uses. The potential for environmentally compatible development of these areas depends on local government management activities.

A better system for developing and obtaining improved land use and environmental quality information is necessary. Once that information is obtained, it appears that an automated (computerized) system should be developed to manage it in an efficient manner. Development of such a system would enable local governments to obtain and manage the wealth of data being developed by state and federal agencies.

RECOMMENDED MANAGEMENT PROGRAM

The Elizabeth River Basin Environmental Management Program recommends that a cooperative state, local and regional program be implemented to manage environmental quality in the Basin. Specific recommendations for improved management in the following areas are made:

- ***Institutional Structure**, including interagency coordination, enabling legislation, financing and modifications to local land development regulatory programs.*

- ***Watershed-Wide Environmental Management**, with special management attention being given to critical natural resources and land use activities that pose the greatest risk for adverse environmental impacts.*

- ***Point Source Pollution Control**, emphasizing continued implementation of state initiatives and regulatory programs, continuation of local and HRSD programs to improve operation of the wastewater treatment system, implementation of the SVPDC "Policy Statement on Provision of Sewage Collection and Treatment Facilities" and enhanced efforts by the U.S. Navy.*

- ***Nonpoint Source Management**, based on compliance with state and federal regulatory programs, implementation of Best Management Practices for all development and improved local operational and maintenance programs.*

- ***Waterfront Development**, including local planning efforts, modifications to local regulatory programs and improved operational practices at marinas.*

- ***Solid and Hazardous Waste Management**, including continued implementation of local and regional programs in these areas, increased attention in local regulatory programs and enhanced U.S. Navy cleanup and management efforts.*

- ***Air Pollution**, emphasizing improved coordination between state air and water agencies, especially with respect to "abrasive blasting" activities.*

- ***Information system**, specifically development of a regional Geographic Information System to support local environmental management efforts.*

- ***Public Education**, including encouragement for "good-housekeeping" programs, integration of public education programs being conducted through all environmental management programs and better information dissemination.*

- ***Monitoring and Future Studies**, emphasizing toxics monitoring, completion of state and federal resource studies to assist local government implementation of the Chesapeake Bay Preservation Act and related initiatives and additional groundwater analyses.*

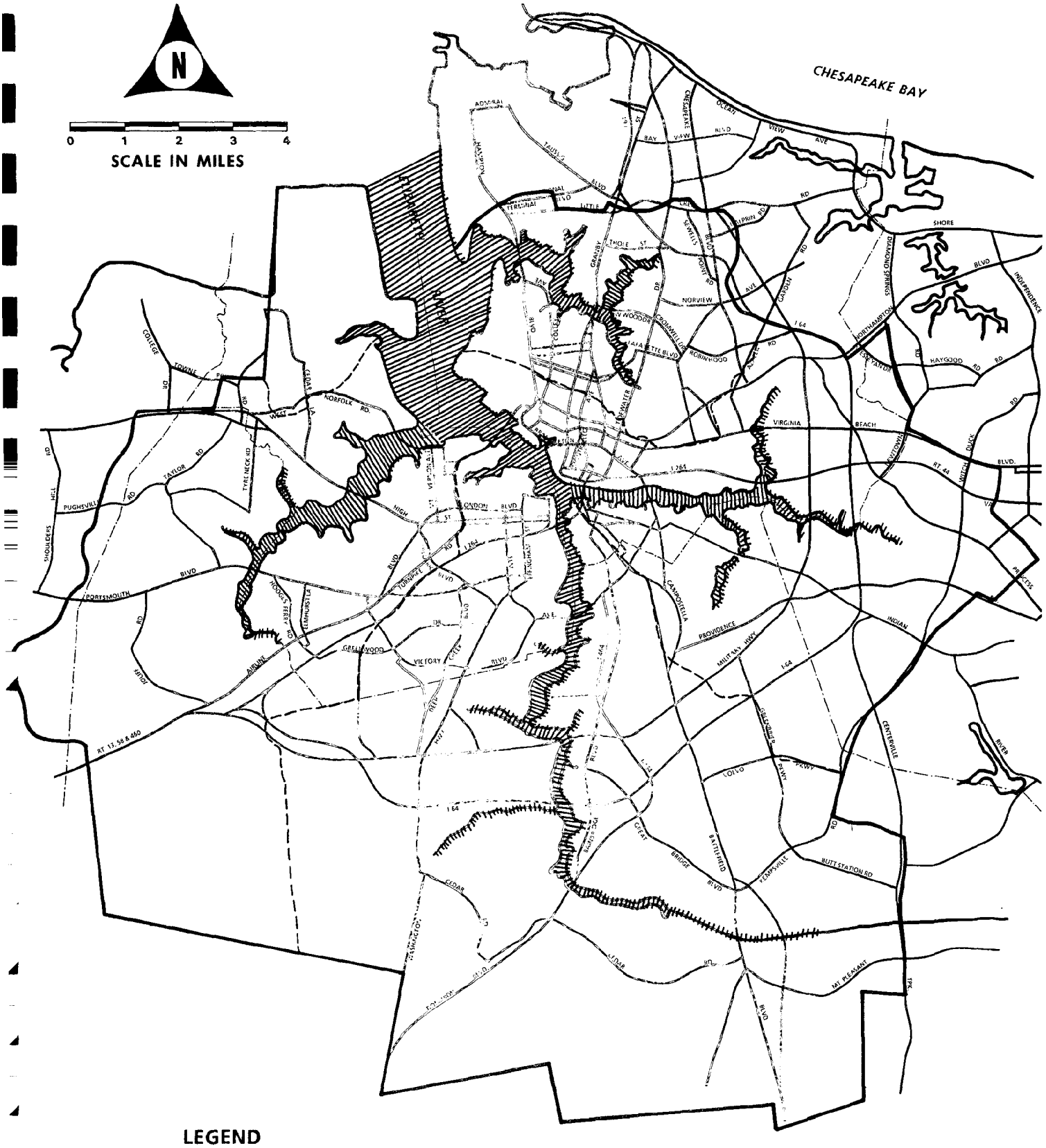
Successful implementation of this comprehensive environmental management program requires a delicate balancing act in state and local decision-making to achieve goals in the areas of social responsiveness, economic development and environmental protection. It requires new levels of local initiative supported by an informed public and by a state government that grants local governments the tools, both regulatory and financial, to accomplish this difficult mission. The recommended program provides an approach to accomplishing this for the Elizabeth River Basin. It also provides additional tools that should permit similar accomplishments in other Basins.

INTRODUCTION

The Elizabeth River is the dominant natural feature in the metropolitan heart of Southside Hampton Roads. Figure 1 depicts the Elizabeth River Watershed including the boundaries between the watersheds of each of the major tributaries to the River. It concurrently divides and unites the metropolitan cities of Chesapeake, Norfolk, Portsmouth and Virginia Beach. Environmental psychologists and urban designers tell us that the Elizabeth River is a "hard edge", an impenetrable barrier. Historically, this has been the case as toll ferries and tunnels have been necessary to move from one community to another. However, the River also unites the communities culturally and socioeconomically. It - Norfolk Harbor - is the "raison d' etre" for the metropolitan area. It is home to the world's largest Naval Complex, the world's largest coal exporting terminal, shipyards, numerous shipping terminals and a growing recreational boating industry. Many Hampton Roads residents depend directly or indirectly on the River for their livelihood. They are drawn by the millions for festivals along the downtown waterfronts. Increasingly, the residents of Hampton Roads are also united in their concern over the health of the River and their desire to improve its quality. All share in the benefits derived from the River, and all contribute to its problems.

Historically, many studies have documented degraded water quality conditions in the River and have recommended far- reaching solutions to those conditions. The Elizabeth River has been characterized by the Chesapeake Bay Program as one of the most highly polluted water bodies in the Bay. Innumerable studies of the Elizabeth River, conducted by the Virginia State Water Control Board, Hampton Roads Water Quality Agency, Virginia Institute of Marine Science, Old Dominion University and others, have identified several specific water quality problems, including:

- Bacterial contamination;
- Violations of Dissolved Oxygen standards;
- High levels of both toxic organics and heavy metals in bottom sediments;
- High levels of both toxic organics and heavy metals in the water column;
- Sediment buildup; and,
- Potential nutrient enrichment.



LEGEND

WATERSHED BOUNDARY

TRIBUTARY WATERSHED BOUNDARY

FIGURE 1
ELIZABETH RIVER WATERSHED

PREPARED BY SVPDC 1989

Discharges from point and nonpoint sources, shipyards and transient vessels have been implicated as causes of these conditions. All of the studies have identified a variety of issues that must be addressed to alleviate the problems. They include point and nonpoint source management, dredging and dredge spoil management, land and waterway use conflicts and shipyard and transient vessel discharges.

In 1986, the Hampton Roads Water Quality Agency and the Southeastern Virginia Planning District Commission completed the Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations (CERWQMP: PMR).[1] That study and its recommendations emphasized nonpoint source management and land use development, in particular waterfront development. It was anticipated that a second phase of this project would be undertaken to refine the recommendations and to integrate them with point source recommendations, being developed by the SWCB. Funding was not obtained and this project was not undertaken.

Completion of the CERWQMP: PMR was marked by confusion about the future direction of the Elizabeth River program at both the state and local levels. Efforts to develop a Comprehensive Water Quality Management Plan for the River have proceeded on two parallel, but independent, tracks. These independent efforts address the two outstanding issues, originally identified in the Hampton Roads Water Quality Management Plan a decade ago. They are:

- Toxic pollution, both ongoing and contamination from past activities; and,

- Nonpoint source pollution and the control thereof.

Efforts to identify sources of toxic pollution to the River and to develop control techniques are continuing under the auspices of the Virginia State Water Control Board. An element of the Governor's Chesapeake Bay Initiatives, the SWCB program is referred to as the Elizabeth River Restoration Strategy. A draft report, which will be briefly reviewed later in this document, has been prepared.

Nonpoint source pollution and the control thereof is being addressed through several activities at the state, federal and regional level. They include the State Nonpoint Source Management Program, Chesapeake Bay Preservation Act, EPA Stormwater Permitting Program and the Elizabeth River Watershed Special Assistance Project.

The Elizabeth River Watershed Special Assistance Project was conceived cooperatively by the Virginia Council on the Environment and the Southeastern Virginia Planning District Commission (SVPDC).[2] It was designed to ensure that land use and waterfront development were adequately considered in the continuing planning process and to ensure that local governments were involved in this process. Specifically, this project was to address the following objectives:

- To protect critical aquatic resource areas from impacts typically associated with land development and conversion.

- To promote continued aesthetic attractiveness of the Elizabeth River.

- To provide reasonable pollution control options to local development review authorities and the private sector for potential development activities within the watershed.

- To develop a comprehensive regional stormwater management strategy for the Elizabeth River, which is coordinated with the strategy for the remainder of Southeastern Virginia.

- To coordinate and integrate other land use and environmental management efforts as they may impact on local governments and the Elizabeth River.

In achieving these objectives, the Special Assistance Project was to evaluate, finalize and facilitate implementation of many of the recommendations contained in CERWQMP: PMR. The project would also assist the Basin's local governments in responding to other state and federal environmental initiatives.

This report documents the results of the Elizabeth River Watershed Special Assistance Project. Because of the variety of technical studies undertaken in this project, this report is organized, in two volumes, as a Plan Summary and series of Technical Appendices. The Plan Summary provides a brief overview of the technical analyses included in the Appendices.[3] It recommends specific actions to be taken by state and local agencies to achieve the goal of environmentally sound development in the Elizabeth River Basin. The Technical Appendices document the:

- Implementation Status of the recommendations contained in the CERWQMP: PMR;

- Updated goals and regulatory compatibility analyses;

- Reevaluation of the Critical Management Area concept;

- Stormwater Management Strategy, prepared in concert with the Regional Stormwater Management Strategy for Southeastern Virginia; and,

- Series of special studies of Hazardous Waste Activities, Water Dependent Uses and ongoing Information System and Data Management Needs.

BACKGROUND

The Elizabeth River's status as a critical water quality basin, stressed by nonpoint source and toxic contamination, has been underscored by the many studies completed within the last ten years. These are particularly important to the current study. They include:

- Hampton Roads Water Quality Management Plan, 1978.
- Hampton Roads Water Quality Management Plan: 1983 Implementation Status Report and HRWQMP Plan Update, 1983.
- Background and Problem Assessment Report for the Elizabeth River, 1984.
- Comprehensive Elizabeth River Water Quality Management Plan: Step One - Issue Identification, 1985.
- Comprehensive Elizabeth River Water Quality Management Plan: Step Two - Problem Agenda, 1985.
- Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations, 1986.
- An Evaluation of the Distribution of Toxicants/Mutagens in the Elizabeth River, Virginia in Relation to Land Use Activities, 1988.
- Elizabeth River 205(j) Water Quality Plan, (Draft), 1988.

The following overview is derived principally from the CERWQMP:PMR. It summarizes each of the foregoing studies as they relate to this project.[4] Studies and projects completed or undertaken since 1986 are also summarized.

HISTORICAL STUDIES

The Hampton Roads Water Quality Management Plan (HRWQMP) was the first study to take a comprehensive look at the relative roles of point and nonpoint source pollution in the health of area water bodies, including the Elizabeth River. It noted that nonpoint source pollutant loads to the Elizabeth River outweighed point source loads in both magnitude and impact. Both nutrient and toxic pollution problems were observed during the course of the study. Recommended solutions included implementation of nonpoint source pollution controls and an increased emphasis on control of toxic pollutants.

Activities to implement these recommendations were documented in great detail in the Hampton Roads Water Quality Management Plan: 1983

Implementation Status Report and HRWQMP Plan Update. Although significant progress was made during the period from 1978 to 1983, action on a number of recommendations was still required. Based on growing evidence of toxic problems in the River, the Plan Update recommended that a Comprehensive Water Quality Management Plan be prepared. That Plan was to establish the framework for implementing specific point source, nonpoint source and land use management strategies.

The Background and Problem Assessment Report for the Elizabeth River was prepared cooperatively by the Hampton Roads Water Quality Agency, Southeastern Virginia Planning District Commission and the Virginia State Water Control Board. It summarized the current (1984) status of the River and highlighted a number of issues that needed to be considered in a Comprehensive Plan for the River. They included:

- Establishment of water quality goals and the associated standards and regulations;
- Nonpoint source pollution and the control thereof; and,
- Waterfront development and the need to ensure compatibility of shoreline and riverine uses.

Implicit in this issue identification was the need to ensure compatibility between water quality and waterfront development goals. A cooperative state and local program to prepare a Comprehensive Plan for the Elizabeth River evolved.

To assist in the cooperative program, River User Groups were established and surveyed. These groups included representatives of industry, business, government agencies, research institutions and citizen groups. The survey results were reported in Comprehensive Elizabeth River Water Quality Management Plan: Step One - Issue Identification (CERWQMP: Step One). Nonpoint source and waterfront development issues were defined with greater specificity. This report was reviewed by the User Groups and used to establish Problem Agendas (Scopes of Work) for each of five issue areas.

The Problem Agendas were documented in Comprehensive Elizabeth River Water Quality Management Plan: Step Two - Problem Agenda (CERWQMP: Step Two). The User Groups and state-local management team further refined and clarified the issue statements during the process of reviewing this report. While stated separately in CERWQMP: Step Two, the nonpoint source and waterfront development issues were determined to be obviously interrelated. Analysis of these two issues was combined in the subsequent technical studies phase of the program.

The technical studies and recommended actions were documented in Comprehensive Elizabeth River Water Quality Management Plan: Preliminary

Management Recommendations (CERWQMP: PMR). Volume I provided a comprehensive overview of water quality conditions in the River and made thirty-four preliminary management recommendations. A number of continuing studies were also recommended. Volume II described the results of the Institutional and Land Use/Nonpoint Source Analyses. Appendix A highlights the implementation status of the CERWQMP: PMR recommendations.

The Virginia State Water Control Board completed the draft Elizabeth River 205(j) Water Quality Plan in 1988. It is a compilation of technical studies and plans, including the CERWQMP: PMR. Several of these studies were identified in the CERWQMP: PMR as necessary to address gaps in information and knowledge about the River. The SWCB draft plan reviews state, federal and local regulatory programs that deal with environmental management issues in the River and its watershed. It characterizes water quality conditions in the River. A comprehensive restoration strategy for the River, including both point and nonpoint source controls as well as additional study needs is recommended. Significantly, many of the land use and nonpoint source management recommendations are derived from the CERWQMP: PMR. This plan has not been formally released for review.

IMPLEMENTATION STATUS

The CERWQMP: PMR, completed in 1986, included thirty-four specific recommendations for action necessary to restore and maintain water quality in the Elizabeth River. Many of them have been implemented since that time. In a number of cases where recommendations have not been implemented, studies are underway or legislation has been enacted, laying the groundwork for future implementation. The current implementation status of those recommendations was determined as one element in establishing the direction for this project. In this review, no attempt has been made to attribute successful implementation to the CERWQMP: PMR. It is recognized that successful implementation is often due to parallel programs or initiatives. Appendix A describes the results of this review in detail.

The implementation status review indicates that the framework for future progress in managing the environmental quality of the Elizabeth River Watershed has been established. Progress with respect to local land use and environmental management has been especially noteworthy. Local governments have elevated the status of water quality protection as a goal in the local comprehensive plan and land use development process. Local environmental protection and waterfront access plans have been prepared and are being implemented. A Wetlands Board has been established by the City of Portsmouth to implement the City's new Wetlands Ordinance. The City of Virginia Beach has enacted a Stormwater Management Ordinance, which is applicable to most land development in the city. Local institutional reorganizations have improved local government's ability to respond to environmental issues.

Progress at the regional level has also been considerable. Household hazardous waste days have been held on several occasions by the Southeastern Public Service Authority of Virginia. SPSA has also established permanent collection points (transfer stations) for household hazardous wastes and recyclables such as used oil. A pilot curbside recycling program has been instituted. The Hampton Roads Sanitation District has continued its efforts to construct the Virginia Initiative Plant to replace two outmoded wastewater treatment plants in the Elizabeth River Basin. HRSD and the localities are continuing their efforts to eliminate infiltration/inflow to the wastewater system. HRSD has also established a Systems Reliability Division. Ongoing public education efforts are being conducted by each of these regional agencies, including the SVPDC and the HRWQA.

State efforts have entailed implementation of new programs in response to new legislation and on refinement of existing programs. Antifoulant paints, containing Tributlytin, have been banned for most vessel applications. The SWCB staff have indicated that most shipyards in the Basin have stopped applying it even in approved applications. A ban on the use of phosphate detergents has been enacted, resulting in improved wastewater treatment plant performance. The SWCB has increased enforcement of discharge regulations and is developing new, more sophisticated control techniques for discharges from shipyards. Finally, through the efforts of the SWCB and various state research institutions, an intensified water quality monitoring program is being implemented. In conjunction with a number of special water quality and discharge evaluation studies, this program will fill many of the data gaps identified in previous water quality studies of the Elizabeth River.

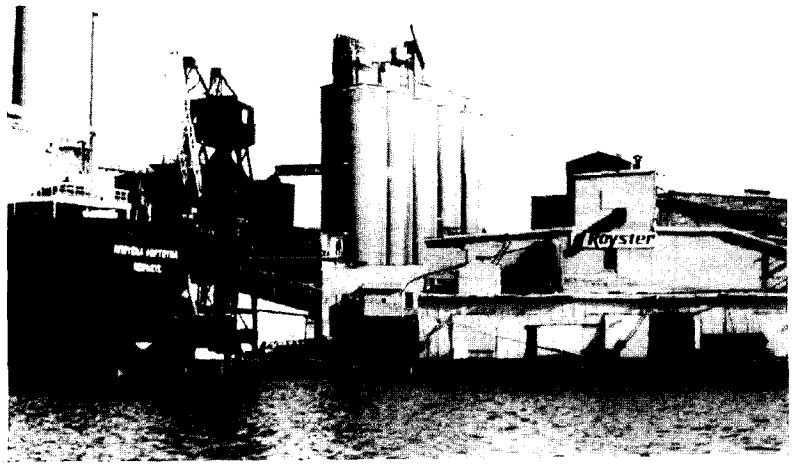
WATER QUALITY CONDITIONS

SYSTEM CHARACTERISTICS

Water quality in the Elizabeth River is controlled by the nature of the River and its watershed as well as by man's activities. The Elizabeth River is located in the Coastal Plain of Virginia. It has a drainage area of approximately 225 square miles. The watershed is flat with a maximum natural elevation of about twenty (20) feet. Areas in close proximity to the Main Stem and lower Branches are intensively developed for urban activities. Naturally, the River itself is a shallow estuary. To accommodate its use by Naval and commercial vessels, the River has been dredged extensively.

Freshwater input to the River system is minimal. There are no free-flowing tributaries. The urbanized character of the watershed reduces groundwater base flow to the River. The Main Stem and Southern Branch are key components of the Atlantic Intracoastal Waterway. Locks at Great Bridge and Deep Creek further constrain freshwater input to the River. Thus, the primary inputs of "fresh" water are stormwater runoff and the effluent discharged from municipal and industrial wastewater treatment facilities. As might be expected, the River is saline and periods of low rainfall result in higher than average salinity levels throughout the River, but especially in the upper tributaries. This tends to exacerbate the impacts of pollutant discharges in these areas.

Tidal currents are relatively weak. Wind currents and other factors produce a fairly homogeneous, well-mixed estauarine system. As a result, tidal exchange with adjacent water bodies is slow. Coupled with minimal freshwater input, this means that pollutants in the Elizabeth River have a long residence time. The pollutants are either degraded within the system or settle to the bottom, becoming part of the pollutant memory of the system. As they are released through natural action and future dredging, they contribute to future water quality problems.



To accommodate large vessels, extensive, deep channels have been dredged in the Main Stem and lower Eastern and Southern Branches. In many cases, dredging to depths comparable to the channels has been accomplished bank-to-bank. This dredging has eliminated much of the flat, shallow parts of the estuary which, especially when vegetated, provided spawning beds, nursery areas and habitat. Together, land development to the bank and dredging have also eliminated much of the natural pollutant buffering capacity of the watershed. Recent studies have also shown that pollutant levels and concentrations tend to be higher in the shallow margins of the estuary.

HISTORICAL CONDITIONS

The Elizabeth River has exhibited water quality problems for decades. Bacterial surveys, conducted by the U.S. Public Health Service in 1914 and 1934, concluded that bacteria levels were too high to permit continued direct marketing of oysters taken from the Elizabeth River. The results of these surveys led the Commonwealth of Virginia to establish the Hampton Roads Sanitation District to provide wastewater treatment service throughout the basin and the adjacent metropolitan area. Subsequent surveys show that conditions are improved but bacteria levels remain too high for direct marketing of shellfish. In the 1970s, algae blooms, attributable to elevated nutrient levels, were observed in the upper reaches of many of the tributaries. Scientists and public officials have long suspected that the industrial character of the basin was causing problems with toxic pollutants.

CURRENT CONDITIONS

No new water quality sampling has been undertaken as part of this study. Characterization of instream or ambient water quality has relied on the conclusions reached by a variety of other studies. Appendix F includes an extensive review of these conclusions. Insofar as toxic pollutants are concerned, Appendix G summarizes the conclusions and recommendations of the recent ODU study. Table 1, excerpted from the CERWQMP: PMR, highlights water quality conditions in the River and its tributaries for a variety of conventional and toxic pollutants. That characterization of River water quality is consistent with the discussions in the above-noted Appendices.

SWCB studies completed in 1975, 1986 and 1988 concluded that the Elizabeth River suffered from water quality degradation attributable to both toxic and conventional pollutants. These problems were exacerbated by the nature of the River system and its tributary watershed. In its draft Elizabeth River 205(j) Water Quality Plan, the SWCB concluded that the Elizabeth River is:

> "ill-suited to assimilate and disperse the pollutants which enter through numerous sources located throughout the system. Therefore, the introduction of pollutants must be reduced or eliminated to improve the environmental quality of the Elizabeth River."[5]

As indicated previously, stormwater runoff is a primary source of freshwater flow to the Elizabeth River. Stormwater runoff carries considerable loads of nonpoint source pollutants. The Hampton Roads Water Quality Management Plan concluded that:

> "Water quality problems will persist in the Elizabeth River through the year 1995. The principle problem appears to be nonpoint loads rather than point source effluents."

That Plan anticipated that most point source discharges would be eliminated through connection to HRSD or through alternative treatment methods. While not as many point sources have been removed as was anticipated in 1978, the overall conclusion about the role of nonpoint source pollution in the water quality problems of the Elizabeth River remains valid. It has been confirmed by the research conducted since that time.

NONPOINT SOURCE EVALUATION

One element of this study involved the preparation of a Stormwater Management Strategy for the Elizabeth River. An updated estimate of nonpoint source loadings to the River was prepared and is documented in Appendix F. The loadings estimate covers conventional pollutants, such as Biological Oxygen Demand, Fecal Coliforms and Total Suspended Solids; Nutrients including both Nitrogen and Phosphorus; and, Heavy Metals, including Zinc and Lead. Estimates for other toxic parameters, including copper, tin, polynuclear aromatic hydrocarbons and other organic compounds, were not developed. Generally, these pollutants are generated by site-specific activities that do not lend themselves to the development of generally applicable loading factors. Also, no estimates were developed for site-specific land uses, such as construction and outside materials storage. Therefore, the loadings estimate is conservative. It does provide a reasonable indication of the magnitude of future nonpoint source problems.

Figure 2 compares estimated nonpoint source loadings to the Elizabeth River to actual loadings from the three existing municipal sewage treatment plant discharges to the River. Nonpoint source loadings are based on 1985 land use conditions in the basin and sewage treatment plant loadings are based on actual operating experience. It should be noted that point source loadings from municipal sewage treatment plants should decrease in the future with completion of the Virginia Initiative Plant.

Nonpoint sources contribute significantly to overall pollutant loadings to the River. They are the dominant source of Suspended Solids and Metals. No comparison of Fecal Coliform loadings was made, because the disinfection process at the sewage treatment plants virtually eliminates Fecal Coliform loadings. In that case, nonpoint source pollution, including transient vessel traffic, is the sole contributor. For many of the parameters for which loading factors were not developed, nonpoint sources, including vessels, are also the primary contributor. These include polynuclear aromatic hydrocarbons and many of the heavy metals. The recent ODU study documented elevated levels of many of these toxic substances in the River.[6] In many cases, nonpoint sources were the only feasible source of these loadings.

These loadings estimates do not translate directly into water quality problems. The actual water quality degradation attributable to them can only be determined through a water quality modelling effort. That has not been accomplished as part of this study. The site-specific location of the actual loading to the River will determine, in large part, the resulting water quality and critical resource degradation. However, previous modelling studies concluded that if all point source discharges to the Elizabeth River were eliminated, future nonpoint source loadings would continue to prevent attainment of some water quality standards and desired uses.

POINT SOURCE POLLUTION

As indicated earlier, the SWCB has prepared a draft water quality plan for the Elizabeth River. It includes an evaluation of the role of point sources in water quality conditions. It also includes recommendations for improved management of point source discharges, including increased enforcement efforts. The Elizabeth River Watershed Special Assistance Project has not addressed point source pollution to the River. Therefore, in developing a recommended management strategy for the Elizabeth River, this project incorporates the SWCB Plan's recommendations.

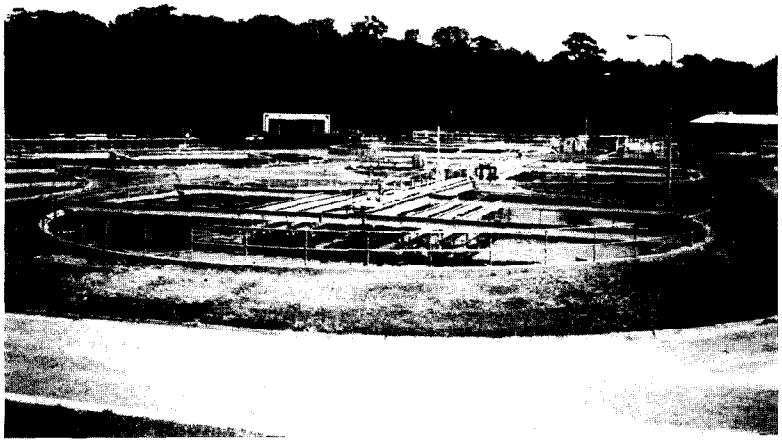


TABLE 1

WATER QUALITY CONDITION BY RIVER BRANCH

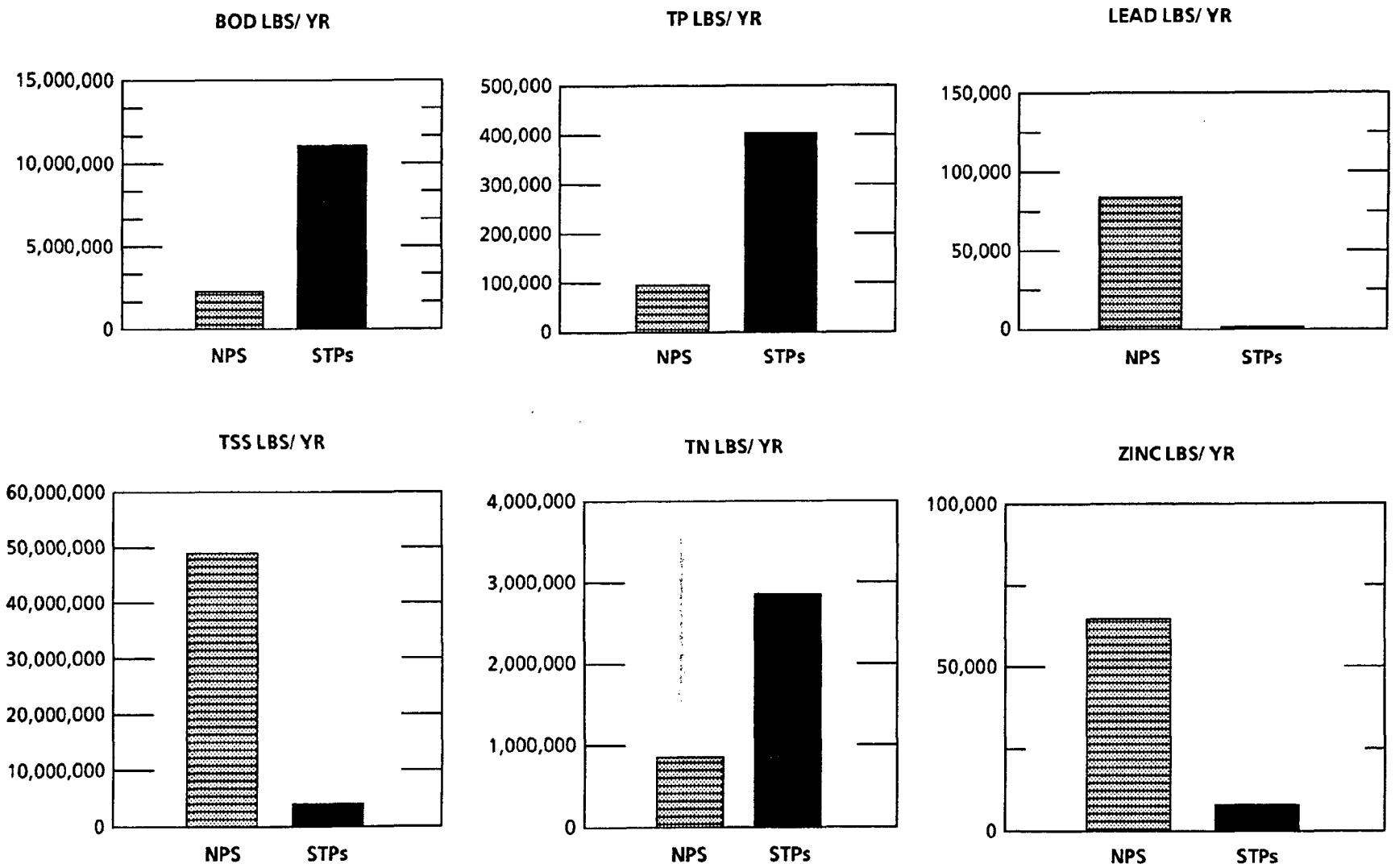
SEGMENT/ PARAMETER	MAIN STEM	WESTERN BRANCH	EASTERN BRANCH	SOUTHERN BRANCH
DO[1]	MARGINAL	MARGINAL	MARGINAL	MARGINAL
BOD[2]	MARGINAL	MARGINAL	MARGINAL	MARGINAL
CHL'A'[3]	GOOD	GOOD	GOOD	MARGINAL
FEC COL I[4]	POOR	POOR	POOR	POOR
TN[5]	GOOD	GOOD	GOOD	GOOD
TP[6]	GOOD	GOOD	GOOD	GOOD
ARSENIC	GOOD	GOOD	GOOD	GOOD
CADMIUM	MARGINAL	MARGINAL	MARGINAL	MARGINAL
CHROMIUM	GOOD	GOOD	GOOD	GOOD
COPPER	POOR	POOR	POOR	POOR
LEAD	POOR	POOR	POOR	POOR
MERCURY	POOR	MARGINAL	MARGINAL	MARGINAL
NICKEL	POOR	POOR	POOR	POOR
ZINC	MARGINAL	MARGINAL	MARGINAL	MARGINAL
PNAH[7]	GOOD	NO DATA	NO DATA	POOR
TBT[8]	LIMITED DATA	LIMITED DATA	LIMITED DATA	LIMITED DATA

NOTES:

1 Dissolved Oxygen
2 Biological Oxygen Demand - 5 day
3 Chlorophyl 'a'
4 Fecal Coliform
5 Total Nitrogen
6 Total Phosphorus
7 Polynuclear Aromatic Hydrocarbons
8 Tributyltin

Source: *HRWQA, Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations, 1986.*

FIGURE 2
ELIZABETH RIVER WATERSHED ANNUAL NONPOINT SOURCE POLLUTANT LOADS COMPARED TO EXISTING ARMY BASE, LAMBERTS POINT, AND PINNERS POINT STPs OPERATING LEVELS



Source: HRWQA, 1989.

GOALS COMPATIBILITY ANALYSIS

Over the past decade, citizens and local and state officials have been involved in extensive discussions about the water quality and development goals to be achieved in the Elizabeth River Basin. That issue was highlighted as critical to the development and success of any management plan for the Basin. All parties to these discussions have agreed that desired and achievable uses of the River should determine the specific goals to be achieved. Specific approaches to restoring and maintaining water quality in the River would be developed based on the goals to be achieved. Implementation costs would, in turn, be determined by the River goals and related management approaches.

Secondarily, it was believed that development goals should be compatible with the desired water quality goals. Conflict between development and water quality goals was believed to impede progress toward achieving the desired water quality goals. Concern was also expressed that development goals conflicted among themselves.

In an attempt to determine whether goals conflict was, in fact, impeding progress in achieving environmental quality goals in the Elizabeth River Basin, the State Water Control Board, Hampton Roads Water Quality Agency and Southeastern Virginia Planning District Commission embarked on a comprehensive planning effort in 1984. It was determined that a consensus building approach should be followed to identify appropriate water quality goals for the River. Local development goals would be identified. Areas of conflict and compatibility between the two sets of goals would be determined. Finally, recommendations for modifications to the goals, which were necessary to resolve areas of conflict, would be developed.

RIVER USE/CHARACTER GOALS

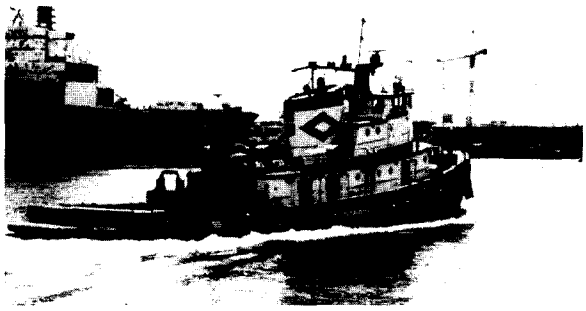
To carry out the consensus building approach, the HRWQA and SVPDC established and worked closely with River User Group Task Forces. These Task Forces were comprised of representatives of the great variety of interest groups concerned with the River. They included representatives of the basin's local governments, state and federal agencies, research institutions, industry, business and citizen groups. Members of each group were surveyed to determine critical issues and goals from their perspective.

Through the River User Group process, basic water quality and land use goals for the Elizabeth River Basin were established. They were as follows:

- *To maintain the usage of the river system as an "industrial and commercial highway".*

- *To maintain the aesthetic quality of the river system for the enjoyment of users.*

- *To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.*



- *To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.*

- *To encourage waterfront land use activities and decisions compatible with the other goals.*[7]

These goals were documented in the CERWQMP: PMR, published in 1986. They have been modified to reflect the extensive discussions of water quality goals that has occurred since that time. At the inception of this project, they were reviewed and determined to remain valid. (It should be noted that the above listing and subsequent discussion does not reflect a prioritization of the goals.)

WATER QUALITY GOALS

Federal and state laws have established water quality goals for all waterbodies, including the Elizabeth River and its tributaries. The federal goal was established in the Federal Water Pollution Control Act Amendments of 1972, while the state goal is established by the State Water Control Law. Although the goals statement is worded slightly differently in these two statutes, the basic intent is the same:

- *To restore water quality to the point that streams are "swimmable and fishable"; and,*

- *to maintain the quality of all waterbodies at that level.*

While both the federal and state water quality statutes have been amended several times over the last two decades, the goal of both remains the same.

The 1987 Chesapeake Bay Agreement documents six basic water quality goals for the Bay and its tributaries and a variety of strategies for achieving them. The Agreement goals are more specific expressions of the statutory goals. They address habitat protection, point and nonpoint source pollution control, management of the environmental impacts of growth and development and public education. The Agreement also includes the non-water quality goal of increasing public access and use of the Bay and its tributaries. Finally, the Agreement addresses the question of institutional arrangements and participation in the management of the Bay and its tributaries.

LOCAL DEVELOPMENT GOALS

The Elizabeth River Basin encompasses all or portions of four cities - Chesapeake, Norfolk, Portsmouth and Virginia Beach. Each has an adopted Comprehensive Plan, which generally contains the City's official statement of development and environmental quality goals. In all cases, regulatory measures and functional plans contain additional, more specific statements of goals.

In all communities, the basic Comprehensive Plan goal is derived from Sections 15.1-427 and 15.1-489 of the Code of Virginia - to promote the health, safety and general welfare of the public. All other goals statements follow from that. In the broadest terms, local goals, as they relate to the Elizabeth River Basin, can be summarized as follows:

- *To promote economic development in order to increase employment opportunities and to increase the economic stability of the community.*
- *To promote the development of the Port of Hampton Roads.*
- *To revitalize older urban areas including the Elizabeth River waterfront.*
- *To provide housing opportunities for all residents of the community.*
- *To protect water quality in the waterbodies of the community.*
- *To maintain and enhance environmental quality in the community in order to maintain the high quality of life for which Hampton Roads is noteworthy.*
- *To provide increased opportunity for public access to the water for both recreation and aesthetic purposes.*

These goals are the products of an ongoing planning process. Over the past three years, the status of comprehensive planning in the region has changed significantly. Revised comprehensive plans have been adopted by the Cities of Chesapeake and Portsmouth. The Cities of Norfolk and Virginia Beach are currently revising their plans. During the interim, the City of Virginia Beach completed a detailed review of its policies and strategies addressing water quality management. This review resulted in modifications to its land use regulatory process to increase attention on water quality protection.[8] Further revisions of the plans of all four communities are expected during the next two years, in part, due to the requirements of the Chesapeake Bay Preservation Act.

COMPATIBILITY ANALYSIS

At the inception of the process to develop both the CERWQMP: PMR and this report, it was believed that goals competition and conflict played an important role in determining the region's ability to achieve water quality goals. Therefore, it was believed that an initial step in the planning process should be to define areas of goals conflict and compatibility.

The Comprehensive Plans of the basin's four cities have been reviewed in light of the River Use/Character Goals, agreed upon during the River User Group process, and the adopted state and federal water quality goals. In completing this review, the relationship between the adopted development goals of the four communities and the state and federal water quality goals and the River Use/Character Goals has been identified. This relationship has been categorized as Compatibility, Potential Conflict or Conflict. Appendix B describes this analysis in detail.

Goals conflict was defined as a situation where the achievement of one goal was likely to have an adverse impact on the ability to achieve another goal or to preclude it altogether. Potential conflict occurred when achievement of one goal would have an adverse impact on achievement of another goal unless management intervention occurred. Goals were compatible when achievement of one goal would either have no impact on achievement of the other or where the two goals were mutually supportive.

The analysis of goals compatibility was initially completed during preparation of the CERWMP: PMR. It has been updated to reflect the extensive local efforts, over the last three years, to update comprehensive plans and to review environmental protection programs. Figure 3 summarizes the results of the compatibility analysis. It compares the goals summary, noted above, to the water quality and river character goals. (Refer to Appendix B for details of the analysis for each community.)

The review of individual local goals revealed a few minor cases of goals conflict. For example, preservation of all nontidal wetlands in the basin is likely to preclude achievement of additional port development or vice versa. Local environmental quality goals are generally compatible with the water quality goals and with most of the river character goals. In most cases, the potential for conflict between development and water quality goals exists. Thus, it appears that specific management activities must be undertaken to ensure that both sets of goals are achieved with a minimum of adverse impact.

With respect to the basin-wide development goals, a similar situation exists. There are no instances of complete conflict between these broad, general goals. Only in the case of local environmental goals is there total compatibility with water quality goals. Local economic and port development goals are compatible with the

river use/character goal of "continued use of the River as an industrial and commercial highway." In all other cases, the potential for conflict between the goals exists.

No attempt has been made to ascertain the potential for conflict among state or federal development and water quality goals. However, it is obvious that a similar situation does exist. For example, both the state and the federal government have the goal of enhancing the Port of Hampton Roads, while improving water quality in the Elizabeth River. Again, management efforts are required to simultaneously achieve these goals. Even state and federal legislation enacted specifically for water quality purposes contains this dichotomous goals relationship.

The CERWQMP: PMR recommended that all basin localities adopt water quality protection as a goal of their Comprehensive Plans. This action would provide the legal and logical basis for incorporating water quality protection into their land use regulatory measures. All localities have now adopted water quality protection as a goal of the comprehensive plan or have included it in a special goals statement. In carrying out the requirements of the Chesapeake Bay Preservation Act to incorporate water quality protection into the comprehensive plan and related regulatory measures, further emphasis will be placed on the role of water quality protection in the comprehensive plan. The legal basis to support local water quality goals is now present. Also, the CBPA recognizes the integral relationship between water quality and a healthy economy. Thus, the need to manage the potential conflict between these goals has been formally recognized as an issue in water quality management.

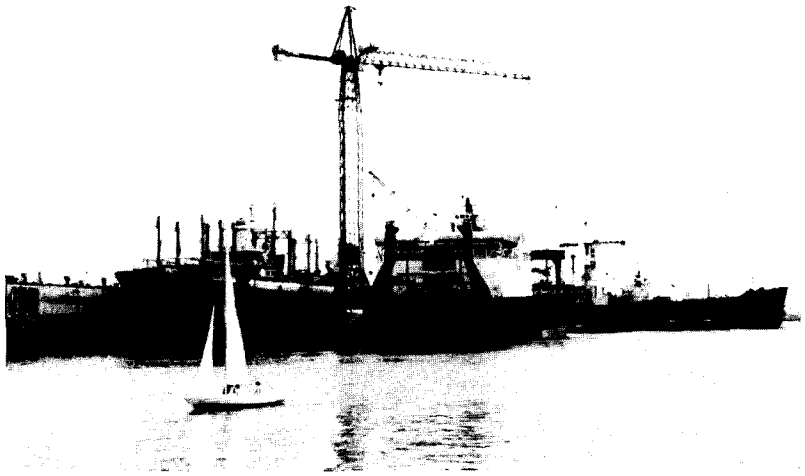


FIGURE 3
SUMMARY
GOALS COMPATIBILITY ANALYSIS

DEVELOPMENT GOAL	WATER QUALITY/RIVER CHARACTER GOAL					
	To restore and/or maintain water quality in the river at a level sufficient for fishing and swimming.	To maintain the usage of the river system as an 'industrial and commercial highway.'	To maintain the aesthetic quality of the river system for enjoyment of users.	To improve and maintain water quality at a level which does not threaten the health of living resources (human and non-human) using the river system.	To prevent river system use activities from adversely impacting the environment in adjacent waterways and areas.	To encourage waterfront land use activities and decisions compatible with other goals.
To promote economic development in order to increase employment opportunities and to ensure economic stability.	X		X	X	X	X
To promote the development of the Port of Hampton Roads.	X		X	X	X	X
To revitalize older urban areas, including the Elizabeth River Waterfront.	X	X	X	X	X	X
To provide housing opportunities for all community residents.	X	X	X	X	X	X
To protect water quality in all waterbodies of the community.		X				X
To maintain and enhance environmental quality in order to maintain the region's high quality of life.		X				X
To provide increased opportunity for public access to the water for aesthetic and recreation purposes.	X	X		X	X	X

LEGEND:

☐ COMPATIBLE

☒ POTENTIAL CONFLICT

▮▮ CONFLICT

Source: Southeastern Virginia Planning District Commission, 1989.

REGULATORY ANALYSIS

The goals compatibility analysis revealed that the local regulatory environment was the key to allowing the concurrent achievement of environmental and development goals while minimizing the areas of conflict between them. To determine whether that could be accomplished or not, the existing institutional structure as well as the regulatory programs of those institutions were examined.

Both the CERWQMP: PMR and this report have reviewed the institutional structure for environmental management in the Elizabeth River in detail. Both studies have also reviewed local development regulations to determine their sufficiency for addressing areas of goals conflict and to determine whether those regulations themselves conflict with achievement of water quality goals. Finally, both studies have examined programs being implemented in other states to determine whether any of the experiences might be transferrable to the Elizabeth River. Appendices C and D to this study describe the results of this review. Emphasis is placed on changes to the institutional and regulatory environment since 1986.

INSTITUTIONAL STRUCTURE

A variety of federal, state, local and regional agencies are involved in land and water resource management as they affect the resources of the Elizabeth River Basin. Table 2 depicts the array of primary agencies and their area(s) of responsibility. Most of these agencies were in existence in 1986. This listing is not meant to be all inclusive. Generally, these agencies have the same areas of responsibility today.

The analysis reveals that the institutional structure has become somewhat more complex, especially at the state level where new agencies and programs have been created. Of particular significance is the Chesapeake Bay Local Assistance Department and its Chesapeake Bay Preservation Area program. The newly enacted legislation, providing for stormwater management planning and regulation, is also of tremendous significance in enhancing local ability to address the areas of potential conflict between development and environmental protection. A variety of activities in the areas of environmental protection, development management, public access to the water and institutional coordination have also resulted from the 1987 Chesapeake Bay Agreement. At present, these activities have not resulted in the development of new institutions with management responsibilities affecting the Elizabeth River.

TABLE 2
EXISTING INSTITUTIONAL STRUCTURE FOR ENVIRONMENTAL MANAGEMENT
ELIZABETH RIVER BASIN

AGENCY	RESPONSIBILITY
Federal Agencies	
Environmental Protection Agency	Air Quality, Water Quality (Point and Nonpoint Source) Solid and Hazardous Waste, Wetlands Resources, Groundwater
U.S. Navy	Facilities and environmental management as a property owner or lessor
Corps of Engineers	Dredging, Wetlands, Navigation Improvements
Coast Guard	Spill Prevention and Cleanup
Department of Agriculture	Soils information, farm plans, forestry plans and practices
Department of Commerce	Coastal Resources Management Program, oceanographic and atmospheric research
Department of Interior	Fisheries, Wetlands Resources, Endangered Species
State Agencies	
Council on the Environment	Coastal Resources Management Program, Environmental Impact Review and Coordination
State Water Control Board	Water Quality, Water Supply, Groundwater, Point Source Permits, Related Issues
Air Pollution Control	Air Quality

TABLE 2 (continued)
EXISTING INSTITUTIONAL STRUCTURE FOR ENVIRONMENTAL MANAGEMENT
ELIZABETH RIVER BASIN

AGENCY	RESPONSIBILITY
State Agencies	
Health	Water and Wastewater Facility Design, Drinking Water, Shellfish Sanitation, Shoreline Sanitation
Waste Management	Solid Waste, Hazardous Waste, Nuclear Waste, Litter Control, Hazardous Materials Emergency Planning (with Emergency Services), Superfund
Conservation and Historic Resources	Soil Erosion, Nonpoint Sources, Recreation and Public Access, Stormwater Management, Agriculture
Marine Resources Commission	Wetlands, Subaqueous Lands, Marine Fisheries
Game and Inland Fisheries	Freshwater Fisheries, Public Access, Wildlife Management
Chesapeake Bay Local Assistance	Water Quality, Nonpoint Sources, Sensitive Areas, Land Use
Port Authority	Facilities and development management as a land owner and lessor
Regional Agencies	
Hampton Roads Sanitation District	Wastewater Treatment
Southeastern Public Service Authority of Virginia	Solid Waste Disposal, Hazardous Waste Management

TABLE 2 (continued)

EXISTING INSTITUTIONAL STRUCTURE FOR ENVIRONMENTAL MANAGEMENT

ELIZABETH RIVER BASIN

AGENCY	RESPONSIBILITY
Regional Agencies	
Southeastern Virginia Planning District Commission	Regional Comprehensive Planning and Technical Assistance
Hampton Roads Water Quality Agency	Water Quality Planning and Environmental Technical Assistance
Local Agencies	
Cities of Chesapeake, Norfolk Portsmouth and Virginia Beach	Planning, Development Regulation, Service Provision
Virginia Dare Soil and Water Conservation District	Agriculture, Nonpoint Sources, Soil Erosion

SOURCE: SVPDC, 1989.

While institutional complexity has increased at the state level, the local institutional structure has become somewhat more streamlined. In all basin localities, a Deputy City Manager or equivalent position has been given day-to-day responsibility for coordinating the activities of all city departments involved in physical development, including environmental management. This organizational structure facilitates development review, resolution of inter-departmental conflicts and focusses responsibility for land development and resource management. The City of Virginia Beach has created an Office of Environmental Management with specific responsibility for ensuring that environmental factors are given adequate consideration in all development decisions. Other cities have and are considering a similar arrangement.

REGULATORY FRAMEWORK

A wide variety of regulatory and incentive programs have been adopted by essentially all of the agencies included in the complex institutional structure, described above. Historically, the most important of these for both land use development and nonpoint source pollution control have been found at the local level. These local programs include Zoning, Subdivision Control, Wetlands Management, Erosion and Sediment Control and public facility design criteria. Recent local innovations have included Stormwater Management and buffering and landscaping requirements.

State and Federal Programs

New state and federal programs to manage land use development and nonpoint source pollution have been created. These include the EPA Stormwater Discharge Permitting Regulations, Chesapeake Bay Local Assistance Board regulations implementing the CBPA, and the new state legislation providing for local stormwater management programs. Appendix J reviews the EPA Stormwater Permitting program as it affects local governments. The Chesapeake Bay Preservation Act and Virginia stormwater programs are reviewed in Appendix C.

The thrust of the new state and federal programs is to elevate the importance of water quality protection in the local land use regulatory process. Because the EPA program requires local governments to assume legal responsibility for discharges from their storm sewers, they will need to be increasingly concerned with the quality of discharges to those storm sewers. It appears that the state stormwater program and the CBPA program provide the necessary authorization for local governments to adopt a regulatory approach to ensuring that discharges from their stormwater systems do not violate EPA requirements because of land use activities in the watershed. In other words, these new state and federal programs will enable local governments to address some of the regulatory deficiencies identified in the CERWQMP: PMR.

Local Programs

Basin-wide, the array of local government management tools that have been adopted is not appreciably different than was the case in 1986. All basin localities have adopted Zoning Ordinances, Subdivision Regulations, Erosion and Sediment Control Ordinances and Programs, Flood Plain Protection, Site Plan Review and Wetlands Zoning. They have also developed the public facility design standards necessary to implement these programs. Increasingly, basin localities are using buffering and landscaping requirements to mitigate instances of incompatibility between adjacent developments.

Major regulatory initiatives have been undertaken by each of the basin's local governments. Concurrently with local efforts to revise their comprehensive plans, the Cities of Chesapeake and Portsmouth have developed comprehensive revisions to their Zoning Ordinances. While the Chesapeake Ordinance was not available for review as part of this study, it is expected, based on the nature of the Comprehensive Plan revision, that it will include increased consideration of environmental protection. The Portsmouth Ordinance does not include specific consideration of water quality protection. However, the City staff has indicated their intent to incorporate water quality to reflect the CBPA criteria, when they are finalized.

Virginia Beach adopted revised Zoning and other development Ordinances in 1988. This ordinance revision package was linked to the adoption of a Stormwater Management Ordinance for the City. It reflects increased attention to water quality protection in the land development process. Further revisions can be expected following development of the final CBPA criteria. The City of Norfolk is presently revising its Zoning Ordinance in conjunction with a major update to its Comprehensive Plan. Again, City staff indicate their intent to include greater consideration of water quality protection and the CBPA criteria in these revisions.

Three major steps have been taken to increase local regulatory consideration of water quality protection. They are adoption by the City of:

- Norfolk of a Site Plan Review Ordinance, which incorporates consideration of a project's compatibility with its environment;
- Portsmouth of a Wetlands Ordinance in conformance with the model ordinance in the Virginia Wetlands Act; and,
- Virginia Beach of a Stormwater Management Ordinance which requires implementation of Best Management Practices in most significant land development.

These steps, coupled with the Ordinance revision process, described above, address many of the concerns outlined in the CERWQMP: PMR.

REVIEW OF STATE PROGRAMS

In conducting this study, land use and natural resource management programs enacted by other states were reviewed. Programs reviewed in detail included the following:

- Virginia Chesapeake Bay Preservation Act
- North Carolina Coastal Area Management Act
- Maryland Critical Area Law
- Oregon Comprehensive Planning and Growth Management Law of 1973, as amended in 1976.

Programs adopted by the States of Florida and Georgia were also reviewed. Appendix D provides detailed documentation of that review. In addition, the management approach used in the Grays Harbor area of Washington state, which is similar to the Elizabeth River Basin, has been reviewed. This information was particularly useful in reevaluating the Critical Management Area concept, recommended in the CERWQMP: PMR.

Given the differing powers of local governments in each of these states, it does not appear that any of the other state programs are directly transferrable to the Elizabeth River Basin. It appears that additional state legislation would be required to implement many of these programs in Virginia. In light of recent initiatives at both the state and local levels, it is also not clear that new legislation along the lines of any of the other state programs is warranted. In fact, application of another state's program to the Virginia situation could be counterproductive at this juncture.

COMPATIBILITY ANALYSIS

A complex and comprehensive institutional structure for dealing with land use development and environmental protection issues is in place. While none of those institutions is specifically charged with environmental management in the Elizabeth River Basin in its entirety, each has responsibility for an area that includes the Basin. Historically, state and federal agencies have been only peripherally involved in land use management; their emphasis has been water quality. Conversely, local institutions have focussed on land use and only secondarily on water quality and environmental protection.

The line of distinction has blurred considerably in the past three years as institutions at all levels have increased the scope of their regulatory endeavors. However, their focus of attention has not changed markedly. State and federal agencies have increased their involvement in land use decision-making from a water quality perspective. Local governments are increasingly concerned with water quality, but from a land use perspective. Also, state enabling legislation has been enacted which permits local governments to actively address water quality in their land use decisions.

As in the goals compatibility analysis, this study has examined local development regulations to determine their compatibility with water quality protection. The relationship between development regulations and water quality goals has been categorized as follows: Conflict, Potential Conflict and Compatibility. No instance of direct conflict between local development regulations and water quality goals was identified. Many local regulations, including Wetlands, Flood Plain regulations, and public facility standards requiring connection to the municipal sewer system, are mutually supportive of the achievement of water quality goals.

Several local regulatory programs present potential conflict with water quality goals. These include the Zoning Ordinance and Subdivision Regulations. The areas of potential conflict within these regulations appear to be inherent in the broad and somewhat divergent purposes of the regulations. Under state enabling legislation, these regulations are to achieve many governmental objectives, including public health, safety and welfare, economic development, environmental protection and governmental efficiency and responsiveness. This broad spectrum of goals can only be achieved through a reasoned and balanced decision-making process.

Local government's ability to accomplish this difficult balancing act has been enhanced by the enactment of state legislation that specifically enables local governments to address water quality in the land use regulatory process. Local programs, such as the Virginia Beach Stormwater Management Ordinance, indicate local government's willingness and ability to use these powers. While various sections of this report describe areas in which local programs could be modified to increase their effectiveness in protecting water quality, there is a concomitant need for legislative support to ensure that local governments are given the powers necessary to modify their programs to achieve this goal.

CRITICAL MANAGEMENT AREA

In recent years, considerable public attention has been directed at the concept of designating defined areas of watersheds as "critical management areas" for purposes of environmental and water quality management. This approach has been used with some degree of success in the Maryland "Critical Areas Program" for managing development in the Chesapeake Bay Watershed. A critical area approach is also included in the Virginia Chesapeake Bay Preservation Act regulatory program.

CERWQMP: PMR RECOMMENDATION

The CERWQMP: PMR recommended that a "tiered critical area" be designated for the Elizabeth River Basin as the means of managing nonpoint source pollution. The "tiered" approach was developed following an extensive review of the alternatives that had been explored or were being used in various other programs, including the Maryland program. Alternatives that were evaluated included:

- All land and water resources in the Elizabeth River Basin.
- All land resources within a specified distance from the shoreline of the entire River.
- Certain segments of the River, based on observed and projected water quality conditions, and all lands tributary to those segments.
- Certain segments of the River, based on observed and projected water quality conditions, and all land resources within a specified distance from those segments.
- All water and water-dependent natural resources of the River and certain critical uses of the land resources of the entire Basin.

Based on this evaluation, the CERWQMP: PMR recommended that a "tiered critical management area" be designated for the Elizabeth River Basin. The recommended area included the entire basin as the broadest management unit, in which Best Management Practices would be required for all development. Special management attention would be given to three resources or uses within that area:

- Natural resources of concern, such as wetlands and other critical aquatic resources.
- Transitional parcels that could be expected to go from low intensity uses to higher intensity urban use.
- Land uses involving the use or storage of hazardous materials and wastes.

This recommendation was not accepted by most reviewers of the CERWQMP: PMR.

REEVALUATION

At the inception of this project, it was felt that the "tiered critical management area" concept should be reevaluated. Appendix E documents that review. Based on this reevaluation, it is concluded that although the original recommendation was technically reasonable, it should be abandoned in favor of a watershed-wide approach to environmental management. This finding is consistent with the conclusions reached by scientific researchers that a watershed-wide approach to water quality management is the most technically defensible alternative.

CHESAPEAKE BAY PRESERVATION ACT

Subsequent to completion of the reevaluation, the Chesapeake Bay Local Assistance Board issued its draft regulations to implement the Chesapeake Bay Preservation Act. Those regulations call for the establishment of a "Critical Management Area" approach to water quality management in the Chesapeake Bay Watershed of Virginia. Specifically, Chesapeake Bay Preservation Areas are to be designated and specific controls applied to development within them.

The draft CBPA regulations provide for designation of a two-tiered Management Area, including Resource Protection Areas and Resource Management Areas. While not included in the draft regulations, the CBLAB has also considered designation of a third tier - Intensely Developed Areas. As presently proposed, the CBLAB regulations are very similar in concept to the Resources of Concern component of the CERWQMP: PMR recommendation.

Under the draft regulations, Chesapeake Bay Resource Protection Areas are to be delineated to include:

- Tidal Wetlands
- Non-tidal wetlands hydrologically connected by surface flow and contiguous to tidal wetlands or tributary streams.
- Tidal Shorelines.
- Other lands as appropriate in the eyes of the local government.
- Buffer Zones (Vegetated) adjacent to and landward of the above areas and along both sides of tributary streams.

Resource Management Areas are to be designated contiguous to the entire RPA and are to include:

- Floodplains.
- Highly erodible soils and steep slopes.
- Highly permeable areas and areas vulnerable to groundwater degradation.
- Non-tidal wetlands not in the RPA.
- Other lands as appropriate in the eyes of the local government.

Specific development controls apply to development in both the RPA and the RMA. In addition, only water-dependent facilities and redevelopment activities are permitted in the RPA.[9] Conceptually, this approach is similar to that recommended three years ago. It differs in the broad definition of the "critical area" and in the degree of restriction on development within that area. While not entirely consistent with the technical and scientific defensibility question inherent in the watershed-wide approach, the two concepts are generally compatible and could be used in conjunction with each other.

SPECIAL STUDIES

During the course of this project, several special studies were undertaken. These studies include:

- Stormwater Management Strategy for the Elizabeth River Basin - Appendix F.
- Hazardous Waste Activities and Sites in the Elizabeth River Basin - Appendix G.
- Water Dependent Facilities in the Elizabeth River Basin - Appendix H.
- Information System and Data Management Needs - Appendix I.

Documentation of each of these studies is included in this report as an Appendix. The following sections summarize each of these studies. Recommendations based on each of them are included in the recommended Implementation Program.

STORMWATER MANAGEMENT STRATEGY

This study addresses nonpoint source pollution control and management. Several initiatives have been undertaken by the state and federal governments in the area of nonpoint source pollution control. They include:

- Stormwater Permitting through the National Pollution Discharge Elimination System Permit Program by EPA. This program is authorized by the Water Quality Act of 1987.
- Nonpoint Source Program, being developed by the state in response to the Water Quality Act of 1987.
- Chesapeake Bay Preservation Act, being implemented by the state.
- State Stormwater Permitting Program, to be developed by the state.

The stormwater management strategy for the Elizabeth River is designed to enable local governments to satisfy the requirements of each of these state and federal initiatives. In a parallel effort, the Regional Stormwater Management Strategy for Southeastern Virginia has been developed.[10]

The Elizabeth River Stormwater Management Strategy is documented in Appendix F. The previous water quality discussion also described estimated nonpoint source loadings to the River as well as their potential impacts. It was based

on the Stormwater Strategy. The Strategy is included in the recommended Implementation Program.

The Stormwater Management Strategy examines seven representative watersheds in Southeastern Virginia. These watersheds were selected because they contain a representative mix of land uses and lend themselves to the development of management approaches which should be transferrable to other locations either in the basin or in Southeastern Virginia in general. While only four of these watersheds are physically located in the Elizabeth River, all are typical of the land use configurations that may be found throughout the Basin. The four Elizabeth River watersheds are also representative of conditions in other watersheds in the region. Each of the watersheds are described, nonpoint source loadings are estimated, and expected impacts on critical aquatic resources are described. Based on this, specific control recommendations have been developed.

The Stormwater Management Strategy builds on the Nonpoint Source Management Strategy, initially recommended in the Hampton Roads Water Quality Management Plan and modified through subsequent local, regional and state planning efforts. It recognizes the EPA Stormwater Permitting Program and the Chesapeake Bay Preservation Act as the basic requirements of a local nonpoint source management program. It recommends the establishment of the local basin-side stormwater management programs, authorized by the recent Virginia legislation on Stormwater Management. Within this framework, specific local techniques for managing different types of nonpoint source problems, needed state assistance and additional study needs are identified.

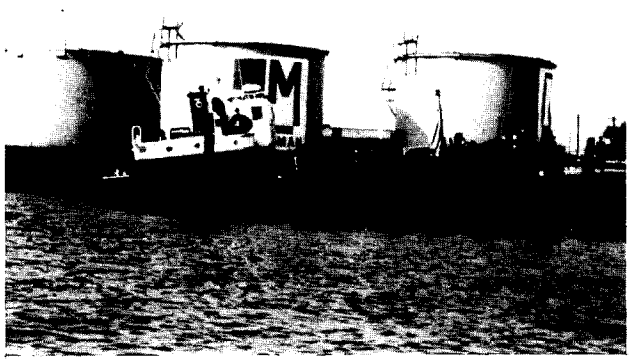
HAZARDOUS WASTE ACTIVITIES

Earlier studies of the Elizabeth River have attributed many of the current water quality and living resource problems in the River to the presence of toxic substances. The HRWQMP in 1978 noted that toxic pollution to the River was a critical problem which precluded many desired uses of the River. It recommended that future water quality research, planning and management efforts emphasize this problem. The CERWQMP: PMR and related studies reiterated this conclusion and recommendation. At the time of those planning efforts, there was a relative paucity of hard data quantifying the relationship between living resource problems, toxic pollutants and land use activities. The ODU study, cited previously in this report, has provided much of the quantitative data necessary to document this linkage.

Over the past year, there have been a number of incidents in the Elizabeth River Basin involving hazardous wastes and materials. Toxic paints have been dumped illegally on a vacant lot in Chesapeake and at the Mt. Trashmore II Landfill in Virginia Beach. A drug lab, involving extensive use of hazardous chemicals, was discovered operating illegally in a small industrial park in Chesapeake. Toxic substances were stored illegally in a self-storage facility in Portsmouth. Within the past month, Sodium Cyanide has been delivered to the SPSA Resource Recovery Plant

in Portsmouth, causing the shutdown of the region's solid waste disposal system and the hospitalization of a number of workers. More than 1.5 million gallons of liquid Nitrogen was dumped into the Elizabeth River as the result of a storage tank failure. Many other examples could be provided.

The CERWQMP: PMR identified the issue of hazardous materials use in the Elizabeth River Basin as one requiring special attention in the land use development and water quality management process. Steps have been taken under various authorities to address this issue. Each of the basin's local governments has established a hazardous materials emergency planning process in accordance with the requirements of the Superfund Amendments and Reauthorization Act of 1986. The SWCB has adopted a Toxics Management Regulation as well as regulations governing the use and management of Underground Storage Tanks. SPSA is implementing a regional hazardous waste management program as an adjunct to its solid waste management system. HRSD operates an Industrial Waste Permit program to protect the region's wastewater treatment system. Under the auspices of the Chesapeake Bay and Superfund programs, the U.S. Navy has stepped up its efforts to correct water quality and other environmental problems associated with its management and use of hazardous materials and wastes. Finally, through environmental audits, the private sector attempts to protect itself from future hazardous waste-related liability in property purchases.



The CERWQMP: PMR included a qualitative evaluation of potential sources of hazardous pollutants in the Elizabeth River Basin. It documented the number of activities involving hazardous wastes, the potential number of underground storage tanks, and noted that a number of sites may have been used in the past for hazardous waste disposal. In 1986, the U.S. Geological Survey and other federal agencies embarked on a study of that issue. Final recommendations for water quality management in the Basin were to incorporate the results of the federal agency study. The CERWQMP: PMR analysis has been updated and the results of the various federal agency studies have been reviewed as part of the current study. The results of that effort are documented in Appendix G.

The number of hazardous waste activity notifiers in the Elizabeth River Basin has increased from 54 to 252 since 1986.[11] Much of this is due to the increased stringency of the hazardous waste regulatory system and is not an absolute increase. These notifiers constitute over 60% of the region's businesses involved in regulated hazardous waste activities and over 75% of the large generators, storers or treaters

of hazardous waste. Most of them, especially the larger ones, are located in close proximity to the River or its tributaries.

The number of underground storage tanks in the basin was not updated as part of this study. However, in 1986, it was estimated that between 1,200 and 4,300 leaking tanks were located in Southeastern Virginia and that the bulk of them were probably located in the Elizabeth River Basin. This latter assumption was based on the urban character of the basin and the age of many of the facilities located there.

As noted above, USGS and other federal agencies, including EPA, began a search for potential hazardous waste sites in the basin in 1986. This was the first step in the identification of potential Superfund sites. Much of the work involved in this project was conducted by or for the EPA. The initial phase involved review of aerial photographs for the period from 1937 to 1986. This effort identified 649 sites in Southeastern Virginia which were potential hazardous waste sites. The second phase of the review involved field visits by an EPA contractor and extensive review of historical files by SVPDC and local government staffs. Following completion of this second phase, 377 sites (both federal and civilian) were considered to be candidates for further review by EPA. Of the 377 sites which are still considered potential Superfund sites, 316 or 84% are located in the Elizabeth River Basin.[12] It is noteworthy that, as EPA observed, the number of candidate sites increases as one moves closer to the River itself.

WATER DEPENDENT FACILITIES

The CERWMP: PMR recommended that the local jurisdictions take steps to increase public access to the Elizabeth River. Subsequent studies conducted by the SVPDC, the Chesapeake Executive Council and basin jurisdictions have documented further needs for public access and have reiterated this recommendation. The Virginia Coastal Resources Management Program provides for shoreline planning for public access as well as a specific planning and management component for energy facilities, many of which are located along the waterfront. The VCRMP also provides for designation, at the request of local governments of "Waterfront Development Geographic Areas of Particular Concern". This designation affords local governments the opportunity to prepare a specific plan for their waterfronts to ensure the availability of land for water-dependent and water- enhanced activities.

Draft Regulations to implement the Chesapeake Bay Preservation Act require local governments to prepare a specific water-dependent facilities element of their comprehensive plans. To facilitate that effort, Appendix H describes the required components of such a plan and documents baseline information for the Elizabeth River for use in such a plan. It includes an inventory of waterfront recreation facilities, a preliminary inventory of waterfront land use in the Elizabeth River Basin, and an inventory of transitional waterfront parcels. Preliminary information on dredging requirements, impacts on critical aquatic resources and goals compatibility is included. It appears that the information on goals compatibility in Appendix B will

satisfy in large measure that requirement. Insofar as critical aquatic resources are concerned, it is noted that there is a relative paucity of information on such resources in the Elizabeth River Basin.

Appendix H describes a suggested framework for categorizing the water-dependency of waterfront land uses. No attempt has been made to categorize the water-dependency of existing land use along the Elizabeth River. Figure 4 depicts anticipated future waterfront land use based on the current local comprehensive plans. All major categories of urban land use are represented along the waterfront. Most of the riverfront land along the Main Stem is expected to be used for military, industrial or transportation purposes. Extensive areas along the Eastern and Western Branches, the upper Southern Branch and several tributaries to all Branches are anticipated to be used for residential purposes, primarily low density single family development. Commercial development is expected along the downtown waterfronts of both Norfolk and Portsmouth, near Great Bridge on the upper Southern Branch, and in isolated pockets on the Eastern Branch and Lafayette River. Major recreation activities can be found on the downtown waterfronts of Norfolk and Portsmouth, at Great Bridge and Deep Creek and in isolated pockets on the other Branches. A major change to the pattern anticipated three years ago is the extensive use of Craney Island for recreation as well as commercial and industrial activities.

Transitional waterfont parcels are also identified in Appendix H. Many of these parcels were identified as "Transitional Parcels of Concern" in the CERWQMP: PMR. They are parcels that are expected to transition from vacant or an existing low intensity use to a higher intensity use. They are the reservoir of available land that could be developed or redeveloped for water-dependent activities. Since they are expected to change use in the foreseeable future, they are also parcels where nonpoint source pollution controls could make a difference in future loadings to the River.

INFORMATION NEEDS

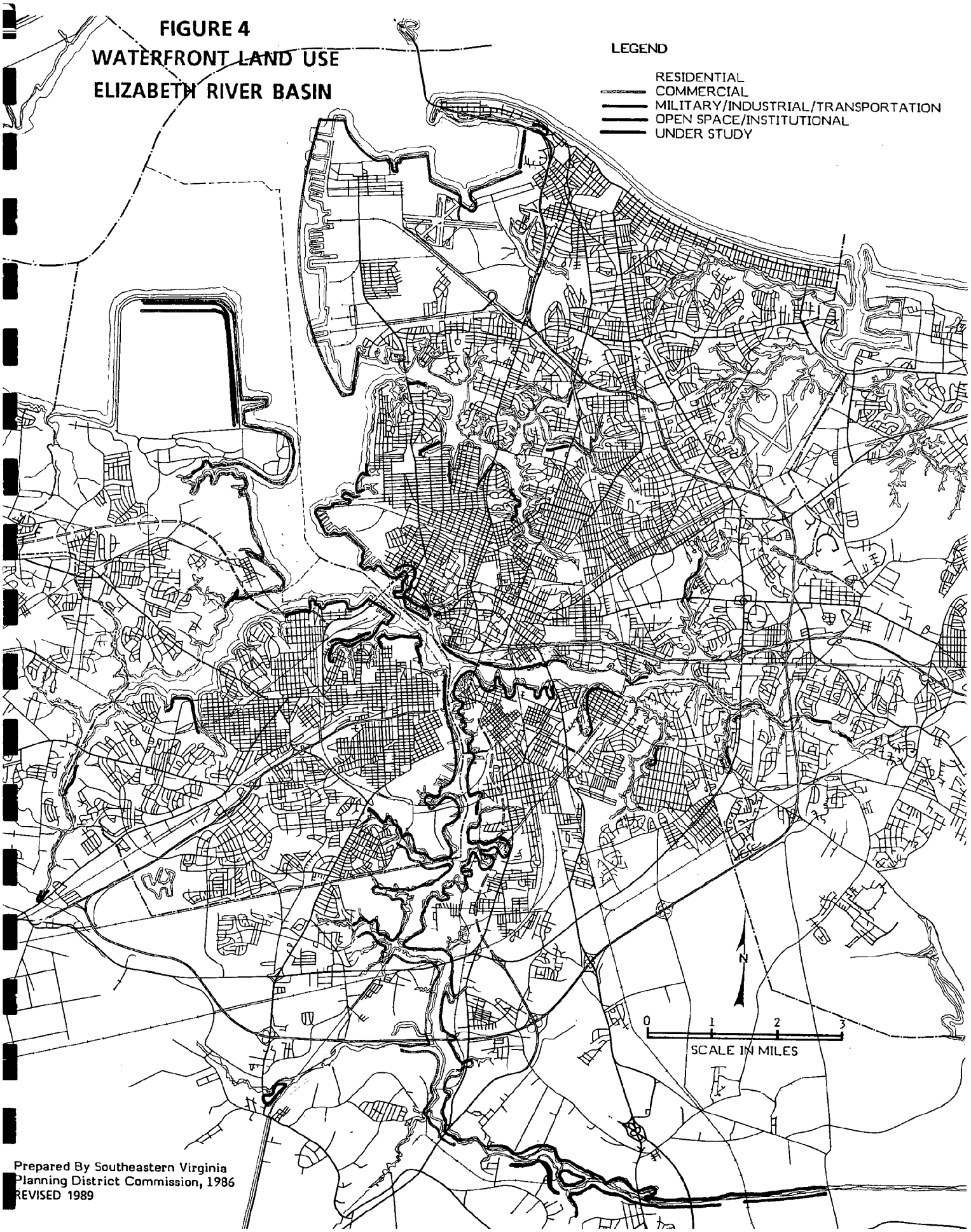
In conducting the various components of this study as well as other recent studies, the need for improved information and for a better system for managing and accessing that information was identified. Appendix I summarizes those needs and examines alternative approaches to addressing them, both in the context of environmental management in the Elizabeth River Basin and of implementation of the Chesapeake Bay Preservation Act. This review concludes that a Regional

Geographic Information System should be developed. The GIS could be used for a variety of purposes, including:

- Improved mapping for general planning and special study purposes.
- Acquisition of land use and natural resource information being developed by state and federal agencies.
- Increase SVPDC ability to assist local governments in complying with the mandates of several state and federal environmental planning and management programs.

Specific computer hardware and software to accomplish this are recommended.

FIGURE 4
WATERFRONT LAND USE
ELIZABETH RIVER BASIN



Prepared By Southeastern Virginia
Planning District Commission, 1986
REVISED 1989

IMPLICATIONS FOR MANAGEMENT PROGRAM

The preceding sections of this report provide an historical overview of efforts to improve water quality in the Elizabeth River Basin. They describe the results of those past efforts and document current water quality conditions in the River. The existing institutional structure with its goals and regulatory programs to achieve those goals has been described. The compatibility of the goals and regulatory programs has been evaluated. Finally, a number of Special Studies that were undertaken as part of this project have been summarized. Each of these items has implications for our ability to manage the Elizabeth River as well as the structure of any management program. This section summarizes the management implications of each of the foregoing discussions. It establishes the framework for the management program.

HISTORIC RECOMMENDATIONS

Both the scientific community and governmental agencies have been studying the River for years. These efforts have documented a long history of water quality problems and improvements thereto. They have recommended a variety of comprehensive approaches for resolving these problems. Many of the recommended actions have been or are being implemented. At least some of the water quality improvements, which have been observed, are attributable to those implementation activities. However, in spite of these improvements, water quality problems remain. Many of today's problems are identical to the historic problems, differing only in degree. Most are attributable to the same or similar causes. New management approaches must recognize and incorporate the successful aspects of ongoing activities.

WATER QUALITY CONDITIONS

The Elizabeth River is an historically troubled system. The water quality problems of the River are attributable to both natural conditions and man's activities within the basin. Over the past decade, water quality in the River has improved, especially with respect to Conventional Pollutants, such as Biological Oxygen Demand and Suspended Solids. There are continuing problems with Nutrients and Toxics, at least in part, due to historic activities. The nature of the system dictates that specific management activities be undertaken if improvements are to occur. These must address both current point and nonpoint sources, as well as the legacy of past activities.

GOALS COMPATIBILITY

Previous planning efforts have assumed that areas of incompatibility between local development goals and water quality goals were impeding our ability to achieve the latter. This study has confirmed that there are a number of areas of potential conflict between the respective goals. Generally, it appears that

management intervention can mitigate these areas of potential conflict and that there is nothing inherent in local development goals that precludes achievement of water quality goals. Finally, with the adoption by all basin localities of water quality protection as a comprehensive plan goal, the policy basis for local water quality management efforts has been established. The legal basis for such efforts has also been established through the enactment of the Chesapeake Bay Preservation Act. Thus, there is no need for local governments to modify their development goals at this time. However, there is a need to continue efforts to translate local environmental goals into specific regulatory measures and programmatic activities.

INSTITUTIONAL AND REGULATORY FRAMEWORK

A complex institutional structure for addressing water quality issues has been identified. It does not appear that there any institutional gaps in our ability to manage water quality, although there is a continuing need to improve institutional coordination. This is true vertically between levels of government as well as horizontally between environmental management programs.

Local institutions have enacted all of the regulatory programs that they have been enabled to adopt. The last two sessions of the Virginia General Assembly have enacted considerable new powers for local governments in the environmental arena. They include the Chesapeake Bay Preservation Act and the state Stormwater Management Program as well as the authorization to consider groundwater quality in the local comprehensive plan. Local initiatives indicate that local governments are willing to use such regulatory powers when they are given to them by the General Assembly.

Existing local regulatory programs contain many useful elements. Obviously, local environmental programs, such as Wetlands and Erosion and Sediment Control Ordinances, are beneficial not only in protection of the specific resource, but also to water quality protection in general. All local Zoning Ordinances include provisions for issuing conditional use permits. These are generally applicable to industrial uses involving outside materials storage and use of hazardous materials. Special waterfront districts, which apply to activities possessing some degree of water-dependency, have been enacted in two jurisdictions. Buffering requirements are becoming used increasingly throughout the basin to alleviate the adverse impacts of adjacent or nearby incompatible uses. Both Site Plan Review and Subdivision Ordinances include provisions for evaluating the impacts of proposed development in the approval process. Finally, the recently enacted Virginia Beach Stormwater Management Ordinance can serve as a model for other localities.

Gaps in local government powers to implement necessary programs remain, especially in the areas of financing and enforcement. Although local efforts to manage stormwater quantity and quality are now specifically authorized, local ability to establish stormwater utilities to pay for these programs is lacking. It is not clear that local governments have the necessary enforcement powers with respect to

discharges to the stormwater system and the need to maintain such systems. In the area of hazardous waste management, it is not clear that local or regional agencies have been given the power to prohibit the disposal of certain waste types at solid waste disposal facilities or to enforce such a prohibition if enacted. Many state and federal environmental programs involving local government implementation have been enacted in recent years. Generally, the necessary financial resources to carry out these programs have not accompanied the mandate. In balancing the variety of competing local interests, local governments will require additional financial resources if implementation efforts are to be successful.

CRITICAL MANAGEMENT AREA CONCEPT

Scientific experts have argued in favor of a watershed-wide approach to environmental management if all sources with potential impacts on water quality are to be effectively managed. This is based on the evidence that land use activities, located some distance from a waterbody may have substantial impact on the quality of that waterbody, including the living resources found in it. Frequently, these impacts, especially in a poorly flushed system like the Elizabeth River, may be greater than the impacts of land uses that are immediately adjacent to the shoreline. Thus, it is not clear that identification of specific critical resources within a basin is the most effective approach to water quality management. It is recognized that this approach is especially useful in the protection of the resources or management of the uses themselves.

It appears that the watershed-wide approach to water quality management is the most defensible one. Within that concept, special attention can be devoted to protection of critical resources or to management of those land use activities, which present the greatest potential danger to the environment. Use of this management concept would permit maximum water quality benefit concurrent with resource protection.

STORMWATER MANAGEMENT STRATEGY

The Stormwater Management Strategy recommended in this study is one element of the comprehensive Regional Stormwater Management Strategy for Southeastern Virginia. This strategy must meet the statutory minimum requirements imposed by state and federal programs, such as the Chesapeake Bay Preservation Act and the EPA Stormwater Permitting Program. Strategy implementation must recognize the competing demands placed on local and state administrators to manage water quality throughout the region. As part of a regional approach, it should be relatively easy to apply lessons learned in one basin to situations in others. Concurrently, specific techniques must focus on those activities, such as shipbuilding and repair, and conditions, such as past waste disposal practices, which are unique to the Elizabeth River Basin.

HAZARDOUS WASTE ACTIVITIES

Evidence indicates that hazardous and toxic wastes are a significant part of the water quality problem of the Elizabeth River. This is attributable to both current Basin uses and to historic activities. The number of both which are located in the Elizabeth River Basin is substantial. Many are located in close proximity to the River and its tributaries. Recent experience indicates that the potential for significant environmental damage due to unanticipated hazardous waste incidents is very real. Management approaches must work to ensure that current basin uses do not create future problems due to waste disposal practices.

Programs are being developed which will be very beneficial. Water quality protection efforts must build on and incorporate these programs. These include the local emergency planning programs under the Superfund Amendments and Reauthorization Act of 1986 and local and regional programs to manage hazardous wastes. Close coordination of land use decision-making with such programs can benefit water quality through management of the risks associated with activities involving hazardous materials and wastes. In addition to the more traditional Best Management Practices applicable to these activities, the environmental audit, used with increasing frequency by the private sector appears to be a useful planning tool.

WATER-DEPENDENT FACILITIES

Increasingly, state and federal programs require that special consideration be given to facilities that are water-dependent. Because of the close relationship between these facilities and water quality, both beneficial and adverse, this appears to be particularly important. Careful planning of waterfront lands to accommodate such activities can also have associated economic benefits for the community. In addition, the increased public access to the water, which is likely to result, will also result in increased public support for environmental management efforts. Finally, the relatively small amount of vacant waterfront land which remains should be viewed as a scarce, only semi-renewable resource. It is a reservoir of future development opportunities. These lands also represent the last remaining opportunity to accomplish new waterfront development with minimum environmental impact.

CONCLUSION

We are about to enter the third decade since environmental concerns became a matter of extensive public policy debate. The 1970s and 1980s have both seen identification of new issues and passage of new legislation to deal with those issues. At each step, the issue and level of governmental implementation focus has changed. Initial efforts in the 1970s were concentrated on establishing the framework for environmental improvement through legislation at the federal level.

The 1980s have seen this activity move to the state level and again the effort has emphasized the establishment of a framework for further activity.

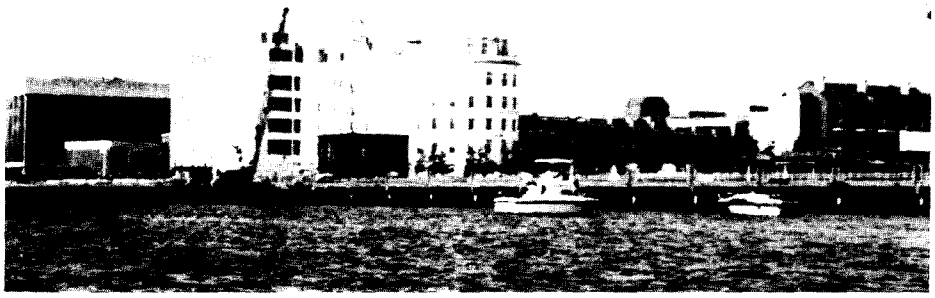
It is likely that the 1990s will move the focus of new activity to the local level. The programmatic framework has been established. Increasingly, the common denominator of issues to be addressed is land use, the traditional focus of local government responsibility and regulatory activity. The litany of environmental programs with a land use component is endless:

- Water Quality - nonpoint source pollution and stormwater management and the location of point sources;
- Air Quality - indirect sources and the location of point or "smokestack" sources;
- Solid Waste - Siting of processing and disposal sites, including permitted landfills and the regulation of "promiscuous" dumps;
- Hazardous Materials and Wastes - Siting of facilities in a manner that is compatible with other facilities and the environment and planning for emergencies;
- Groundwater - Integrally related to each of the above and requiring land use planning and regulation for protection;
- Critical Habitat and Resources - Wetlands, both Tidal and Non-Tidal, Beaches, Coastal Barriers and so forth;
- Airport Noise and Crash Hazards; and,
- Floodplains and other naturally hazardous locations.

The elements of each of these programs which are currently the primary responsibility of state and federal agencies are firmly established and generally have a strong technological and engineering component. The land use portion of each is less rigorously defined and more political in nature.

Previous sections of this report have discussed the apparent conflict between development and environmental protection goals and the notion that local regulatory programs were not sufficient to achieve environmental protection goals. It has been shown that these apparent conflicts are inherent in the statutory charge which has been given to local government. This charge requires a delicate balancing act in decision-making to achieve local government goals in the areas of social responsiveness, economic development and environmental protection. When given the legal tools and financial resources to accomplish these divergent goals, local governments have shown themselves to be generally equal to the task. Continued

success requires new levels of local initiative supported by an informed public and by a state government that grants local governments the tools to accomplish this difficult mission. The Environmental Management Program, described in the ensuing section, provides an approach to bring all of these pieces of the puzzle together to address the critical management needs of the Elizabeth River Basin.



ENVIRONMENTAL MANAGEMENT PROGRAM FOR THE ELIZABETH RIVER BASIN

Preparation of an environmental management program for the Elizabeth River Basin has been an evolutionary process over a period of several years. The recommended program which is outlined in this section builds upon the framework which has been established during that time. It reflects the considerable progress which has been made as well as the deficiencies of past efforts. The success of this ambitious program depends upon cooperation among agencies at all levels of government and in the private sector, but most importantly between Virginia state and local governments. The recommended program is structured in accordance with the categories of activities discussed previously in this report.

INSTITUTIONAL

This report has documented a complex institutional structure for environmental management in the Elizabeth River Basin. Federal, state, local, and regional governmental agencies and the private sector all play significant roles. Frequently, environmental management is not viewed as a partnership among the various entities. Also, there are gaps and redundancies in the regulatory programs which the various agencies implement. There is a need for increased institutional coordination and for additional legislation to more effectively manage the Basin's environment.

State Programs

The state role in managing Basin environmental quality can be categorized as follows: program implementation, support for local programs and activities and coordination. To accomplish each of these:

- *State agencies must rigorously implement the regulatory and incentive programs that fall within their respective purview.*

- *Institutional links between state agencies operating related programs must be strengthened and formalized. These linkages must increase program coordination and reduce duplication. This is particularly true in the areas of:*

  - *Nonpoint Source and Stormwater Management - VSWCB, VDSWC and CBLAB.*

  - *Toxics Management - VSWCB, VDAPC and VDWM.*

  - *Local Assistance - VCOE and CBLAB.*

- *Similarly, the institutional links between state agencies, regional agencies and local governments operating programs in these functional areas must be strengthened and formalized.*

- *The Virginia Council on the Environment should assume lead responsibility for coordinating state program activities and for coordinating state technical assistance to local governments on environmental issues. This responsibility should be accomplished in a proactive manner.*

- *The cognizant state agencies must continue to ensure that an opportunity to play an active role in the Chesapeake Bay Program is provided for local governments.*

- *The Virginia General Assembly needs to ensure that local governments are granted the legislative authority and financial resources to carry out their environmental management responsibilities. Areas of particular concern include:*

  - *Stormwater System Management, including authority to issue permits for discharges to local systems and to require maintenance of privately-owned components of those systems.*

  - *Authority to establish local and/or regional Stormwater Utility Districts.*

  - *Authority to require the provision of an environmental audit as one element in the subdivision and site plan review processes.*

  - *Authority to require permits from non-residential sources of solid waste and to enforce the provisions of those permits.*

  - *Financial assistance to carry out environmental mandates and to enhance local nonpoint source management programs.*

Local Programs

Previous studies have recommended that local governments adopt water quality protection as a goal of their Comprehensive Plans and incorporate that goal

into their land use development regulations. That recommendation has been accomplished.

- *Basin local governments must translate that comprehensive plan goal into meaningful regulatory and operational programs. These programs need to address areas of potential conflict between environmental quality and development goals. The recent series of reports prepared by the Institute of Environmental Negotiation at the University of Virginia for the Virginia Council on the Environment provides an excellent summary and critique of regulatory options available to the localities for this purpose. Concurrently, local operational programs must emphasize achievement of the goal as well.*

- *Local governments should consider designating one department or office as the coordinator of all local government environmental programs.*

- *Local governments should adopt Stormwater Management Ordinances establishing the legislative basis for implementing the Regional Stormwater Management Strategy. The recently enacted Virginia Beach Ordinance provides a good example of such an ordinance.*

- *Local governments should modify their Zoning, Subdivision and Site Plan Review Ordinances to accomplish the specific recommendations for Point and Nonpoint Source Management, Air Pollution Control, Solid and Hazardous Waste Management and Waterfront Development. Particular attention should be placed on use of the Conditional Use Permit provisions of the Zoning Ordinance and adoption of a Waterfront Zoning District.*

Regional Programs

Local governments have enacted a wide variety of programs to assist in managing the complex environment of the Elizabeth River Basin. However, those programs and activities have not been formally coordinated throughout the basin. To accomplish this, it is recommended that:

- *SVPDC should strengthen its efforts to facilitate the coordination of local environmental management programs. Initially, this should include hosting quarterly coordination meetings among the local government staffs involved in Environmental Management in the Elizabeth River Basin, including those involved in:*

- *CBPA Implementation*

- *Erosion and Sediment Control Program implementation*

- *Implementation of the Stormwater Permitting program.*

- *SVPDC should facilitate a regional effort, involving local governments and the development community to develop regional design and operational standards for stormwater and nonpoint source management facilities and erosion and sediment control practices.*

- *SVPDC and the VCOE should cooperatively develop a routine process for coordinating local and state efforts to improve environmental management in the Basin.*

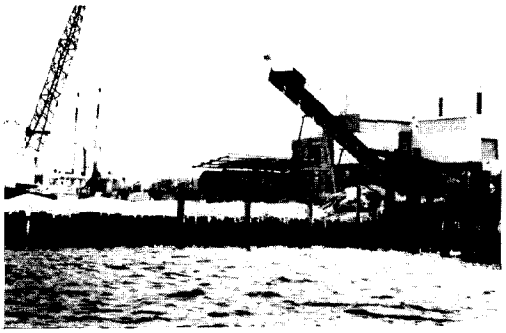
CRITICAL MANAGEMENT AREA

Previous recommendations on the establishment of a Critical Management Area for the Elizabeth River have been reevaluated during this study. Based on that reevaluation and in light of recent state and federal legislation dealing with critical area designations and nonpoint source management, those previous recommendations have been modified. It is recommended that the following "critical management area" be implemented in the Elizabeth River Basin:

- *Elizabeth River Basin - Implement the recommended Stormwater Management Strategy, including the Erosion and Sediment Control Program, application of Best Management Practices to all new development, and retrofitting of BMPs in specific situations.*

- *Natural Resource Areas - Implement the requirements of existing regulatory programs, including the Virginia Wetlands Act, Flood Plain Ordinances and Subaqueous Lands Guidelines. Rigorously apply the Wetlands and Subaqueous Lands Guidelines developed by the VMRC and the VIMS. Implement the RPA and RMA designations as embodied in the Chesapeake Bay Preservation Act regulations.*

- *Devote intensified local regulatory attention to land use activities involving outside storage of materials, use and handling of hazardous materials and wastes and sites which have been used in the past for such activities.*



Because much of the basin is already intensively developed, the Natural Resource Areas aspect is applicable only in certain portions of the basin. Therefore, basin local governments should continue to work with the Chesapeake Bay Local Assistance Board and Department to develop alternative management standards for the already developed areas of the Elizabeth River Basin. Adoption of the watershed-wide management approach coupled with increased management attention to those land uses that present a greater potential for environmental damage would seem to make the Already Developed Area approach to the CBPA more feasible.

POINT SOURCES

Past water quality studies have attempted to deal with both point and nonpoint source management. Development of this management program did not entail an analysis of point source pollution. Concurrently with its preparation, the VSWCB has completed a draft Elizabeth River 205(j) Water Quality Plan, which gives explicit consideration to point source related problems. The recommendations of that Plan appear to be generally valid and appropriate. They should be incorporated into the recommended Environmental Management Program for the Elizabeth River. Specifically:

- *The VSWCB should continue to implement the Virginia Pollution Discharge Elimination System (NPDES) permit program within the basin. Emphasis, through the VSWCB Toxics Management Program, should continue to be placed on the control of toxic discharges.*

- *The VSWCB should continue to upgrade its inspection and enforcement efforts in the Elizabeth River Basin.*

- *Concurrently, the VSWCB should implement its Elizabeth River Monitoring Program to improve the technical basis for evaluating discharges and setting water quality and effluent standards.*

The CERWQMP: PMR contained a number of recommendations dealing with control of pollution from point sources. While action to implement most of these is already underway, the recommendations remain valid. They include:

- *The Hampton Roads Sanitation District should continue its program to combine treatment for the current Lamberts Point and Pinners Point Sewage Treatment Plants at the Virginia Initiative Plant. Plans for this facility, which is currently under construction provide for an advanced secondary treatment facility with biological phosphorus and nitrogen removal. This facility, which will reduce the number of point source discharges to the River, is endorsed.*

- *All sanitary sewerage collection systems and their components should be upgraded to meet Virginia Sewerage Regulations Class I Reliability standards.*

- *Public sewerage facilities should be extended to all parts of the basin.*

- *The HRSD, local jurisdictions and U.S. Department of Defense should continue present efforts to eliminate infiltration and inflow to the public sewerage collection and transmission system.*

During 1987, the SVPDC adopted a "Policy Statement on Provision of Sewage Collection and Treatment Facilities". The Policy established guidelines for the provision of new wastewater collection and treatment facilities throughout Southeastern Virginia. The guidelines provide that:

- *No new private point source discharges of wastewater should be permitted to waterways which:*

  - *contain productive or potentially productive shellfish grounds, whether presently condemned or not.*

  - *are used for primary contact recreation.*

  - *are existing or potential potable water supply sources.*

- *New private point source discharges that would degrade the ambient water quality of the receiving waterbody will not be permitted.*

- *Where new sewage treatment capacity is needed, centralized regional facilities are preferred.*

- *All new facilities treating domestic wastewater should be owned and operated by the public sector - HRSD or the local jurisdiction.*

- *Where provision of centralized wastewater treatment facilities is infeasible, on-lot septic systems would be used if soils and development density are suitable for such use. In all cases, the requirements of the Virginia Department of Health must be followed.*

- *Private facilities having a discharge to surface waters and serving one dwelling unit are acceptable only if no other service options are available and only if strict conditions are met.*

This Policy should be endorsed and implemented by basin localities, the SWCB and the Department of Health.

The Hampton Roads Sanitation District is implementing a number of innovative programs to ensure the safety and reliability of the municipal wastewater system. They include:

- *Industrial Waste Discharge Permit Program, including requirements for permits prior to discharge, laboratory testing of wastes to be discharged and enforcement.*

- *System Reliability Program. Recently established, this program increases HRSD's attention to system maintenance and performance on a day-to-day basis.*

These efforts should be endorsed.

The U.S. Navy constitutes the largest single owner of waterfront land in the Elizabeth River Basin. In addition, it is the largest single operator of vessels using the River. It is incumbent upon the federal government to set an example for the private sector in its environmental management efforts, especially in light of its Chesapeake Bay Agreement commitments. Therefore, it is recommended that:

- *The U.S. Navy continue its efforts to upgrade on-base, primarily industrial, wastewater treatment systems.*

- *The U.S. Navy should enhance its efforts to control accidental or intentional discharges of wastewater, oil and other substances from ships in port.*

NONPOINT SOURCES

In 1983, the HRWQA completed development of the Nonpoint Source Control Strategy for the Hampton Roads Area. That strategy has served as the overall framework for nonpoint source pollution management since that time. Through this study and the companion project, Regional Stormwater Management Strategy for Southeastern Virginia, that framework has been updated to reflect recently passed legislation and new local initiatives. The Regional Stormwater Management Strategy recommends implementation of a Stormwater Impact Monitoring Program, Institutional Initiatives and both Structural and Non-structural Controls. Therefore, it is recommended that:

- *The Regional Stormwater Management Strategy for Southeastern Virginia be recognized as the overall framework for nonpoint source pollution management in the region. Insofar as the Elizabeth River is concerned, Appendix F details the application of that strategy to the basin. It includes:*

  - *A minimum stormwater management strategy consisting of compliance with the EPA Stormwater Permitting Regulations and the CBPA Management Criteria.*

  - *A preferred management strategy consisting of a watershed-wide stormwater management program in accordance with the requirements of HB 1848/SB 722 and the Critical Management Area recommended above.*

- *While the Strategy indicates a preference for wet detention basins for stormwater management in Southeastern Virginia, specific practices should be determined on a site and development-specific basis. Specific management techniques would include:*

  - *Best Management Practices should be required on all new development in the Basin which is subject to the requirements of the Erosion and Sediment Control Ordinance.*

  - *Rigorous implementation and enforcement of erosion and sediment control ordinances should be undertaken.*

  - *Routine storm drainage maintenance programs should be established to ensure the continued effectiveness of existing drainage facilities and the best management practices required on all new development.*

  - *Best Management Practices should be required for all activities involving outside materials storage and the use or storage of hazardous materials and wastes.*

  - *Establishment of a permit program covering all private stormwater discharges to the municipal system.*

  - *Use of alternative site design practices, such as clustering, which are useful in reducing development-induced stormwater runoff.*

  - *Use of landscape design and maintenance practices on public projects that are useful in reducing development-induced stormwater runoff and nonpoint source pollution.*

  - *Retrofitting of Best Management Practices should be required on all land uses in highly impervious areas, using the methodology described in the WASHCOG Manual.*[13]

Through the Chesapeake Bay Agreement process, a Commitment Report, Chesapeake Bay Watershed Development Policies and Guidelines has been prepared. This report contains a wide variety of specific development guidelines and management techniques for use in the Chesapeake Bay Basin. These guidelines are generally mutually supportive with the Regional Stormwater Management Strategy. The recommended policies provide for the design, location and construction of new developments in a manner that controls the introduction of sediment, nutrients and toxic substances into the Bay and its tributaries, that minimizes alterations of the natural hydrologic cycle and that minimizes the destruction and degradation of important habitats for plants and animals and that is protective of natural resources. Specific guidelines for accomplishing these policies are described.

- *Basin local governments should incorporate those guidelines into their development and regulatory programs.*

The VSWCB has also addressed the issue of nonpoint source management in its Elizabeth River Water Quality Plan. The recommendations contained in that document are mutually supportive of the overall Elizabeth River Stormwater Management Strategy. Many of them are associated with implementation of the Stormwater Permitting Program. Similarly, the Virginia Division of Soil and Water Conservation has developed the Virginia Nonpoint Source Management Program, detailing specific techniques to be implemented by a variety of state, local and private entities. That program is one component of the Regional Stormwater Management Strategy.

- *The VSWCB and the VDSWC should implement the institutional recommendations described above.*

- *The VSWCB should vigorously pursue development of BMPs for shipyard activities and include those BMPs in the VPDES Permits for the shipyards.*

In conjunction with local implementation of a watershed-wide stormwater management program, it appears that new legislation will be necessary to enable local governments to carry out their responsibilities.

- *The Virginia General Assembly needs to ensure that adequate local authority is provided to:*

  - *Establish stormwater management utility districts on a local and/or a regional basis.*

  - *Establish permit and/or enforcement programs to ensure that stormwater discharges meet water quality standards.*

- *Increase sanctions and penalties for violations of the Erosion and Sediment Control Law and local Ordinances to ensure that they are a sufficient incentive for compliance.*

WATERFRONT DEVELOPMENT

The Chesapeake Bay Program and the CBPA regulatory process have raised the priority on consideration of public access to the waters of the Bay basin. Previous local and regional planning efforts have also emphasized the public access issue.

- *The four basin localities should prepare Shoreline Plans in accordance with the requirements of the CBPA, as components of their Comprehensive Plans. These Plans should be coordinated to the maximum extent possible. Appendix H provides a common data base and indication of additional study requirements to accomplish this. The regional coordination approach, described above, represents one way to accomplish that.*

- *To facilitate implementation of the Shoreline Plans, local governments should:*

  - *Adopt the Waterfront Development Zoning Classification discussed in the Institutional Recommendations section.*

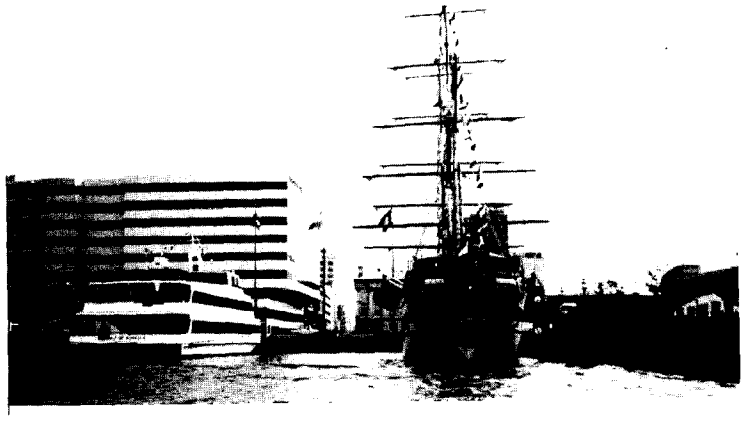
  - *Incorporate the Chesapeake Bay Agreement Development Policy of reserving the waterfront for water-dependent uses into their plans and regulations.*

- *Basin localities and the Commonwealth should implement the recommendations contained in* <u>*The Waters of Southeastern Virginia*</u>.

- *Two recommendations, contained in* <u>*CERWQMP: PMR*</u> *should be reaffirmed. They are:*

  - *Through their site plan and other development reviews, local jurisdictions should ensure that public access, both physical and visual, to the Elizabeth River and its tributaries is provided and/or maintained. Where warranted, such access should be provided through public acquisition of specific parcels or of easements on specific parcels.*

- *Local governments and waterfront property owners should ensure that the river and its shoreline are maintained in a state of cleanliness in order to maintain the viability of these aesthetic resources for the enjoyment of the citizens. In support of this, local governments should support the Corps of Engineers' project to remove drift material and the sources of such material from the Hampton Roads Harbor.*



- *Local governments should continue to work with the Commonwealth and the Corps of Engineers to identify and develop a site for the disposal of material dredged from the Elizabeth River and other area waterbodies.*

Closely related to the preceding recommendation is the need to control the introduction of sediments and toxic substances through appropriate nonpoint source pollution controls. Such efforts will reduce future maintenance dredging requirements and should increase the environmental compatibility of dredged material requiring disposal.

Frequently, efforts to increase public access are criticized as being counter-productive due to perceived and actual increases in pollution due to boating and other waterfront activities. To alleviate the criticism and the pollution, several activities are necessary.

- *Public and private entities should work to increase the number of pump-out facilities in the Elizabeth River and associated waters.*

- *Runoff controls should be required at marinas to prevent residuals from boat maintenance activities from being washed into receiving waters by stormwater. Specifically, these controls should include a requirement that all painting and hull scraping be conducted in an area surrounded by an impermeable dike. The area should be underlain by an impermeable surface to prevent groundwater contamination. Screening should be provded to contain airborne emissions. Periodic removal and proper disposal of residual materials would also be required.*

- *The VSWCB and the U.S. Coast Guard should strictly enforce existing regulations to control discharges from vessels as well as other regulations to control littering and other waste disposal in the waters.*

SOLID AND HAZARDOUS WASTE MANAGEMENT

All local governments in the Elizabeth River Basin, either directly through the SARA Title III program, or indirectly through the SPSA waste management programs, are actively involved in hazardous materials and waste management. They are also actively involved in solid waste management activities. However, current activities do not address the legacy of past disposal practices except in limited cases.

- *Local governments should continue operation of or participation in existing programs to plan for and manage solid and hazardous wastes and hazardous materials.*

- *Those sites, which have been identified through recent EPA studies, as having the potential for inclusion on the Superfund list should be subjected to more rigorous local government management attention. Specifically, local governments should require:*

  - *in the case of site plan or subdivision reviews, documentation of any environmental audits of the site.*

  - *in the case of local government acquisition of such sites, soil borings and associated tests to document the presence or absence of hazardous wastes on the site.*

  - *development of site-specific management plans reflecting historic uses of these sites.*

- *Conditional use permits should be required for all activities involving the storage or use of hazardous materials or wastes.*

Conditions should include buffering, distance from sensitive receptors and mandatory implementation of specific best management practices, such as use of dikes, covering and impervious pads for outdoor materials storage areas. Similar requirements could be imposed through the Site Plan Review Process for sites that do not require additional zoning action.

- *Local governments should support efforts by the Southeastern Public Service Authority to conduct Household Hazardous Waste Days and to establish permanent transfer stations for both Household and Conditionally Exempt Small Generator Hazardous Wastes.*

- *Local governments should continue their litter control programs in cooperation with the Virginia Department of Waste Management and the private sector. It would also be appropriate to incorporate litter control more directly into the local solid waste management system.*

- *The Department of Defense should work expeditiously to complete planned and needed cleanup programs at Naval facilities in the basin.*

- *It appears that additional legislation may be required to enable local governments and regional agencies to:*

  - *Establish waste disposal permit programs and to enforce those programs.*

  - *Require environmental audits in the land use regulatory process.*

The Chesapeake Bay Watershed Development Policies and Guidelines also address the question of introduction of toxic substances to the Bay and its tributaries. Specific guidelines should be incorporated into the local regulatory process. They include:

- *Reduce the use of toxic compounds in the construction, operation and maintenance of new development.*

- *Site new activities that use, store, or manufacture significant quantities of toxic substances away from proximity to the Bay and its tributaries.*

- *Trap spills before they reach the Bay or its tributaries.*

AIR POLLUTION

Because of the symbiotic relationship between air and water pollution control:

- *The Department of Air Pollution Control and the Virginia State Water Control Board should cooperatively develop a regulatory program including Best Management Practices and superstructure containment for above-the-waterline "sandblasting" activities at shipyards.*

- *The DAPC and the VSWCB should work with the Virginia Department of Transportation to develop similar management techniques applicable to "blasting" activities on highway bridges and related structures.*

- *The DAPC and the VSWCB should coordinate their activities to control the introduction of toxic materials to the Elizabeth River through both air emissions and point and nonpoint source discharges.*

- *Vehicle owners, especially those operating vehicle fleets, should be required to institute maintenance programs to ensure proper operation of emissions controls.*

INFORMATION SYSTEM

To facilitate long-term management of environmental quality in the Elizabeth River Basin, a comprehensive Geographic Information System needs to be developed.

- *The SVPDC should develop a Comprehensive Geographic Information System, using the ARC/INFO system, for the Elizabeth River. This program should be structured to support local government management efforts.*

- *Efforts to develop similar systems at the local level should be coordinated with the SVPDC system to ensure compatibility and to ensure the widest availability of data for the region.*

- *The Virginia Council on the Environment, through the Virginia Rivers Inventory Project, should make natural resource data available in computerized and hard copy format to local governments and regional agencies.*

PUBLIC EDUCATION

A key component in the success of this environmental management program is the development of an educated and concerned citizenry. Both river users and the public at large must be involved. The CERWQMP: PMR recommended that:

- *Public education and information programs conducted by state, regional and local agencies should be continued and augmented. These programs should focus on the good housekeeping practices that can be implemented by homeowners and other residents. Opportunities to "piggyback" these programs with similar programs on Coastal Resources, Hazardous Waste and so forth should be explored and used to the maximum extent possible.*

That recommendation remains valid and should be pursued.

- *Useful "good-housekeeping" programs that should be encouraged include:*
  - *Litter control.*
  - *Proper disposal of home chemicals that are toxic.*
  - *Proper timing and application rates for fertilizers and pesticides.*
  - *Use of native plant materials in landscaping.*
  - *Vehicle maintenance.*

The VCOE and the SVPDC have discussed the need for a workshop, involving all state and local agencies with responsibility for environmental management in the Basin. Insofar as water quality monitoring is concerned, the VSWCB has conducted such as effort as a prelude to development of its Elizabeth River Monitoring Program. It appears that a similar effort could be beneficial to overall environmental management efforts.

- *The VCOE and the SVPDC in their coordination roles should convene a workshop of all state and federal agencies, local governments, and academic researchers to discuss ongoing and anticipated activities and needs for coordination. Future sessions should be planned based on the success of the initial workshop.*

- *The VCOE and the SVPDC should convene workshops for river users and the public in general if warranted, based on the information available through the agency and researcher workshop (s).*

Many of the problems with the Elizabeth River today are the result of past activities. To develop a full appreciation of the River's problems and potentials, an historic perspective needs to be developed in the public. A similar situation exists in the City of Baltimore with Baltimore Harbor. The City of Baltimore has prepared a very informative document, The Baltimore Harbor, describing the history, current status and future prospects of the various segments of Baltimore Harbor. A similar effort could be of long- term benefit to the Elizabeth River and Hampton Roads.

- *The SVPDC, in cooperation with the basin localities, should prepare a report, suitable for widespread public distribution, describing the history, current status and future prospects of the Elizabeth River. It is expected that this report would involve compiling and editing material from a variety of existing publications.*

MONITORING AND FUTURE STUDIES

To determine progress in achieving the recommendations of this Plan, to identify needed modifications in this Plan and related regulatory programs and to fill gaps in the information base for management decisions, a number of studies need to be completed.

- *The VSWCB should continue its Comprehensive Elizabeth River Water Quality Monitoring Program.*

- *The VSWCB should continue its Toxics Monitoring Program. Related to the efforts to monitor toxic point source discharges is the need to continue the effort to characterize the relationship between toxic effects and stormwater runoff.*

- *Local governments should implement a comprehensive stormwater impact monitoring program in conformance with the requirements of the EPA Stormwater Permitting Program. It is believed that this should be conducted on a cooperative regional basis. In addressing water quality impacts, the impacts of stormwater runoff on aquatic resources should be determined.*

- *The VSWCB and local government monitoring programs should be closely coordinated to ensure that the results are mutually supportive.*

- *The Virginia Institute of Marine Science in cooperation with the state resource management agencies should complete inventories of shellfish beds, fish nursery areas and prime submerged aquatic vegetation beds in the Elizabeth River. These inventories should not only identify the locations of such areas, but also the quality of the areas and their potential value assuming river quality goals are met.*

- *The Virginia Institute of Marine Science should complete the Tidal Wetlands Inventories for the basin.*

- *Inventories of Nontidal Wetlands should be completed for the entire basin. These should include the necessary "ground-truthing".*

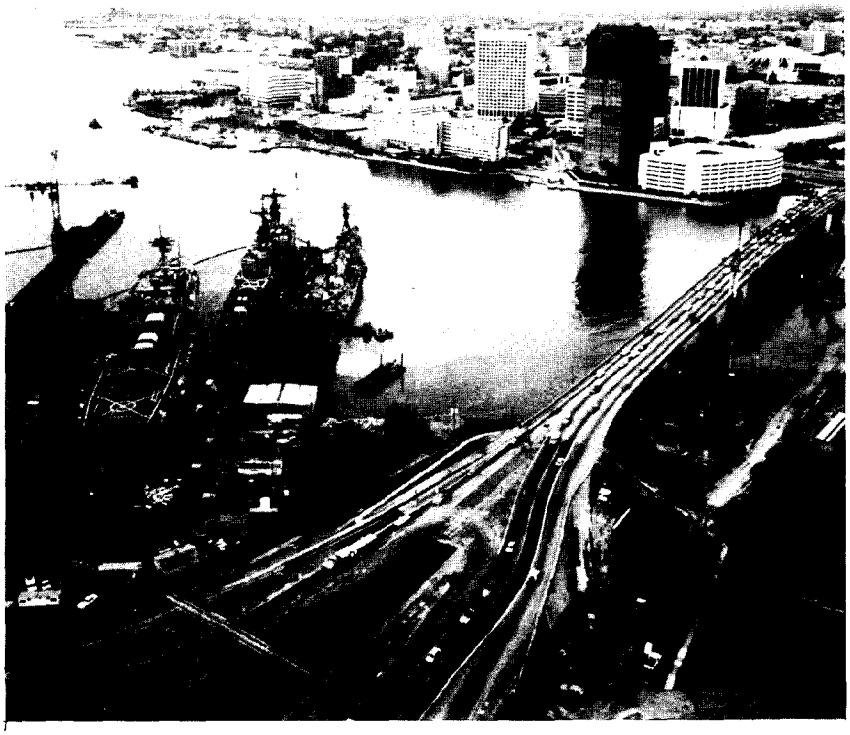
- *The Soil Conservation Service should complete the Soil Survey for the City of Chesapeake in a timely fashion.*

- *Continued analyses of the effectiveness of Best Management Practices should be conducted through the Chesapeake Bay Initiatives and related programs.*

- *A full scale water quality modelling exercise should be conducted to evaluate the most cost-effective means of accomplishing the forty percent (40%) nutrient reduction goal of the Chesapeake Bay Agreement. Model resolution for this effort should be sufficient to allocate efforts between point and nonpoint sources.*

- *The U.S. Geological Survey, in cooperation with the VSWCB, SVPDC and local governments, should expand its groundwater model for Southeastern Virginia to account for the water table and other shallow aquifers and the relationship between them and surface waters.*

This ongoing monitoring program is ambitious and will not be inexpensive. However, conducting such a program will be crucial to the long-term success of the Elizabeth River Environmental Management Program. In all cases, the results of the monitoring efforts and other studies should be published on a regular basis. To be most effective in conducting this program, the published results need to be distributed widely.



ENDNOTES

[1]Hampton Roads Water Quality Agency, Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations, (Norfolk, Virginia: HRWQA, 1976). Hereinafter, this document is referred to as CERWQMP: PMR.

[2]Southeastern Virginia Planning District Commission, Regional Coastal Resources Management Program for Southeastern Virginia: Fiscal Year 1987-88 - Elizabeth River Watershed Special Assistance Project (Chesapeake, Virginia: SVPDC, 1987).

[3]The number of Endnotes has been kept to a minimum in this Plan. Full documentation to support the discussion in the Plan is included with appropriate references in the Technical Appendices.

[4]Throughout this summary, each of these principal studies will be referred to by title. Full citations for each may be found in the Bibliography.

[5]Virginia State Water Control Board, Elizabeth River 205(j) Water Quality Plan - Draft (Richmond, Virginia: VSWCB, 1988), p. 37.

[6]Applied Marine Research Laboratory, Old Dominion University, An Evaluation of the Distribution of Toxicants/Mutagens in the Elizabeth River, Virginia in Relation to Land Use Activities (Richmond, Virginia: VSWCB, 1988).

[7]Hampton Roads Water Quality Agency, Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations (Norfolk, Virginia: HRWQA, 1986), pp. 29-30.

[8]Virginia Beach Department of Planning, A Report With Recommendations for Improved Management of Environmental Resources (Virginia Beach, Virginia: The City, 1987).

[9]Chesapeake Bay Local Assistance Board, "Chesapeake Bay Preservation Area Designation and Management Regulations," VR 173-02-00, Parts III and IV, at 5 Virginia Register of Regulations 1891, April 24, 1989.

[10]Southeastern Virginia Planning District Commission, Regional Stormwater Management Strategy for Southeastern Virginia (Chesapeake, Virginia: SVPDC, 1989.)

[11]Virginia Department of Waste Management, Virginia Hazardous Waste Activity Notifiers (Richmond, Virginia: DWM, 1989).

[12]NUS Corporation, Field Investigation Team Activities at Uncontrolled Hazardous Substance Facilities - Zone I: Special Project Report Phase I for the Elizabeth River Study (Philadelphia, Pennsylvania: EPA, 1988).

13Thomas R. Schueler, Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs (Washington, D.C.: Washington Council of Governments, 1987).

BIBLIOGRAPHY

Aldre Properties, Inc. v. Board of Supervisors of Fairfax County, Virginia. Chancery Nos. 78463-A, 67476, 78450, and 78425. Nineteenth Judicial Circuit of Virginia, January 7, 1985.

Applied Marine Research Laboratory, Old Dominion University. An Evaluation of the Distribution of Toxicants/Mutagens in the Elizabeth River, Virginia in Relation to Land Use Activities. Richmond, Virginia: VSWCB, 1988.

_____. "Distribution and Management Implications of Contaminants in the Sediments of the Elizabeth River." A Draft Proposal Submitted to the Virginia State Water Control Board. Richmond, Virginia: VSWCB, 1989.

Byrd, Bill. "State Renews Elizabeth River Water Tests" in The Virginian-Pilot and The Ledger-Star. October 18, 1986.

Camp, Dresser and McKee. Water Quality Management Plan for Skiffe's Creek Reservoir Watershed. Prepared for HRWQA. Annandale, Virginia: CDM, 1984.

Carlock, John M. "The Elizabeth River: Problems, Conflicts and Solutions" in Virginia Water Resources Research Center, Critical Water Issues in Tidewater Virginia: Four Papers from Meetings of the American Society of Civil Engineers. Blacksburg, Virginia: Virginia Polytechnic Institute and State University, 1988.

"Chesapeake Bay Agreement", December 15, 1987.

Chesapeake Bay Land Use Roundtable. Land Use Initiatives for Tidewater Virginia: The Next Step in Protecting the Bay. Charlottesville, Virginia: Institute for Environmental Negotiation, 1987.

Chesapeake Department of Planning. Future Land Use Plan: Chesapeake, Virginia. Chesapeake, Virginia: The City, 1979.

_____. Basic Policies for the Comprehensive Plan of Chesapeake Virginia. Chesapeake, Virginia: The City, 1988.

_____. Chesapeake Land Use Element. Chesapeake, Virginia: The City, 1977.

_____. Comprehensive Plan - Draft. Chesapeake, Virginia: The City, 1985.

Chesapeake Department of Public Works. Public Works Department Public Facilities Manual. Chesapeake, Virginia: The City, 1983.

Chesapeake Executive Council. Technical Assistance and Incentives to Local Governments. A Chesapeake Bay Agreement Commitment Report. Richmond, Virginia: Commonwealth of Virginia, 1988.

_____. Chesapeake Bay Watershed Development Policies and Guidelines. A Chesapeake Bay Agreement Report. Richmond, Virginia: Commonwealth of Virginia, 1989.

_____. Population Growth and Development in the Chesapeake Bay Watershed to the Year 2020. Report of the Year 2020 Panel to the Chesapeake Executive Council. Richmond, Virginia: Commonwealth of Virginia, 1988.

_____. Chesapeake Bay Basinwide Toxics Reduction Strategy. A Chesapeake Bay Agreement Report. Annapolis, Maryland: State of Maryland, 1988.

_____. Baywide Conventional Pollutants Control Strategy. A Chesapeake Bay Agreement Commitment Report. Annapolis, Maryland: State of Maryland, 1988.

_____. The First Progress Report Under the 1987 Chesapeake Bay Agreement. Richmond, Virginia: Commonwealth of Virginia, 1989.

City of Chesapeake. Zoning Ordinance of the City of Chesapeake. Chesapeake, Virginia: The City, 1969, as amended through 1977.

_____. City Code, Chapter 8A, "Erosion and Sediment Control". Chesapeake, Virginia: The City, 1976.

City of Norfolk. City Code, Appendix A, "Zoning Ordinance". Ordinance No. 24,504, as amended.

_____. City Code. "Erosion and Sediment Control". Section 15-1, et. seq. Norfolk, Virginia: The City, 1983.

_____. City Code, Chapter 42.5. "Subdivisions". Ordinance No. 30,009, July 10, 1979.

_____. City Code, Chapter 32.1. "Site Plan Review". Ordinance No. 34,815, November 24, 1987.

City of Norfolk, Citizens Advisory Commission. Community Environment. Norfolk, Virginia: The City, 1983.

City of Portsmouth. City Code, Chapter 40. "Zoning Ordinance". Ordinance 1972-125, October 24, 1972.

_____. "Draft Zoning Ordinance Update". Portsmouth, Virginia: The City, 1988.

_____. City Code, Chapter 33. "Subdivisions". Ordinance 1972-124, October 24, 1972.

_____. City Code, Section 32-60.1, et. seq. "Erosion and Sediment Control." Ordinance 1975-222. Portsmouth, Virginia: The City, 1975.

City of Raleigh Planning Department. Preliminary Implementation Report on Facility Fees of the City of Raleigh. Raleigh, North Carolina: The City, 1986.

City of Virginia Beach. City Code. "Erosion and Sediment Control". Section 30-56, et. seq. Virginia Beach, Virginia: The City, 1979, as amended.

_____. City Code: Appendix A - Zoning Ordinance. Virginia Beach, Virginia: The City, 1973, as amended.

_____. City Code: Appendix B - Subdivision Regulations. Virginia Beach, Virginia: The City, 1970, as amended.

_____. City Code: Appendix C - Site Plan Ordinance. Virginia Beach, Virginia: The City, 1965, as amended.

_____. City Zoning Ordinance: Virginia Beach, Virginia. Virginia Beach, Virginia: The City, 1988.

_____. Development Ordinance Revisions, Including Stormwater Management Ordinance and Subdivision Ordinance: City of Virginia Beach. Virginia Beach, Virginia: The City, 1988.

Commonwealth of Virginia. "State Water Control Law", Title 62.1, Chapter 3.1 through 3.4, Code of Virginia, 1950, as amended.

_____. "Chesapeake Bay Preservation Act". Chapter 608 Acts of Assembly, 1988. Title 10, Chapter 25, Code of Virginia, 1950, as amended.

_____. Senate Bill 722/House Bill 1848, "Stormwater Management". Amending Title 10.1, Chapter 6, Code of Virginia, 1950, as amended.

_____. House Bill 1743, "Solid Waste Planning". Amending Title 10.1-1411, Code of Virginia, 1950, as amended.

Duncan, James B., Terry D. Morgan and Norman R. Standerfer. Drafting Impact Fee Ordinances. A Paper Presented at the Mid-Atlantic Regional Meeting of the American Planning Association. Virginia Beach, Virginia. September 1986.

Environmental Quality Branch, Atlantic Division, Naval Facilities Engineering Command. "Water Quality and the Navy: A Perspective on the Navy's Environmental Management Program." A Paper presented at the Virginia Conference on Land Use and the Chesapeake Bay. May 16, 1984.

Fischer, Michael L. "California's Coastal Program: Larger-Than- Local Interests Built into Local Plans" in Journal of the American Planning Association, Volume 51, No. 3. Chicago, Illinois: APA, Summer 1985.

Hampton Roads Sanitation District. Wastewater Characterization Study, 1987. Virginia Beach, Virginia: HRSD, 1988.

Hampton Roads Water Quality Agency. Hampton Roads Water Quality Management Plan. Virginia Beach, Virginia, HRWQA, 1978.

_____. Hampton Roads Water Quality Management Plan: Appendix 5 - Nonpoint Source Studies. Virginia Beach, Virginia: HRWQA, 1978.

_____. Hampton Roads Water Quality Management Plan: Appendix 7 - Physical Features and Land Use Studies. Virginia Beach, Virginia: HRWQA, 1978.

_____. Hampton Roads Water Quality Management Plan: Continuing Planning Process - Water Quality Studies of Lynnhaven and Northwest Rivers. Norfolk, Virginia: HRWQA, 1982.

_____. Hampton Roads Water Quality Management Plan: Continuing Planning Process - Preliminary Nonpoint Source Control Plan and Management Practice Effectiveness and Cost Studies. Norfolk, Virginia: HRWQA, 1982.

_____. Hampton Roads Water Quality Management Plan: Plan Update 1983. Norfolk, Virginia: HRWQA, 1983.

_____. Hampton Roads Water Quality Management Plan: Plan Update 1983 - Socioeconomic Studies. Norfolk, Virginia: HRWQA, 1983.

_____. Hampton Roads Water Quality Management Plan: Plan Update 1983 - Technical Studies. Norfolk, Virginia: HRWQA, 1983.

_____. Comprehensive Elizabeth River Water Quality Management Plan: Step One - Issue Identification. Norfolk, Virginia: HRWQA, 1985.

_____. Comprehensive Elizabeth River Water Quality Management Plan: Step Two - Problem Agenda. Norfolk, Virginia: HRWQA, 1985.

_____. Management Practice Inventory and Cost Evaluation. Virginia Beach, Virginia: HRWQA, 1979.

_____. Review of Selected State Land Use and Natural Resource Management Programs. Chesapeake, Virginia: HRWQA, 1988.

_____ with Southeastern Virginia Planning District Commission. Comprehensive Elizabeth River Water Quality Management Plan: Preliminary Management Recommendations. Norfolk, Virginia: HRWQA, 1986.

Harford County, Maryland. Harford County - Proposed Chesapeake Bay Critical Area Management Program. Bel Air, Maryland: The County, 1987.

Institute for Environmental Negotiation. Shoreline Management Options for Virginia Coastal Localities. Charlottesville, Virginia: University of Virginia, 1988.

_____. Planning and Growth Management in Virginia: A Survey of Local Practice. Charlottesville, Virginia: University of Virginia, 1988.

_____. A Critical Evaluation of Selected Shoreline Management Tools. Charlottesville, Virginia: University of Virginia, 1988.

_____. "Memorandum to Chesapeake Bay Land Use Roundtable Members". Charlottesville, Virginia: IEN, 1987.

Kelly & Potter, P.C., James Duncan and Associates, and Hart- Freeland-Roberts, Inc. Zoning and Subdivision Regulation in Portsmouth, Virginia. Pueblo, Colorado: Kelly & Potter, P.C., n.d.

Kendig, Lane; Conner, Susan; Byrd, Cranston; and Judy Heyman. Performance Zoning. Chicago, Illinois: Planners Press, 1980.

Kinsey, David N. "Lessons from the New Jersey Coastal Management Program" in Journal of the American Planning Association, Volume 51, No. 3. Chicago, Illinois: APA, Summer 1985.

Levine, Johnathon and John D. Landis. "Geographic Information Systems for Local Planning" in Journal of the American Planning Association, Volume 55, Number 2. Chicago, Illinois: APA, Spring, 1989.

McCrone, Inc. Town of Elkton - Chesapeake Bay Critical Area Protection Program. Elkton, Maryland: The Town, 1987.

New Hanover County Department of Planning. Conservation Resources in New Hanover County. Wilmington, North Carolina: The County, 1984.

Norfolk Department of City Planning. Zoning Map: City of Norfolk, Virginia. Norfolk, Virginia: The City, 1985.

Northern Virginia Planning District Commission. Guidebook for Screening Urban Nonpoint Pollution Management Strategies. Falls Church, Virginia: NVPDC, 1979.

NUS Corporation. Field Investigation Team Activities at Uncontrolled Hazardous Substances Facilities - Zone I: Special Project Report - Phase I for the Elizabeth River Study. Prepared for U.S. Environmental Protection Agency. Philadelphia, Pennsylvania: EPA, 1988.

Owens, David W. "Coastal Management in North Carolina: Building a Regional Consensus" in Journal of the American Planning Association, Volume 51, No. 3. Chicago, Illinois: APA, Summer 1985.

Portsmouth Department of Planning. Comprehensive Plan: Portsmouth, Virginia. (Draft). Portsmouth, Virginia: The City, 1988.

_____. Comprehensive Plan: Portsmouth, Virginia - Technical Report. Portsmouth, Virginia: The City, 1988.

_____. Comprehensive Plan: City Goals. Portsmouth, Virginia: The City, 1980.

_____. Comprehensive Plan: Plans for Action. Portsmouth, Virginia: The City, 1980.

_____. Comprehensive Plan: Summary and Future Land Use. Portsmouth, Virginia: The City, 1980.

Portsmouth Public Works Department. The City of Portsmouth Development Guide Book - Draft. Portsmouth, Virginia: The City, 1986.

Praful, Shah and Associates, Inc. with Land Design Research, Inc. Prepared for the Portsmouth Redevelopment and Housing Authority. Priority Action Program for Central Portsmouth. Portsmouth, Virginia: The City, 1985.

Public Access Task Force Committee. Chesapeake Bay and Susquehanna River Public Access Guide. Richmond, Virginia: Commonwealth of Virginia, 1989.

Public Law 92-500. "Federal Water Pollution Control Act Amendments of 1972".

Public Law 99-499. "Superfund Amendments and Reauthorization Act of 1986, Title III."

Rogers, Golden, and Halpern, et.al. Cecil County - Chesapeake Bay Critical Area Program. Cecil County, Maryland: The County, 1987.

Schueler, Thomas R. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Washington, D.C.: Washington Council of Governments, 1987.

Southeastern Virginia Planning District Commission and Hampton Roads Water Quality Agency. Briefing Paper: Urban Use Segment Classification for Elizabeth River. Norfolk, Virginia: SVPDC, 1980.

Southeastern Virginia Planning District Commission. Nonprocessable Solid Waste Plan for Southeastern Virginia. Norfolk, Virginia: SVPDC, 1982.

_____. Hazardous Waste in Southeastern Virginia. Norfolk, Virginia: SVPDC, 1986.

_____. Regional Energy Impact Analysis. Norfolk, Virginia: SVPDC, 1984.

_____. Watershed Management Plans: Cavalier Industrial Area and Greenbrier Planned Community, City of Chesapeake, Virginia. A Report to the HRWQA. Norfolk, Virginia: SVPDC, 1985.

_____. Nonpoint Source Control Program for the Hampton Roads Area. A Report to the HRWQA. Norfolk, Virginia: SVPDC, 1983.

_____. Transportation Data Report: Land Use Files - Cities of Chesapeake, Norfolk, Portsmouth and Virginia Beach, 1985. Norfolk, Virginia: SVPDC, 1986.

_____. The Waters of Southeastern Virginia. Two Volumes. Chesapeake, Virginia: SVPDC, 1988.

_____. The Value of Wetlands: A Guide for Citizens. Chesapeake, Virginia: SVPDC, 1988.

_____. Regional Coastal Resources Management Program for Southeastern Virginia: Fiscal Year 1987-88 - Elizabeth River Watershed Special Assistance. (A Proposal Submitted to the Virginia Council on the Environment by the SVPDC.) Chesapeake, Virginia: SVPDC, 1987.

State of Maryland. Summary: Chesapeake Bay Critical Area Commission. Annapolis, Maryland: Maryland Department of Natural Resources, 1986.

State of North Carolina, Department of Natural Resources and Community Development, Division of Coastal Management. Striking a Balance:

Reflections on Ten Years of Managing the North Carolina Coast. Raleigh, North Carolina: DNRCD, 1985.

_____. Subchapter 7B - Land Use Planning Guidelines. Raleigh, North Carolina: DNRCD, 1985.

State of Oregon, Land Conservation and Development Commission. Oregon's Statewide Planning Goals - 1985. Salem, Oregon: Land Conservation and Development Commission, 1985.

The Phipps Group. City of Annapolis - Critical Area Program Appendices. Annapolis, Maryland: The City, 1987.

U. S. Department of Defense, Army Corps of Engineers. 33 CFR Parts 320-330. "Regulatory Programs of the Corps of Engineers". 47 Federal Register 31794, July 22, 1982.

_____. "Intent to Prepare a Draft Supplemental Environmental Impact Statement (DSEIS) for Proposed Elizabeth River and Southern Branch 45-foot and 40-foot Navigation Improvements in the Vicinity of Norfolk Harbor, Hampton Roads, Virginia". 54 Federal Register 15964, April 20, 1989.

U.S. Department of Defense. Water Quality Assessment of DOD Installations/Facilities in the Chesapeake Bay Region: Phase III Report. Arlington, Virginia: Tetra Tech, Inc. for Deputy Assistant Secretary of Defense for Environment and the U.S. Army Corps of Engineers, Baltimore District, 1987.

U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory. Inventory of Potential Hazardous Waste Sites Elizabeth River Area, Virginia. Two Volumes. Philadelphia, Pennsylvania: EPA, 1987.

U.S. Environmental Protection Agency with Applied Biology Inc. and Gannett Fleming Corddry and Carpenter, Inc. Coastal Marinas Assessment Handbook. Atlanta, Georgia: EPA, 1985.

U. S. Environmental Protection Agency. Chesapeake Bay: A Framework for Action. Philadelphia, Pennsylvania: EPA, 1983.

_____. Chesapeake Bay: Findings and Recommendations. Philadelphia, Pennsylvania: EPA, 1983.

_____. Results of the Nationwide Urban Runoff Program: Executive Summary. Washington, D.C.: EPA, 1983.

_____. Results of the Nationwide Urban Runoff Program: Final Report. (3 Volumes). Washington, D.C.: EPA, 1983.

_____. "Notification Requirements for Owners of Underground Storage Tanks; Final Rule". 40 CFR Part 280. 50 Federal Register 46602, November 8, 1985.

_____. "Oil Pollution Prevention: Non-Transportation Related Onshore and Offshore Facilities". 40 CFR Part 112. 38 Federal Register 34163, December 11, 1973.

_____. "National Pollution Discharge Elimination System Permit Regulations; Final Rule". 40 CFR Parts 122, 124 and 125. 49 Federal Register 37997, September 26, 1984.

_____. "National Pollution Discharge Elimination System Permit Regulations; Storm Water Point Sources; Additional Information and Request for Comments". 40 CFR Part 122. 50 Federal Register 32547, August 12, 1985.

_____. "National Pollution Discharge Elimination System Permit Regulations; Modification of Application Deadline for Storm Water Point Sources; Final Rule". 40 CFR Part 122. 50 Federal Register 35199, August 29, 1985.

_____. "National Pollution Discharge Elimination System Permit Application Regulations for Storm Water Dischargers; Proposed Rule". 40 CFR Parts 122, 123, 124, and 501. 53 Federal Register 49416, December 7, 1988.

_____. "Tributyltin Antifoulants: Notice of Intent to Cancel; Denial of Applications for Registration; Partial Conclusion of Special Review". 53 Federal Register 39022, October 4, 1988.

U. S. Geological Survey. "Elizabeth River Watershed Geographic Information System Work Plan". Richmond, Virginia: USGS, 1986.

U.S. Geological Survey in cooperation with the Southeastern Virginia Planning District Commission. Evaluation of Municipal Withdrawals from the Confined Aquifers of Southeastern Virginia. Richmond, Virginia: USGS, 1988.

Virginia Beach Department of Planning. The Comprehensive Plan: Virginia Beach, Virginia. Virginia Beach, Virginia: The City, 1985.

_____. A Report with Recommendations for Improved Management of Environmental Resources. Virginia Beach, Virginia: The City, 1987.

_____. Landscaping, Screening, & Buffering Specifications and Standards. Virginia Beach, Virginia: The City, 1988.

Virginia Beach Department of Public Works. Engineering Standards and Specifications. Virginia Beach, Virginia: The City, 1982.

Virginia Chesapeake Bay Local Assistance Board. "Chesapeake Bay Preservation Act Designation and Management Regulations". VR 173-02-00. 5 Virginia Register of Regulations 1891, April 24, 1989.

Virginia Council on the Environment with U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Commonwealth of Virginia Coastal Resources Management Program and Final Environmental Impact Statement. Washington, D.C.: U.S. Department of Commerce, 1986.

Virginia Department of Conservation and Historic Resources, Soil and Water Conservation Commission. (Now Division of Soil and Water Conservation.) Virginia Erosion and Sediment Control Handbook. Richmond, Virginia: DSWC, 1980.

_____. Virginia Nonpoint Source Management Program. Richmond, Virginia: The Division, 1988; Revised, 1989.

Virginia Department of Waste Management. Virginia Hazardous Waste Activity Notifiers. Richmond, Virginia: DWM, 1989.

_____. Solid Waste Management Regulations. VR 672-20-10. Richmond, Virginia: DWM, 1988.

Virginia Groundwater Protection Steering Committee. A Groundwater Protection Strategy for Virginia. Richmond, Virginia: VSWCB, 1987.

_____. Groundwater Protection in Virginia. Annual Report of the Groundwater Protection Steering Committee. Richmond, Virginia: VSWCB, 1989.

Virginia Institute of Marine Science and Old Dominion University. Elizabeth River Long-Term Monitoring Program: Phase I - February - June 1989. (A Draft Proposal Submitted to the Virginia State Water Control Board.) Richmond, Virginia: VSWCB, 1989.

Virginia Institute of Marine Science. A Resource Atlas and Existing Conditions Report on the Southern Branch of the Elizabeth River. Gloucester Point, Virginia: VIMS, 1979.

_____. Shoreline Situation Report: Cities of Chesapeake, Norfolk, and Portsmouth. Gloucester Point, Virginia: VIMS, 1976.

Virginia Institute of Marine Science and Virginia Marine Resources Commission. Wetlands Guidelines. Newport News, Virginia: The Commission, 1986.

_____. Subaqueous Guidelines. Newport News, Virginia: The Commission, 1986.

Virginia State Water Control Board with Hampton Roads Water Quality Agency and Southeastern Virginia Planning District Commission. Background and Problem Assessment Report for the Elizabeth River. General Information Bulletin No. 557. Richmond, Virginia: VSWCB, 1984.

Virginia State Water Control Board. Elizabeth River 205(j) Water Quality Plan. (Draft). Richmond, Virginia: VSWCB, 1988.

_____. State Water Control Board Regulations. Richmond, Virginia: VSWCB, 1989.

_____. Best Management Practices Handbooks. Richmond, Virginia: VSWCB, 1979.

_____. Chowan Basin Nutrient Control Plan for Virginia - Draft. Information Bulletin 561. Richmond, Virginia: VSWCB, 1984.

_____. Water Quality Standards. Publication No. RB-1-80, as amended. Richmond, Virginia: VSWCB, 1982, with amendments.

_____. "Summary of EPA's Oil Pollution Prevention Regulation, 40 CFR 112". Richmond, Virginia: VSWCB, 1974.

_____. Issue Paper: Storm Water Runoff NPDES Permit Procedure. Richmond, Virginia: VSWCB, 1985.

Washington Department of Ecology and the Grays Harbor Regional Planning Commission with National Oceanic And Atmospheric Administration. Program Draft Environmental Impact Statement: Washington State Coastal Zone Management Program - Grays Harbor Estuary Management Plan. Olympia, Washington: Department of Ecology, n.d.

Woolpert Consultants. Coastal Zone Management Plan: City of Portsmouth, Virginia. Portsmouth, Virginia: The City, 1988.

PERSONAL COMMUNICATIONS

Memorandum to HRWQA Goals, Objectives and Policies Task Force from Assistant Director, Norfolk Department of City Planning. March 10, 1986.

Memorandum to Paul E. Fisher, HRWQA, from Norman E. Larsen, VMRC. March 6, 1986.

Letter, J. R. Bailey, U.S. Navy, to Hampton Roads Water Quality Agency. February 26, 1986.

Letter, John M. Carlock, SVPDC, to Alan E. Pollock, SWCB, concerning SVPDC/HRWQA recommendations for "Elizabeth River Monitoring Program". October 7, 1988.

Letter, Alan E. Pollock, SWCB, to John M. Carlock, SVPDC, concerning "Elizabeth River Long Term Monitoring Program". December 22, 1988.

Letter, John M. Carlock, SVPDC, to Alan E. Pollock, SWCB, concerning review of "Elizabeth River Long Term Monitoring Program". January 4, 1989.

DATE DUE

GAYLORD No. 2333 PRINTED IN U.S.A.

NOAA COASTAL SERVICES CENTER LIBRARY

3 6668 14107 7562