
Environmental Assessment

SHORELINE MANAGEMENT PLAN
COLONIAL NATIONAL HISTORICAL PARK
JAMESTOWN ISLAND, VIRGINIA

Prepared by

Norfolk District
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for

National Park Service
Yorktown, Virginia

April 2002

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Environmental Assessment

Shoreline Management Plan
Colonial National Historical Park
Jamestown Island, Virginia

April 2002

National Park Service

Environmental Assessment Shoreline Management Colonial National Historical Park Jamestown Island, Virginia

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1.0 PURPOSE AND NEED FOR ACTION

1.1 Introduction

The National Park Service (NPS) proposes to develop and implement erosion control measures at the Colonial National Historical Park (COLO) that would stabilize eroding shorelines at Jamestown Island and the Colonial Parkway that are currently impacting or have the potential to impact significant archaeological sites in the not too distant future. The specific objectives of these erosion control measures, as described in this Environmental Assessment (EA), include the following:

- Protect historic and pre-historic archaeological sites.
- Protect, maintain, enhance and/or create wetlands habitat, both vegetated and non-vegetated.
- Management of upland runoff and groundwater flow through the maintenance of vegetated wetland fringes.
- Minimize potential secondary impacts to downdrift shores through a reduction in the sand supply or the encroachment of structures onto subaqueous land and wetlands.
- For Jamestown and environs, a proposed shoreline strategy should not interfere with historical interpretation.
- Minimize the impacts from the staging of equipment and materials during construction.

The above objectives were assessed within the context of each shoreline reach. While all objectives were considered, each one did not carry equal weight. In fact, satisfaction of all objectives for any given reach is not likely as some may be mutually exclusive. Areas of significant archeological concern along the Jamestown Island and Colonial Parkway shorelines were identified during meetings and field trips with COLO personnel. It was agreed at these meetings that there is an immediate need to take action as the continuing erosion of shoreline areas adjacent to (and in some cases in the middle of) these significant archeological sites threatens the permanent loss of these resources.

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA), 42 USC. 4321-4347; the Council on Environmental Quality (CEQ), 40 CFR 1500-1508; and NPS Director's Order 12. The focus of the EA is the erosion of the Jamestown Island and Colonial Parkway shorelines and the alternatives considered to control the erosion through a shoreline management plan. Each alternative considered is intended to prove effective in providing protection against erosion for Jamestown Island's infrastructure as well as preserve historic and cultural resources, ecological habitat, and recreational resources. Construction of each alternative would require work on offshore, submerged lands, tidal areas, and the immediate shoreline of Jamestown Island and the Colonial Parkway. This EA will evaluate both the short-term and long-term environmental impacts related to the construction and permanent installation of these protection alternatives.

2.0 BACKGROUND

2.1 Project Background

COLO is located in southeastern Virginia about 33 miles northwest of the City of Norfolk and about 45 miles southeast of the City of Richmond (Figure 1). It is situated on the peninsula that separates the James and York Rivers within the counties of York, James City, Gloucester, and Surry and the City of Williamsburg. The park lies within the coastal plain of Tidewater Virginia and has a direct hydrological link to the Chesapeake Bay.

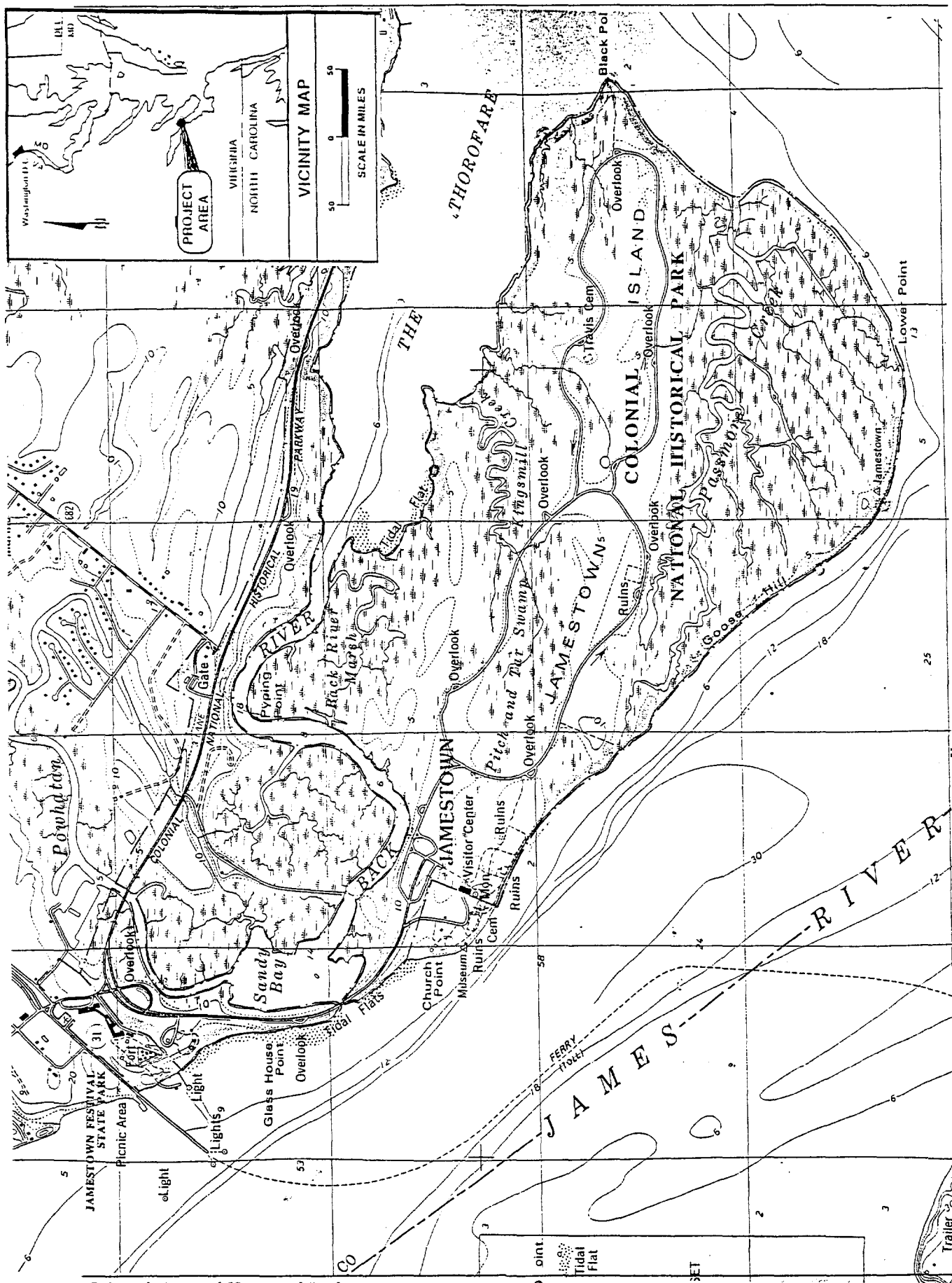
COLO was created in 1930 as Colonial National Monument and renamed in 1936 to its current name. The park is approximately 9,350 acres in size and embraces a historic region that includes Williamsburg, Yorktown, and Jamestown Island as well as other historic sites of interest. Archaeological and historical studies as well as reconstruction of old places of interest have been accomplished in the Park. Numerous streams, creeks, and ponds flow through the Park and feed directly into the James or York Rivers. Mixed pine and hardwood forests cover most of the Park. Substantial acreage of both tidal and nontidal wetlands and open fields also exist.

Jamestown is the one name recognized by almost all Americans as the site of the first permanent English settlement established in North America in 1607. The Powhatan Indians had inhabited the area for hundreds of years before the colonists arrival. The original site of Jamestown served as Virginia's capital until 1699 but had become farmland by the mid-1700's. Jamestown Island is a 1,561-acre low terrace island, nearly level to gently sloping. It contains pine-oak forests and associated marshes and wetlands.

The Association for the Preservation of Virginia Antiquities (APVA), a private organization, acquired that portion of the island that included the Old Church Tower (built circa [ca.] 1639), the graveyard, and the west end of the town site in 1893. NPS acquired the remainder of the island in 1934, and in 1940, the Secretary of the Interior designated the entire island as a National Historic Site. NPS and the APVA cooperate fully in the administration, protection, and development of Jamestown Island.

In preparation for the 350th anniversary celebration in 1957 of the landing at Jamestown Island, NPS completed the construction of the 23-mile Colonial Parkway, which was begun in 1930 and connects Yorktown and Jamestown. The Parkway provides an aesthetic drive through natural environments with few modern intrusions.

National Park Service



Colonial National Historical Park
Shoreline EA

Figure 1. Location of Jamestown Island.

Also in connection with the 350th anniversary celebration, the Commonwealth of Virginia built the Jamestown Festival Park adjacent to Jamestown Island. The Jamestown Foundation, an official agency of the Commonwealth, is responsible for the operation and management of the Park. The park contains exhibit pavilions and replicas of the first fort, the three ships that brought the first settlers, and a Native American lodge. Because of the close physical and historical relationship between the Jamestown Festival Park and Jamestown Island, the Commonwealth of Virginia has a strong interest in the preservation of the original site of the Jamestown settlement.

Photographs of some of the main features of Jamestown Island and the Colonial Parkway are shown in Figures 2 and 3.

2.2 Purpose and Need for Action

The need for shoreline protection at Jamestown Island has been recognized for some time. A meeting held by COLO in August 1997 began discussions in earnest to identify the problem and to pursue solutions. A number of alternative solutions were discussed and evaluated in subsequent meetings and in the study ultimately conducted by the Virginia Institute of Marine Science (VIMS) and the US Army Corps of Engineers, Norfolk District (COE).

Generally, the entire COLO shoreline on the James and York Rivers is subject to wind-driven wave-forces that cause moderate to severe shoreline erosion. Storm activity, in particular, over the last several years (i.e., Hurricane Gordon in 1994, Hurricanes Bertha and Fran in 1996, the 1998 Twin Northeasters, and Hurricane Bonnie in 1998) has eroded much of the shoreline along the James River. Numerous shoreline structures, such as stone revetments and seawalls, have been installed over the years to protect exposed upland areas from erosion, but the unprotected shorelines continue to erode.

The study area shoreline includes the shoreline of Jamestown Island and those shorelines within park boundaries along the James River, Powhatan Creek, Sandy Bay, Back River, and The Thorofare. Also included is the College Creek side of the Colonial Parkway Peninsula. A brief description of each shoreline segment, as shown in Plates 1-5, respectively, is provided in the following paragraphs. Plates 1-5 are found in Appendix D. Photographs of some of the areas are shown in Figure 4.

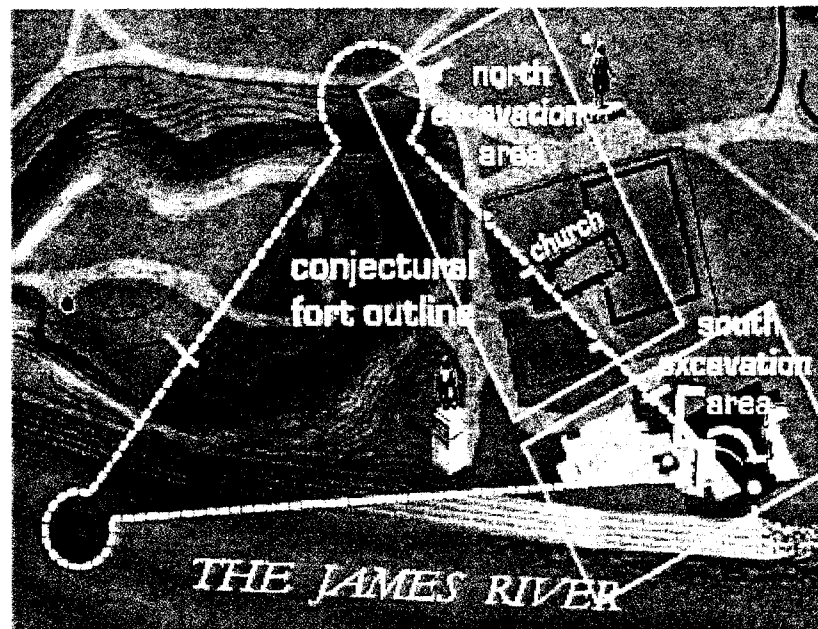
Study Area Shoreline No. 1

The shoreline shown on this plate includes a total of approximately 8 miles of shoreline segments along the James River, Powhatan Creek, the Back River, Sandy Bay, and The Thorofare. The James River segment is mostly upland bank and includes the Jamestown Isthmus. Most of this area is fronted by hardened structures such as seawalls, revetments, and bulkheads. The shorelines located along Powhatan Creek, Sandy Bay, Back River, and The Thorofare are mainly unstable marsh areas with intermittent areas of unstable upland banks. Most of these shorelines have no shore protection and show signs of chronic erosion along both the upland banks and the marsh shores. Areas of archeological importance along the Plate 1 shoreline segments include the original Jamestown Fort and the original glasshouse and recreated glasshouse furnace.



National Park Service Website

Captain John Smith Statue Facing the James River



APVA Website

North and South Excavation Areas for Original Fort

Figure 2. Two of the Main Attractions at Jamestown Island



Colonial Connections Website

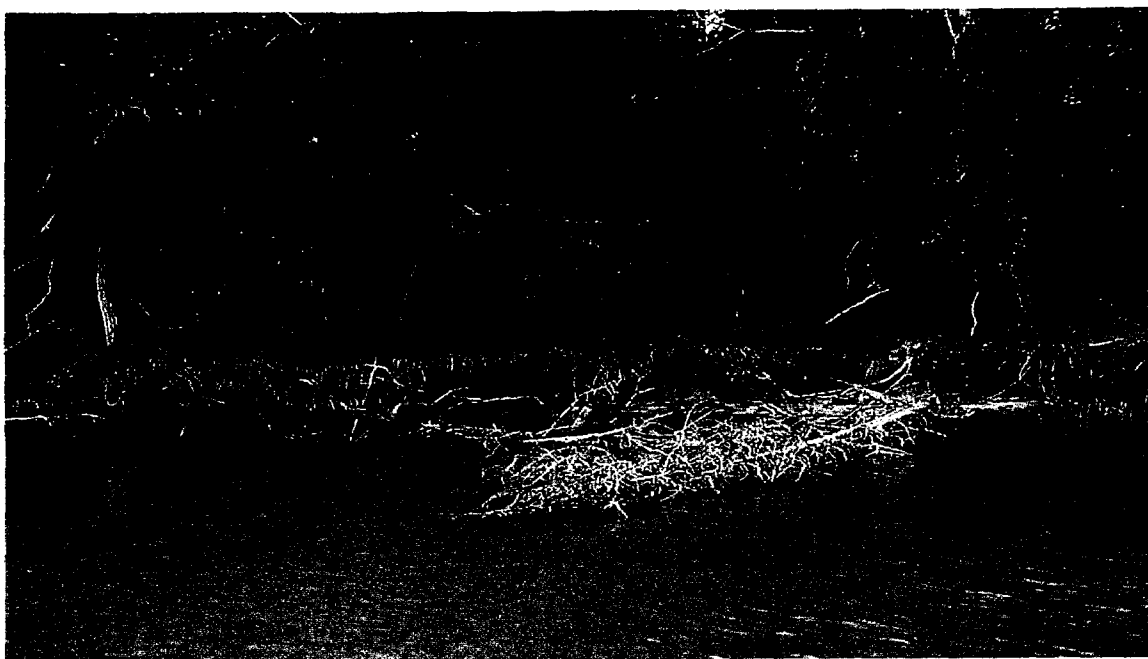
Colonial Parkway at Jamestown Island



Colonial Connections Website

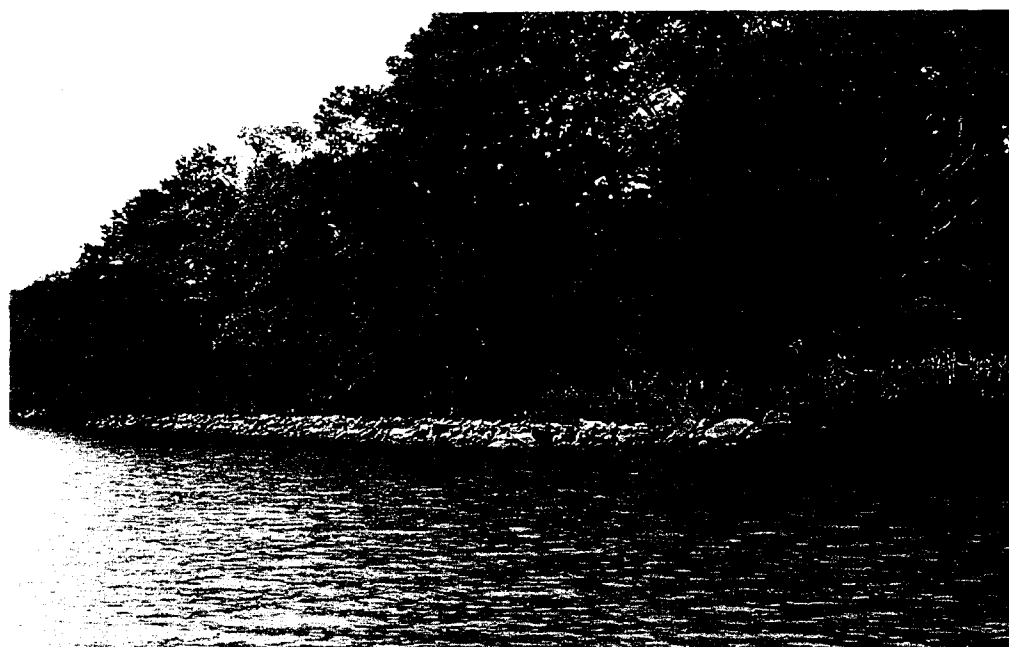
Reconstructed Glasshouse of 1608

Figure 3. Two of the Main Attractions at Jamestown Island



Hudgins 2002

Plate 1 Shoreline Just South of Sandy Bay



Hudgins 2002

Plate 2 Shoreline Along the James River
(Note Existing Stone Revetment)

Figure 4. Shoreline Areas of Jamestown Island

Study Area Shoreline No. 2

The shoreline shown on this plate includes a segment along the James River covering a distance of about 2.2 miles. The upstream third of this shoreline is protected by defensive measures, including a 1,500-foot sloped concrete seawall at the original Jamestown Fort area and a 2,000-foot stone revetment immediately downstream. The remaining shoreline is approximately one-half unstable marsh and upland bank and one-half stable upland bank. This shoreline is unprotected and eroding but becomes more stable with a widened beach toward Lower Point. Many cultural resources are located in the adjacent upland areas of the AVPA property and New Towne.

Study Area Shoreline No. 3

The shoreline shown on Plate 3 extends along the southeast end of Jamestown Island from Lower Point to and including Black Point, a distance of approximately 1.3 miles. This thick marsh peat shoreline is mostly unprotected and eroding except for a 1,000-foot segment immediately southwest of Black Point, which is fronted by a low revetment. Erosion is most significant at Black Point, which is where the few cultural resources along this shoreline are located.

Study Area Shoreline No. 4

The shoreline shown on Plate 4 includes about 14,000 feet of shoreline along the north and south sides of The Thorofare. Approximately 5,000 feet of the shoreline is unstable upland bank, 6,000 feet is unstable marsh, and the remaining 3,000 feet is hardened by protective structures. The protective structures include a low stone revetment along both sides of the entrance to Mill Creek and a crude rubble revetment along the National Memorial Park. There are numerous small, subtle pocket beaches located along the shoreline that were formed from the erosion of fill that was placed during the construction of the Colonial Parkway in the mid-1950's. The Jamestown Island shorelines along The Thorofare show a general erosional trend, which is where several known archeological sites are found.

Study Area Shoreline No. 5

The shoreline shown on this plate includes approximately 2.9 miles of James River shoreline along the Colonial Parkway, where several overlooks are located. The shoreline is comprised of approximately 9,500 feet of unstable upland banks, 2,000 feet of unstable marsh, 2,500 feet of stable upland, and 1,000 feet of hardened shoreline (revetment). The water's edge comes relatively close to the Colonial Parkway, and the erosion of the fill material used to build the Parkway originally has provided the necessary sand for a moderate to narrow beach in several areas. Intermittent to severe bank erosion has taken place over the past several years. There are very few areas of archeological significance in this area, with the exception being a Civil War redoubt. The Colonial Parkway, however, represents a very valuable piece of infrastructure.

2.3 Colonial National Historical Park's (COLO's) Land Use Goals

Resource Management Goals are outlined in COLO's General Management Plan and Resource Management Plan. The Mission Statement in the Plan is "To preserve the cultural, scenic, and natural resources of Jamestown, Yorktown, Green Spring and related areas, to interpret

the colonial era from 1607 to 1781, and to maintain the Colonial Parkway and its surrounding resources for the benefit and enjoyment of the people." Selected goals that pertain to this study are listed in the following subsections.

General Management Plan

For the entire park, the goals and objectives are:

- To preserve colonial-period resources and resources from pre-historic and other historic periods.
- To protect, enhance, and interpret natural resources in a manner consistent with applicable policies and regulations, while supporting cultural resource objectives.
- To cooperate with organizations, individuals, and other agencies to further park objectives and encourage compatible land uses.

For Jamestown, in particular, they are:

- In areas without evidence of habitation, to maintain the natural environment in ways that suggests the conditions of the 1607 forest environments.
- To promote a sense of the primitive isolation Europeans experienced in 1607.

For other natural resources, they are:

- To develop an up-to-date inventory and database of natural resources.
- To develop an active resource monitoring program.
- To promote resource preservation and monitoring of land uses that could affect park management.

Resource Management Plan

The goals and objectives toward increased general resource management include:

- To preserve, protect, and interpret cultural resources, museum collections, and natural processes/resources in their environment.
- To achieve better understanding of cultural and natural processes through research and monitoring to guide management activities and interpretation including ecologically sound decision making; to gather and evaluate information through research and monitoring in natural science, visitor use, archaeology, history, and land uses to guide decision making and management actions.

- To develop and maintain cooperative protection strategies with Federal, state, and local government agencies, community groups, corporations, and individuals to protect the integrity of the natural and cultural environments within and surrounding the Park.

For water resource management they are:

- To develop up-to-date water resources inventory and database compatible with the Park's geographic information system and database management system.
- To manage floodplain and wetland resources in a manner that will protect their beneficial attributes and uses.

2.4 Shoreline Management Plan

The Shoreline Management Plan (Plan) presented in this EA was developed as a cooperative effort between VIMS, COE, and NPS in response to NPS' desire to develop a comprehensive Plan for the COLO. Portions of the narrative presented in Sections 3 through 5 of this EA are taken directly from sections of the VIMS/COE Final Report entitled "*Colonial National Historical Park, Shoreline Management Plan for Jamestown Island, Powhatan Creek, Sandy Bay, Back River, The Thorofare, and James River Shorelines*" by Scott Hardaway and Mark Hudgins (1999).

The Plan addressed the mutual desire of Federal and state agencies to develop cooperative projects to improve water quality and enhance wetland habitat in the Chesapeake Bay area while preventing the loss of significant resources, particularly those archaeological sites near the water's edge. Specific goals of COLO, described in previous paragraphs, were incorporated into the analyses in order to produce a comprehensive Plan. The study developed recommendations that addressed shoreline erosion on a reach basis and that included shoreline protection strategies that would be relatively non-intrusive to natural surroundings yet effective within the context of long-term shoreline erosion control. This was accomplished with a combination of stone structures such as sills, revetments, and/or breakwaters along with sand nourishment to create a stable substrate for establishing wetland vegetation. High priority was given to eroding shorelines where infrastructure and/or archaeological resources are being threatened. Eroding upland banks and shoreline headlands were addressed holistically in the context of the overall Plan.

The Shoreline Management Plan presented in this EA refers to the recommended plan that consists of a combination of sills, revetments, and breakwaters with sand nourishment and vegetative plantings. This Plan is designated as Alternative 1 later in this document. Also presented later in this document is a bulkhead plan, which is designated as Alternative 2. The impacts of "doing nothing" to the shoreline are also presented later in this document. No action or "do nothing" would result in loss of fundamental cultural resources of the Park and is designated as the No Action Alternative.

2.5 Relationship to Other Plans, Studies, and Projects

2.5.1 Green Spring Draft General Management Plan (GMP) Amendment and Environmental Impact Statement (EIS)

This Draft GMP Amendment and EIS present plans for the management of the Green Spring unit of COLO, which contains the home of Sir William Berkeley, an influential 17th Century Governor of Virginia. Green Spring represents the expansion of British society around Jamestown and was acquired by NPS in 1966. Green Spring is located about three miles from Jamestown Island and is, therefore, outside of the area covered in this EA. NPS' plans regarding Green Spring would have no impact on the shoreline management plans addressed in this EA.

2.5.2 Alternative Transportation System Study

This study conducted for NPS by BRW and Cambridge Systematics (2001) evaluated and made recommendations for a long-term transportation plan for COLO that would lessen the impact of increased automobile traffic, provide enhanced visitor experiences, and protect the structural integrity of Colonial Parkway and structures along the other roadways. The study recommends: (1) a multi-jurisdictional regional public transportation system using fixed-route and fixed schedule bus routes and a central transit transfer center throughout Jamestown, Williamsburg, and Yorktown; (2) alternative transportation services along the Parkway; (3) a visitor shuttle system to serve the tour roads at Yorktown Battlefield and on Jamestown Island; and (4) a multi-modal opportunity at the Jamestown end of the Park through the use of water taxis and bicycles.

2.5.3 Shoreline Protection Projects and Studies

In addition to the three shoreline protection alternatives (i.e., Alternatives 1 and 2 and the No Action Alternative) that were developed and evaluated for COLO by VIMS and COE (Hardaway and Hudgins, 1999), as discussed briefly in the preceding paragraphs of this EA, there are other shoreline protection projects in place along some of the erosional shoreline segments of the study area that are providing varying levels of shoreline erosion control.

There are also two shore protection projects along a portion of the southern edge of the Jamestown Island shoreline adjacent to the James River, which include a 1,500-foot long, sloped concrete seawall constructed by COE and a 1,500-foot stone revetment downstream of the seawall constructed by NPS. COE constructed the seawall between 1894 and 1901 and provided limited rehabilitation in 1969 and 1982. The seawall fronts APVA property and includes that portion of the island that contains the Old Church Tower, the graveyard, and the west end of the original town site. The revetment protects the adjacent NPS property, including the area referred to as New Towne.

The potential increase in still water level (sea level) warrants further assessment of the ability of the concrete seawall and stone revetment to provide long-term shore protection and the recommendation and eventual implementation of remedial actions. COE is conducting a congressionally authorized study of the seawall for the purpose of evaluating its structural stability and determining if major rehabilitation or replacement is warranted. Construction could begin as early as calendar year 2004, in the event that it is determined that rehabilitation or

replacement is warranted. With regard to the stone revetment, preliminary evaluations by COE indicate that the addition of another layer of stone to this structure would maintain its structural integrity and provide an increased level of wave attenuation. The need for rehabilitation of the stone revetment at New Towne is being addressed in conjunction with Alternatives 1 and 2 and the No Action Alternatives presented in this EA.

2.5.4 The JAMESTOWN PROJECT

Planning is currently underway by NPS, the Commonwealth of Virginia, and APVA for the 400th Anniversary Celebration in 2007 commemorating the first English landing at Jamestown Island in 1607. The purpose of the planning is to identify needed improvements to the facilities and programs at Jamestown and to coordinate activities for 2007 and beyond. The preparation for this celebration will involve the construction of numerous parking lots, vehicular roadways, pedestrian pathways, bridges, visitor centers and restroom facilities, refreshment areas, and access and multi-modal transportation facilities and services, etc., to accommodate the magnitude of anticipated visitors.

As part of the JAMESTOWN PROJECT, NPS is considering several alternatives that involve varying levels and types of construction. Each of the alternatives would involve construction within the Resource Protection Areas (RPA's), which would impact the riparian buffer and contribute to erosion along the shoreline. RPA's, as designated by the Chesapeake Bay Preservation Act (CBPA), are lands at or near the shoreline that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts that may result in significant degradation to the quality of state waters. In order to make room for new construction for each alternative, a number of trees would require removal from the RPA's, which would destabilize soils, as well as remove the natural filtering system that exists along the waterways. Three of the alternatives also include the construction of three new boat docks, one on Powhatan Creek and two on the Back River, and the construction of a new, pile-supported bridge connecting Neck of Land to the townsite as part of the existing hiking and bike trail. The boats operating between the new docks would potentially impact the study area shoreline by the created boat wake. Construction of the bridge and boat docks would have a direct impact on the shoreline, as vegetation would be removed for their placement, resulting in increased sediment levels in the waterways. NPS proposes to mitigate the adverse impacts of increased erosion and sedimentation by implementing strongly enforced construction sediment control plans, minimizing disturbance in RPA's, replacing vegetation where possible, setting speed limit controls on boat traffic, and implementing the recommendations set forth in the Shoreline Management Plan. Although no final decision has been made regarding the construction of the above-mentioned bridge or boat docks, based on currently available information, it is anticipated that if these structures were to be constructed, that construction would not begin before mid to late calendar year 2004.

The above projects are discussed, as appropriate, in Section 5.0 with regards to cumulative impacts on Park resources and values.

2.6 Impact Topics

Resource topics selected for impact analysis in Sections 4.0 and 5.0 include:

- Geology, soils, and topography
- Ecological Resources (including Rare, Threatened, and Endangered [RTE] Species, Submerged Aquatic Vegetation [SAV], Wetlands, Aquatic Organisms, Terrestrial Flora and Fauna, and Essential Fish Habitat [EFH])
- Air Quality
- Water Quality
- Visitor use and experience (including visitor access and transportation and aesthetics)
- Cultural/Historical resources

2.7 Applicable Regulatory Requirements, Coordination, and Permits

This EA has been prepared to evaluate the impacts of the alternatives described in Section 3.0 and is formatted in accordance with NPS-12, NEPA Guidelines and the provisions of the National Environmental Policy Act of 1969 (NEPA) (Public Law 91-190, 42 USC 4321-4247).

Regulatory requirements, coordination, and permits that may be applicable to the activities addressed in this EA, are presented in Sections 6.0, 7.0, and 8.0.

3.0 ALTERNATIVES CONSIDERED

3.1 Introduction

As part of the design and EA process, several alternatives were considered, each of which would achieve the overall goals and needs of the project area. In addition, each alternative must be consistent with the general management plans and resource management plans of COLO presented in the previous chapter and the requirements of NPS. The purpose of this chapter is to summarize the development of these alternatives, give a brief description of each alternative, and evaluate the potential of each to impact the physical, natural, and cultural resources of the study area.

3.2 Development of Alternatives

In general, there are two basic strategies available to NPS to address the shoreline erosion problems being experienced at Jamestown Island. NPS could choose to take no action and allow the erosion to continue, or it could develop and implement some type of corrective action by employing one or more shoreline management technique or method. The following information regarding the development of shore protection alternatives is summarized from the VIMS/COE Plan developed by Hardaway and Hudgins (1999).

Coastal Protection/Erosion Control Structures—Initial Screening

In developing corrective actions to address the shoreline erosion problems, Hardaway and Hudgins (1999) first looked at the variety of coastal protection/erosion control structures that could be employed as components of several overall shore protection methods. Typical coastal protection/erosion control structures include revetments, bulkheads, breakwaters, sills, gabions, groins, concrete armor units, sand nourishment, vegetated wetland creation, and more recently geo-tubes.

An initial assessment of each structure was accomplished to determine its appropriateness to each shoreline segment under consideration. Based on this initial assessment, concrete armor units, gabions, and geo-tubes were eliminated from further evaluation. Concrete armor units and gabions were eliminated due to low aesthetic acceptability and high installation and maintenance costs. Geo-tubes were eliminated due to high susceptibility to vandalism and storm damage, low aesthetic acceptability, and relatively high maintenance costs.

Shoreline Management Methods—Intermediate Development

The coastal protection/erosion control structures that passed the initial screening were evaluated in more detail as potentially viable shoreline management methods, as described below.

a. Method 1. Method 1 would consist of the use of rubble-mound breakwaters, stone revetments, stone sills, and the creation of vegetated wetland to provide erosion control. Although in use for many years, rubble-mound or stone structures have come into common use within the Chesapeake Bay system within the past decade, making them important elements for shoreline protection. Within the Virginia portion of the bay system, revetments have been

constructed along the Potomac River shoreline and breakwaters along the Chesapeake Bay shoreline of the City of Norfolk and along the James River at Hog Island. Within the Maryland portion of the bay system, breakwaters have been constructed along the Choptank River in Talbot County and along the Patuxent River in Calvert County.

Stone revetments are shoreline-armoring systems that protect the base of eroding upland banks and usually are built across a graded slope, as shown in Figure 5. The dimensions of the revetment are dependent on bank conditions and design parameters, such as storm surge and wave height. These parameters also determine the size of the rock required for long-term structural integrity. Generally, two layers of armor stone are laid over a bedding stone layer with filter cloth between the earth sub-grade and bedding layer. Marsh toe revetments are low rock structures placed along low eroding upland banks or eroding marsh shoreline. During storms, they usually are submerged and waves break directly on, or shoreward of, the revetment.

Rubble-mound breakwaters and stone sills, as shown in Figure 6, are "free standing" structures designed to reduce wave action by attenuation, refraction, and diffraction before it reaches the upland region. A sill has a lower crest, is closer to shore, and usually is more continuous than larger breakwater units that the sill can be used in combination with. Sand nourishment would, typically, be placed landward of the sills to create a substrate for establishing a marsh fringe or vegetated wetland (see Figure 7).

b. Method 2. Method 2 would consist of the construction of bulkheads in those areas of the study area shoreline where erosion is taking place. Bulkheads are a traditional form of shoreline protection, which basically are retaining walls constructed of steel or wooden sheets, whose main purpose is to prevent the erosion of soil and provide protection from wave action. Bulkheads are also used to protect eroding bluffs by retaining soil at the toe, thereby increasing stability, or by protecting the toe from erosion or undercutting. A typical bulkhead is shown in Figure 8.

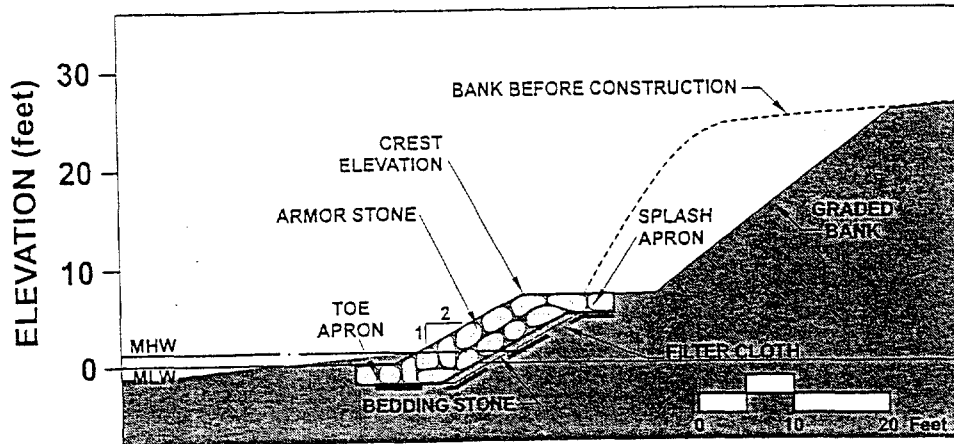
c. Method 3. Method 3 would consist of the placement of sand along those segments of shoreline where erosion is taking place. Sand placement or beach fill involves the placement of large quantities of sand along the eroding shoreline by mechanical means, such as dredging and pumping from offshore deposits or overland hauling and dumping by trucks. The resulting beach provides some protection to the area behind it by functioning as an eroding buffer zone. Periodic renourishment is often required to maintain the protective beach. A typical sand placement or beach fill profile is shown in Figure 9.

d. Method 4. Method 4 would consist of the construction of groins along erosional areas of shoreline. Groins are usually timber or steel structures constructed perpendicular to the shore and extending out into the water. Used in groups called groin fields, their purpose is to trap sand or retard its longshore movement along the shoreline. The trapped sand acts as a protective barrier, which waves can attack and erode without damaging the previously unprotected upland areas. A typical groin field is shown in Figure 10.

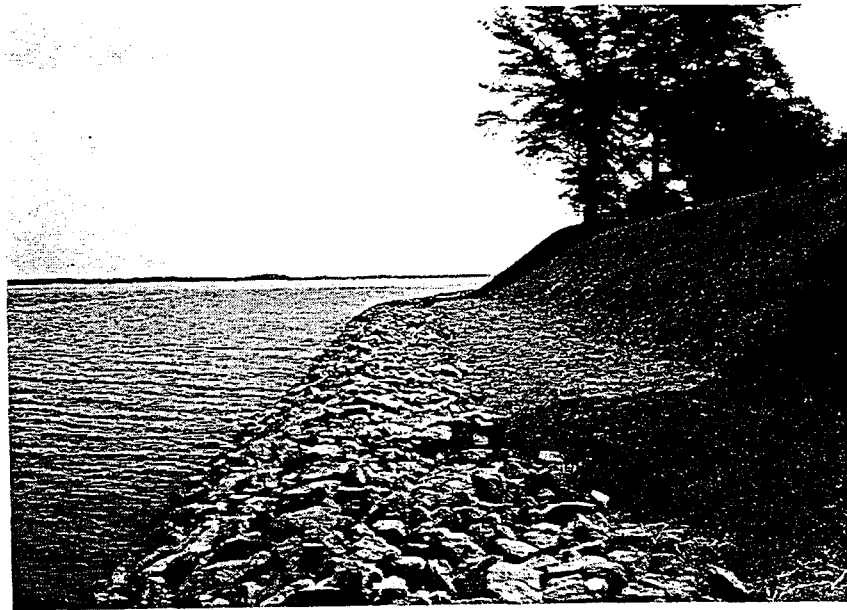
e. No Action Method. A decision to take no action to address the shoreline erosion problem remains a viable option to implementing a shoreline management method.

Shoreline Protection Alternatives—Final Development

Each of the above shoreline management methods presented in the previous paragraphs was evaluated under the *Choose by Advantages (CBA) Process* of NPS based upon each method's ability to: (1) protect cultural and natural resources; (2) provide for visitor enjoyment; (3) improve efficiency of park operations; and (4) provide cost-effective, environmentally responsible, and other beneficial development for NPS. A summary of this analysis is contained in Appendix A of this EA. As presented in the matrix, the outcome of these evaluations was a recommendation to pursue rubble mound breakwaters, utilized in conjunction with stone revetments, stone sills, limited sand nourishment, and vegetated wetlands, as the best overall method to provide protection to the cultural and natural resources of Jamestown Island. In this regard, Method 1 has been identified as the overall best method to achieve a balance between long-term, predictable shore protection and cost. The second best method is Method 2, which is the traditional approach utilizing bulkheads to provide protection. Methods 1 and 2 have undergone further detailed development to address the specific erosion control needs and opportunities of Jamestown Island. Both methods now represent significant alternatives for consideration for shoreline management at Jamestown Island and are hereafter referred to as Alternative 1 and Alternative 2, respectively. The details regarding both alternatives are presented in the following section. The No Action Method is also presented in the following section as a basis for comparison with Alternatives 1 and 2. The No Action Method from this point on in this EA is referred to as the No Action Alternative.



Cross-section of typical revetment



Stone revetment shortly after construction on the Potomac River, Va.

Figure 5. Stone Revetments

After Hardaway and Byrne, 1999

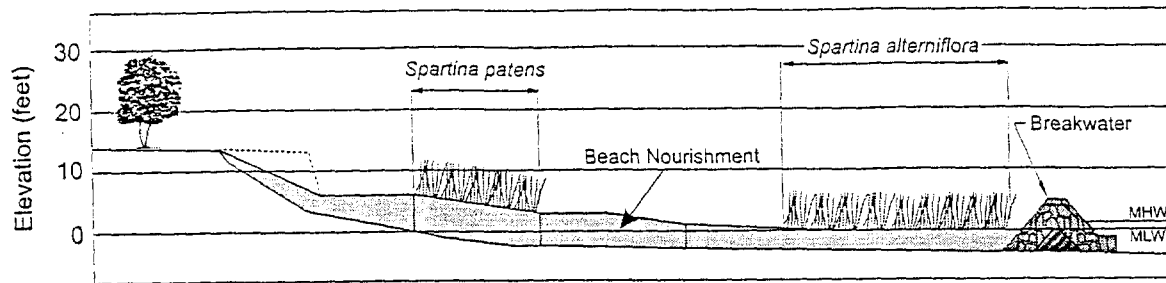


Stone sill with connecting breakwaters, sand fill, and marsh implantation on the Choptank River, Talbot County, Maryland shortly after construction

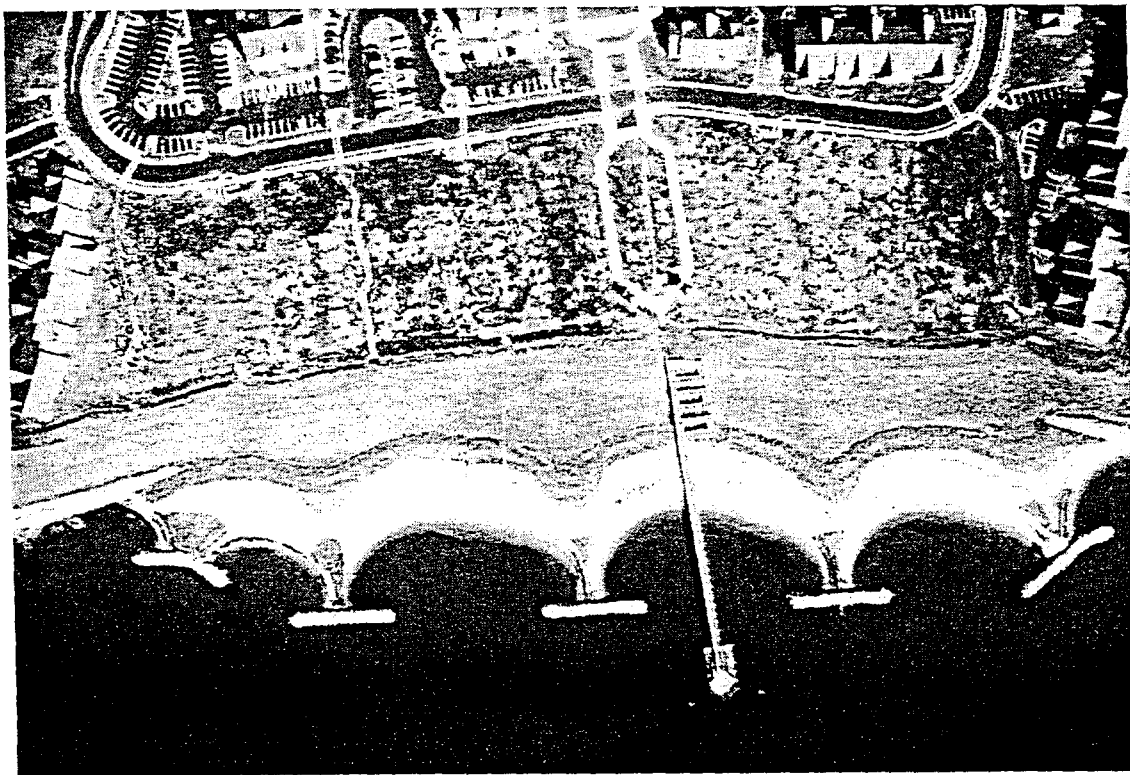


Stone sill and breakwater project after 5 years.

Figure 6. Stone Sills And Rubble-Mound Breakwaters



Typical breakwater cross-section.



Breakwater system on Patuxent River in Calvert County, Md.

After Hardaway and Byrne, 1999

**Figure 7. Sand Nourishment And Wetland Plantings In
Conjunction With Breakwaters**

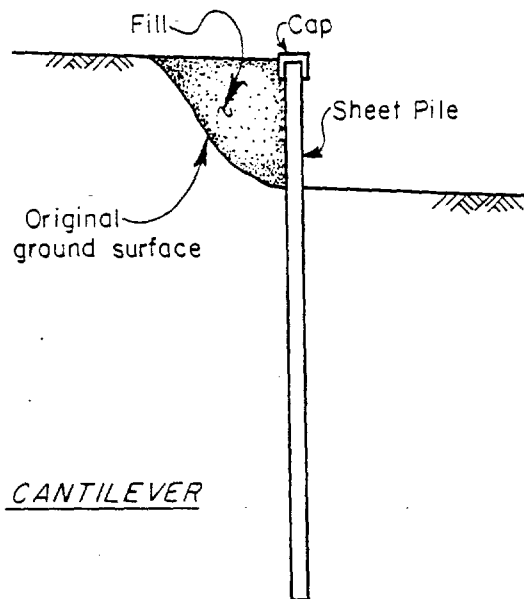
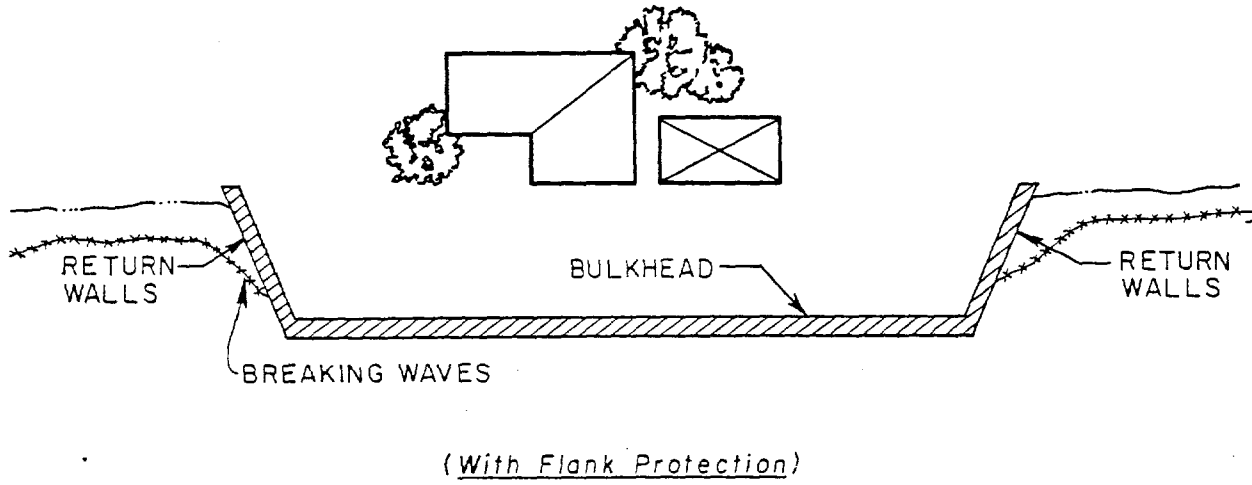
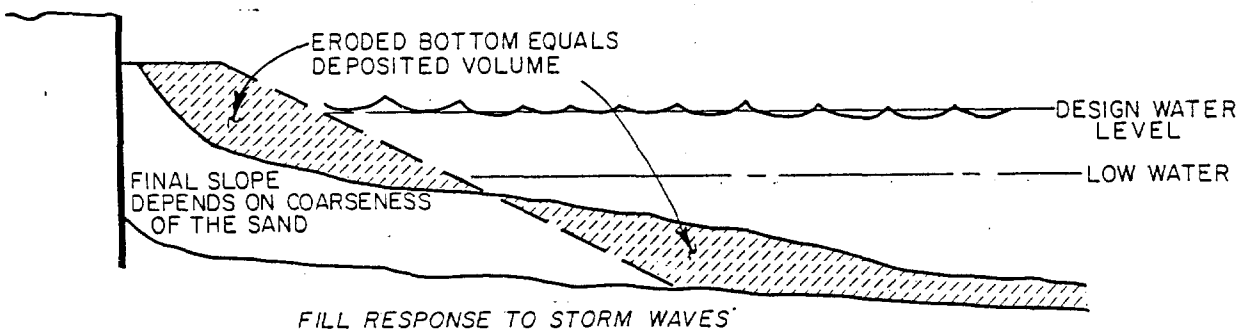
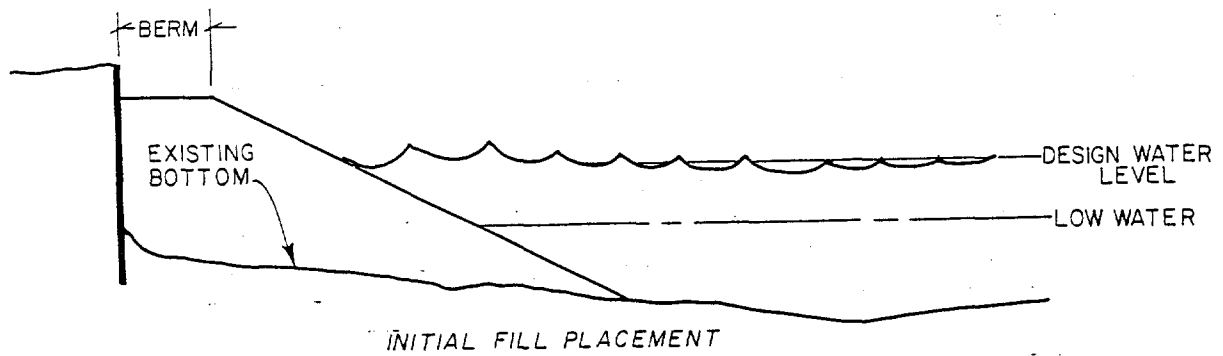
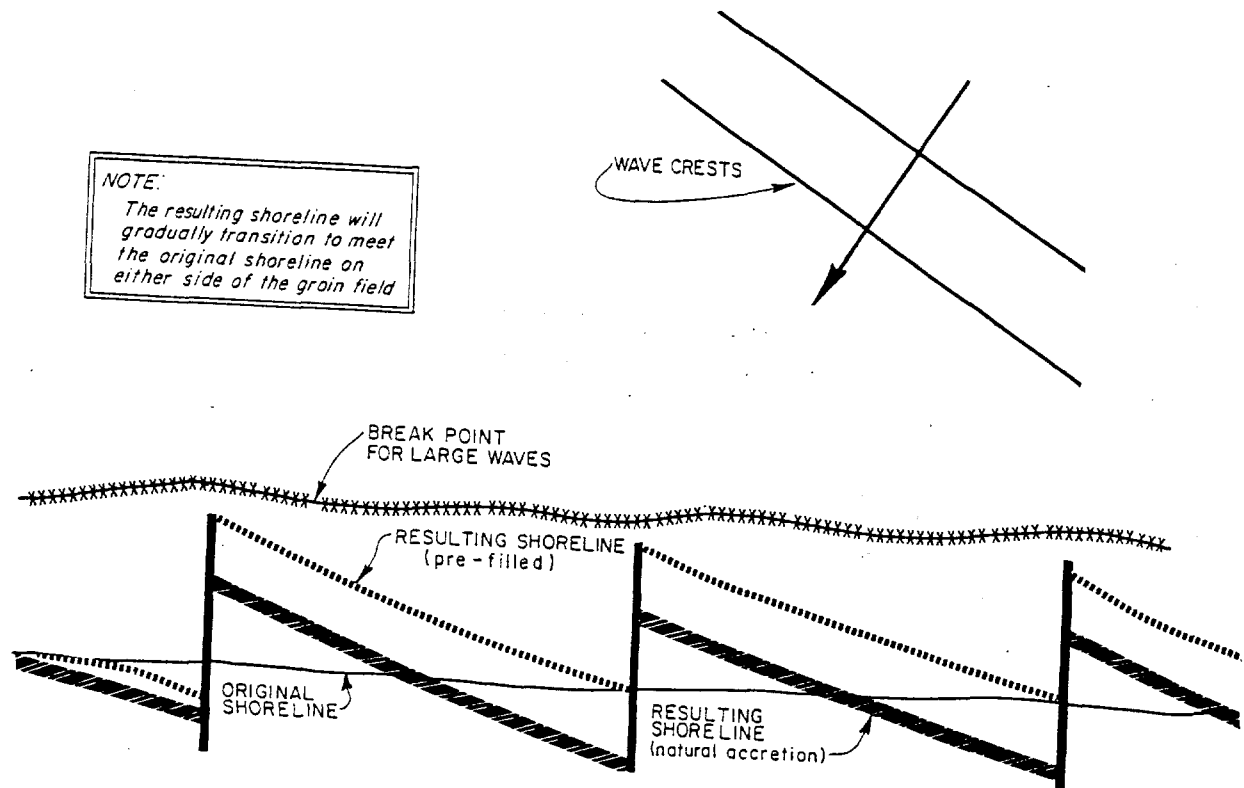


Figure 8. Bulkheads

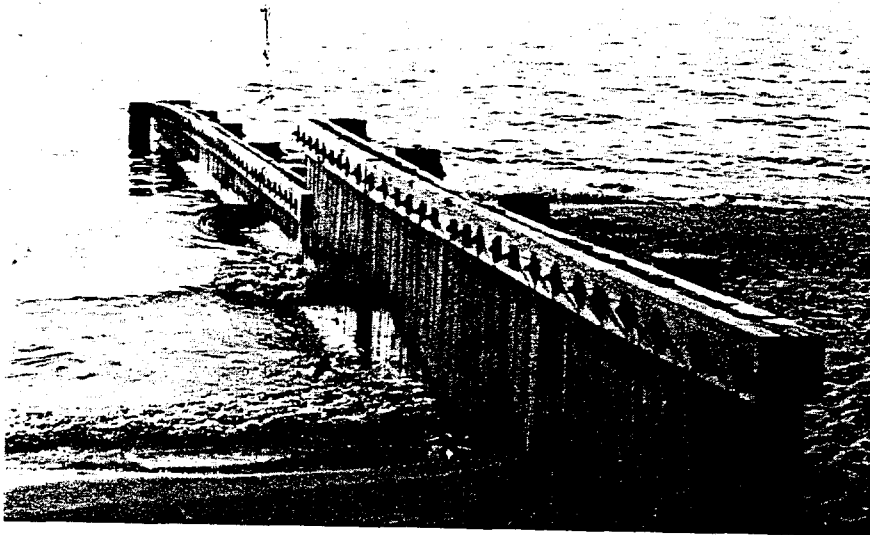


Beach Fill

Figure 9. Sand Placement Or Beach Fill



Effects of Groins



Timber Sheet Pile Groin

Figure 10. Groins

3.3 Specific Shoreline Management Alternatives for COLO's Jamestown Island

3.3.1 No Action Alternative

NPS could choose to take a no corrective action approach to shoreline erosion and allow nature to take its course at Jamestown Island and along the Colonial Parkway. This would allow continued erosion and degradation of the shoreline. It is recognized within the context of the No Action Alternative, that NPS may undertake, at such time as important archeological sites may be threatened by erosion damage, minimal stopgap measures to control erosion. This implies an action -- reaction approach to erosion control lacking a unified and comprehensive planning, design, and construction effort. It is difficult to estimate the overall cost of such an approach to erosion control, but it is possible that it would represent multiples of the costs of Alternatives 1 and 2. It's not inconceivable that the construction could take place over a 10- to 20-year period or more.

3.3.2 Elements Common to the Action Alternatives

There are several elements common to each of the considered shoreline management alternatives (Alternatives 1 and 2), as presented in the paragraphs to follow.

Glasshouse Parking Overlook on Powhatan Creek

Near the Glasshouse parking overlook on Powhatan Creek (see Plate 1), a 10-foot vertical bank or scarp has been configured by erosion, primarily from boat wake as well as overland runoff. The proposed action for this site would be to build out the bank with fill, regrade the fill to a more stable slope, and install a rock revetment at the base of the bank. This action would require the removal of some trees and shrubs, which are now falling into the creek because of bank erosion.

Black Point Shoreline

Managing Black Point, the leading headland feature on the eastern end of Jamestown Island (see Plate 3), would be an important component of the strategies proposed along both the Thorofare and the shores to the southwest extending on both sides of the entrance to Passmore Creek. The Black Point Shore Protection Plan would include a low sill with wetland plantings and an opening at the apex of Black Point for water access to a panoramic view of the James River. A spur would also be constructed at the north end of the existing revetment as part of the plan. The Black Point project is shown in Figure 11.

New Towne Revetment

The rehabilitation of the 1,500-foot-long stone revetment fronting NPS New Towne property (see Plate 2) along the James River would involve the placement of a new layer of armor stone along the entire length of the revetment to maintain its structural integrity and to provide an increased level of wave attenuation.

Upland (Bank) Shoreline Management

The management of upland (bank) areas would be included as components of Alternatives 1 and 2. Bank grading, however, would only be utilized in those few instances where required, as natural vistas would be better maintained by allowing continued erosion instead of by grading.

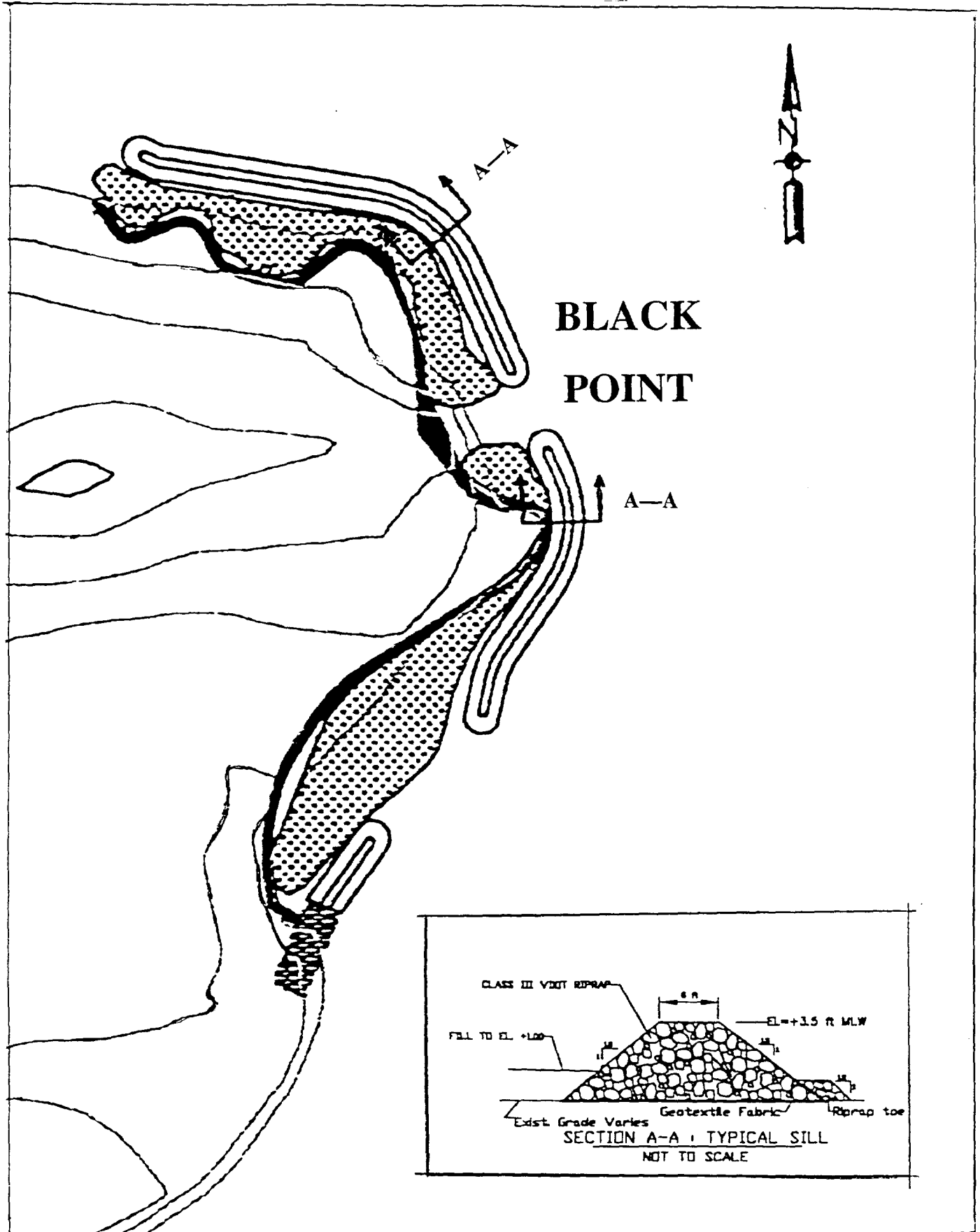


Figure 11. Proposed Protection for Black Point Shoreline

Vegetative Plantings

Sand fill landward of the breakwaters and sills (Alternative 1) and the bulkheads (Alternative 2) would be provided from a commercial upland borrow area, would be compatible with existing sediments, and would be required to meet certain specified construction standards in the American Society for Testing Materials (ASTM). ASTM D 2487 requires that the sand fill shall be medium to coarse-grained sandy soils classified as SW and SP. The material must contain less than ten percent passing the number 100 sieve, not more than 15 percent by weight retained on the number 8 sieve, with no stone having a diameter greater than one-half inch. The sand-filled areas would be planted with *S. alterniflora* and *S. patens*, and replanting would be accomplished as needed during the first two planting seasons to ensure the successful establishment of vegetation.

3.3.3 Alternative 1—Breakwaters, Sills, and Vegetated Wetlands

Alternative 1 would provide shoreline protection for Jamestown Island and the Colonial Parkway by controlling or hardening points along the shoreline and allowing much of the adjacent shoreline to evolve (through continued erosion) to equilibrium planforms. This would be accomplished by a shoreline management system that would utilize breakwaters, spurs, and sills in combination with beach fill and the establishment of vegetative wetland fringes. The breakwaters, spurs, and sills with beach fill and wetland fringes would constitute an offensive approach to shoreline erosion control, while the strategic placement of breakwaters would constitute a headland control approach. The system, by utilizing both approaches, would prove very effective in providing protection against erosion for Jamestown Island's infrastructure, as well as preserving historic and cultural resources, ecological habitat, and recreational resources. The system would most likely represent a phased effort by addressing major points and areas of critical erosion as the first order of priority. The system would also be designed to interface with adjacent shorelines, thereby minimizing potential downdrift and updrift impacts. Figure 12 demonstrates the concept of controlling or hardening points along the shoreline with breakwaters and allowing much of the adjacent shoreline to evolve over time to stable embayments (equilibrium planforms).

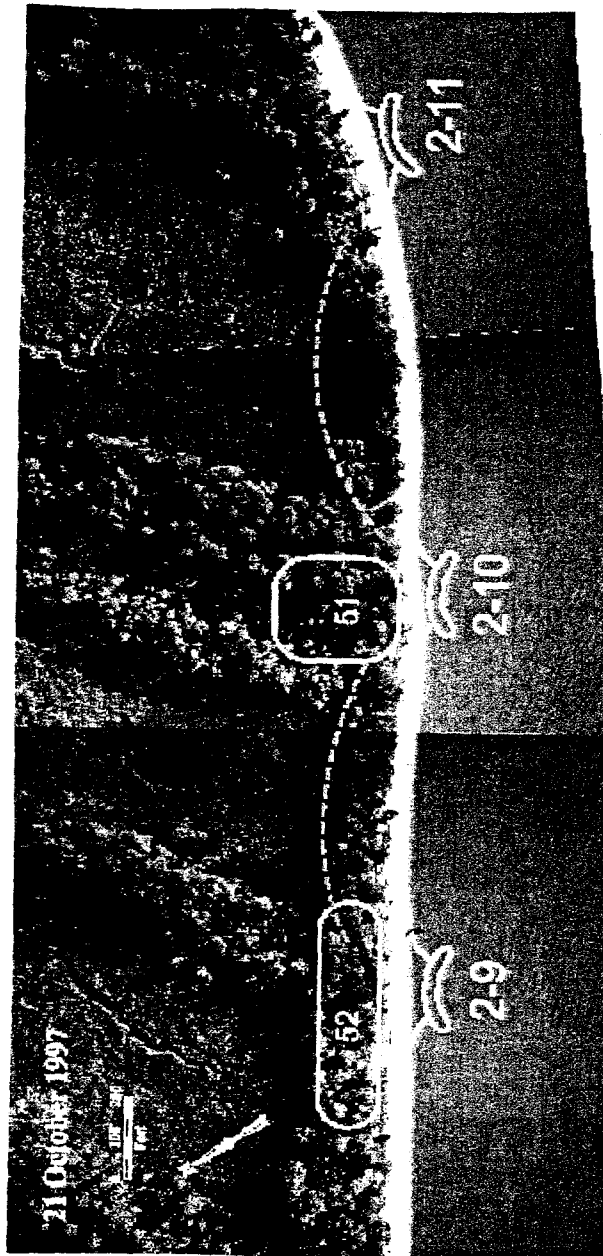


Figure 12. The Headland Control Approach—Long-Term Shore Evolution to Stable Embayments

The six different structure types that would be included as components of Alternative 1 are shown in Figures 13, 14, 15, and 16. The following is a more detailed description of Alternative 1 by shoreline segment.

Study Area Shoreline No. 1

The primary targets of shoreline management along this shoreline are the vertically exposed, eroding upland banks and strategic marsh segments. These eroding uplands are interfluves and considered significant in the presence of threatened infrastructure and/or cultural resources. Offshore sills would be the components of Alternative 1 for this segment of the project shoreline. These structures with a sand substrate would allow the development of a marsh fringe that is preferred in terms of aesthetics and estuarine habitat. A typical cross-section and the two designs are shown in Figure 13. The locations of the sills are shown on Plate 6.

Study Area Shoreline No. 2

The targeted areas along this shoreline include the non-protected marsh areas fronting the many cultural resources located in the adjacent upland banks. The strategic placement of breakwaters along this entire shoreline segment to initiate the process of headland control would be the component of Alternative 1 for this segment of the project shoreline. Figure 14 shows the typical design of one breakwater, which is compatible with the marsh shore of the James River. The other breakwater would be of a low-crested design as shown in Figure 15. The locations of the breakwaters are shown on Plate 7. As the ultimate stability of the shoreline would be dependent on the eventual evolution to equilibrium planforms, care would be required in the phasing of the construction of the breakwaters, and periodic monitoring would be required to ensure cultural and natural resources would not be impacted. A sand substrate would be placed landward of the breakwaters to promote the development of a marsh fringe. No additional beach nourishment would be included as a component of Alternative 1 for this shoreline; however, as a long-term strategy, it is recommended that COLO consider placing any sand available from dredging offshore navigation channels along the shore between established headlands.

Study Area Shoreline No. 3

The shoreline protection plan for Black Point has been previously described in Section 3.3.1. The sill shown in Figure 13 and the breakwater shown in Figure 11 would be the components of Alternative 1 for this segment of shoreline where the goal again would be to establish headland control. However, the timing of the initiation of the process of headland control should be weighed against more pressing needs along other shore segments, as the portrayed long-term equilibrium embayments would take a long time (possibly 100+ years) to develop since evolution of thick marsh peat shorelines occurs about half as fast as adjacent, low, upland banks. The locations of the breakwaters and sill are shown on Plate 8.

Study Area Shoreline No. 4

The components of Alternative 1 for this shoreline would include a combination of offshore sills and breakwaters that would be designed to protect archaeological sites on Jamestown Island and enhance existing headland features along the Colonial Parkway shoreline. A typical cross-section and the two sill designs are shown in Figure 13. These structures with a sand substrate would allow the development of a marsh fringe that is preferred in terms of aesthetics and estuarine habitat. The two breakwater components would include the type that

would be compatible with marsh shores as shown in Figure 14 and the low-crested type as shown in Figure 15. The locations of breakwaters and sills are shown on Plate 9.

Study Area Shoreline No. 5

A system of offshore breakwaters, as shown in Figures 14 and 15, would be the components of Alternative 1 for this shoreline. The locations of the breakwaters are shown on Plate 10. The water's edge comes relatively close to the Colonial Parkway along this shoreline, and the intermittent to severe bank erosion has allowed subtle geomorphic features to develop as headlands. The use of breakwaters would take advantage of these headlands and encourage the long-term evolution of the shoreline on the upland banks. The proposed strategies require ongoing monitoring to assess development of embayments between structures. Beach nourishment could eventually be required along the entire shoreline or portions of the shoreline in order to provide a protective edge.

The design of Alternative 1, including breakwater location, spacing, stone size, and dimensions, was determined based on COE design criteria as appropriate for the wave climate, storm surge and wave height, and topographic and hydrographic conditions of the study area. Alternative 1 would require the placement of quarry stone with a weight range of 500 to 1,500 pounds to form the breakwater segments. The stone would be placed over an area (combination of open water/intertidal/upland) with a total length of approximately 11,600 feet and a width varying from 15 to 25 feet. The breakwaters would be located approximately 50 feet from the shoreline. No dredging of the water bottom would be required before stone placement. The construction would take place from water-based equipped with articulated backhoes, except at site 1-1, where access would be fully coordinated with archeologists and natural resource specialists prior to construction. Typically, there would be no maintenance required for stone structures placed in this type of environment, nor would there be any expected damage to the structures from the increased boat traffic and resultant wave activity that may be associated with the JAMESTOWN PROJECT. It is estimated that construction of the entire shoreline protection project could begin in the fall of 2002 and be completed within 24 months. The estimated cost of Alternative 1 (including stone, sand, and plants) is \$4.5 million, depending on the final options selected by NPS. This cost does not include the cost for engineering and design or construction management.

3.3.4 Alternative 2—Bulkheads

As presented in previous paragraphs, Alternative 2 is basically a bulkhead alternative. The selected design for the bulkhead would basically be the same for the entire project shoreline. It would consist of a vertical wall constructed with very tightly spaced steel sheets driven vertically into the ground with special pile-driving equipment. The bulkhead would be of the cantilever type, meaning that it would be supported solely by the extent of the ground penetration. The steel sheet-piles would be approximately 15 feet in length and driven in the ground until the top elevation is 4.5 to 5 feet above mean low water. The areas behind the bulkhead would be backfilled, as necessary. The locations of the bulkheads for Study Area Shorelines No. 1 through No. 5 are shown on Plates 11 through 15, respectively.

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The steel sheets used in the construction of Alternative 2 would be placed with land-based equipment working on the landside of the bulkhead line. The bulkhead segments would extend over an area (combination of intertidal/upland) with a length of approximately 11,600 feet and a width of approximately 10 feet. Sand fill to be placed on the landward side of the bulkheads would be provided from a commercial upland borrow area and would be required to meet certain specified construction standards. The useful life of steel sheet pile bulkheads is typically 20 to 25 years, which means that major replacement or rehabilitation would be required at that time. It is estimated that the entire shoreline protection project could begin in the fall of 2002 and be completed within 24 months. The estimated cost of Alternative 2 is \$5 to \$6 million, excluding the cost for engineering and design and construction management.

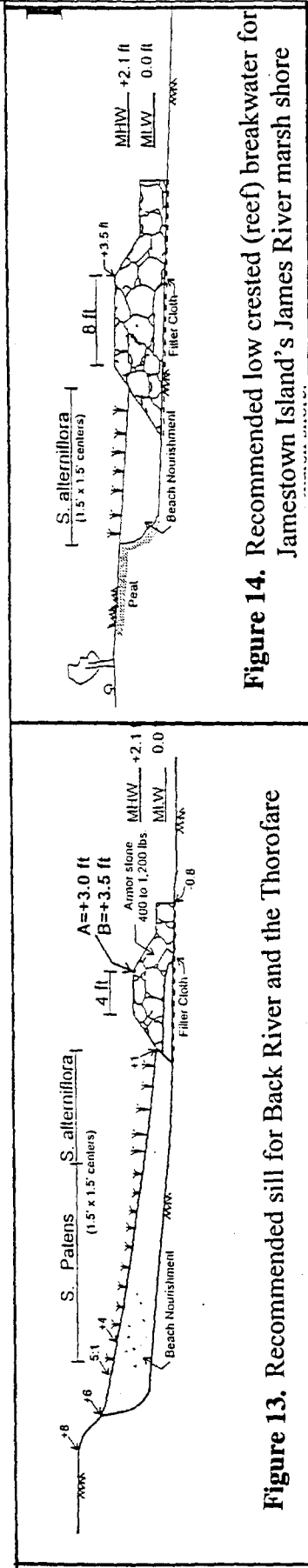
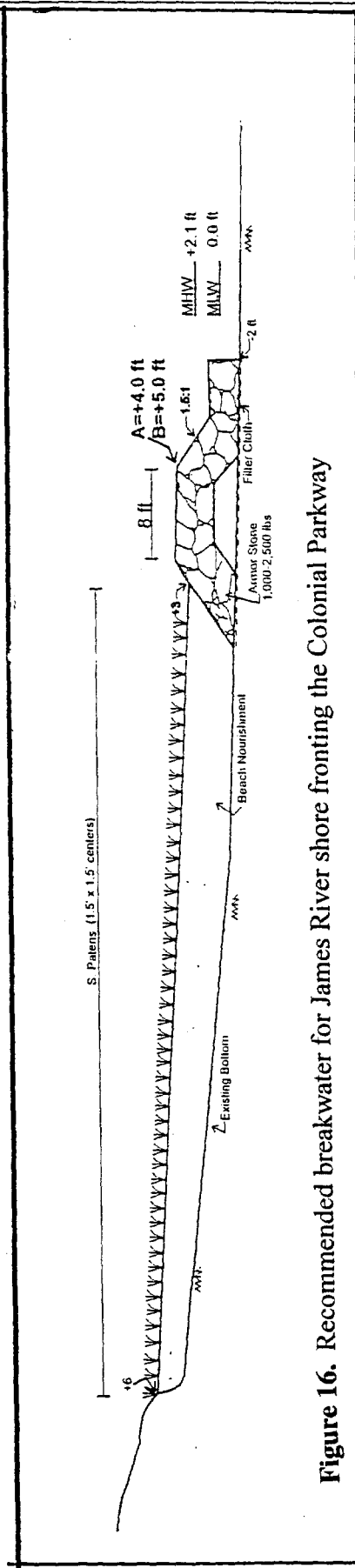
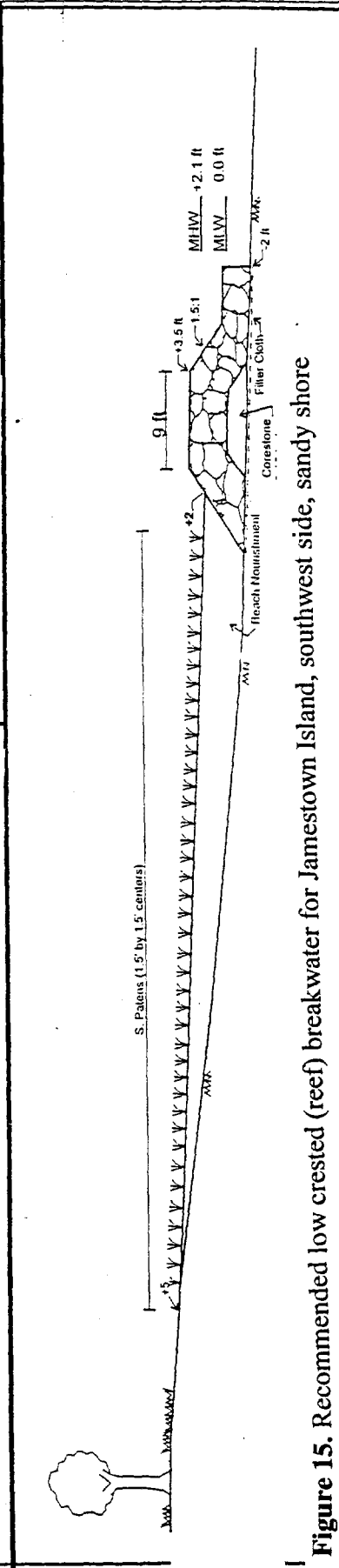


Figure 14. Recommended low crested (reef) breakwater for Jamestown Island's James River marsh shore



3.4 Mitigation--Avoidance, Minimization and Compensation

3.4.1 General

Alternatives 1 and 2 were designed to avoid adverse environmental impacts to the greatest extent practicable. In addition, it is reasonable to assume that any stopgap shoreline protection measures undertaken by NPS in conjunction with the No Action Alternative would also be designed to avoid adverse environmental impacts. Several measures have been designed into the alternatives to minimize impacts. These include implementation of best management practices, such as temporary erosion control practices, and adherence to management recommendations of the Virginia Department of Conservation and Recreation (DCR) and the United States Fish and Wildlife Service (USFWS) when working in areas adjacent to sensitive habitats and nesting areas for RTE species such as bald eagles, great blue herons, great egrets, and least bitterns. Typical erosion control practices include planting, and quick growing, native, non-invasive grass on disturbed areas, using sediment traps and curtains, check dams, and other means to slow the movement of water across disturbed sites, and trapping the soil that does get transported by runoff. The management recommendations of DCR and USFWS are presented in section 3.4.3. Appropriate coordination with NPS, DCR, and USFWS staffs throughout the construction process would also be an important measure to avoid or minimize impacts. Should unknown archeological resources be uncovered during construction, work would be stopped in the project area, the discovery would be protected, and NPS staff would be consulted according to 36 CFR 800 and, if appropriate, provisions of the Native American Graves Protection and Repatriation Act.

3.4.2 Mitigation of Impacts to Natural Areas

COLO contracted the DCR to develop site conservation plans for natural areas identified within and adjacent to the Park. Results of the conservation-planning project for these natural areas are presented in the report entitled *Conservation Planning for the Natural Areas of Colonial National Historical Park, Virginia* (Clark and Rafkind 1998). The following management recommendations were presented in that report and, as indicated in the previous paragraph, would be implemented, where appropriate, in conjunction with Alternatives 1 and 2 and the No Action Alternative to minimize impacts.

"Land use within the natural area should be limited to legitimate natural heritage resource monitoring and cultural and scientific research activities. Road or trail construction, timber harvest, and other potentially disturbing activities should be restricted from within the disturbance conservation zone. Landing of boats on the beach should not be permitted."

"Recreational boating and related activities should be discouraged within the open water areas of the natural area. It may be possible to place signs or buoys around the area or execute some other method of notification or education asking boaters to voluntarily stay away from the sensitive areas. This is a difficult issue, and drawing more attention to the site may be counter-productive. Consultation with the Virginia Department of Game and Inland Fisheries, the Virginia Marine Resources Commission, and the US Coast Guard would be necessary."

3.4.3 Mitigation of Impacts to the Bald Eagle, Great Blue Heron, Great Egret, and Least Bittern

DCR, in consultation with COLO, has made certain recommendations regarding the bald eagle and the great blue heron as detailed earlier in this report. These management recommendations include:

- *“Access to within 250 yd (229 m) of any bald eagle nest, which has been active within the last three years, should be restricted year round with the exception of existing roads. Travelers of roads within this zone should be encouraged not to stop while passing through it.*
- *“Large scale or loud activities, such as road repair or maintenance, should be restricted from within 440 yd (400 m) of any eagle nest from November 15 through July 15.*
- *“Human activities within 100 yd (91 m) landward and 300 yd (275 m) riverward of forested shoreline should be discouraged year round to minimize disturbance to foraging bald eagles.*
- *“All human activities should be restricted from within 300 yd (275 m) of heron colonies from February through August. VDGIF and USFWS should be consulted regarding compliance with regulatory requirements for these species.”*

The USFWS has also made recommendations specifically addressing the protection of the bald eagle in its publication entitled *Bald Eagle Protection Guidelines for Virginia*. Adherence to these recommendations is generally considered appropriate by the USFWS to avoid impacts to the bald eagle and therefore, avoid the need for a Section 7 consultation. These recommendations are categorized within management zones as described and presented below:

Primary Management Zone—This zone is defined as an area within a 250-yard (229-meter) radius of an occupied eagle’s nest. The following activities should not occur at any time within this zone:

- *Land clearing, clear cutting, mining, and other habitat modification activities;*
- *Development of residential, recreational, agricultural, commercial, or industrial structures, power lines, roads, trails, or any other construction activity;*
- *Use of chemicals toxic to wildlife, such as pesticides and herbicides.*

The following activities should not occur during the breeding/nesting season (December 15-July 15) unless the nest is determined to be unoccupied in a particular year:

- *Maintenance of existing buildings and roads;*

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- *Use of motorized vehicles and heavy equipment;*
- *Aircraft flyovers within 1,000 vertical feet of the ground;*
- *Human entry and activities, including recreation, such as hiking, camping, picnicking, hunting, fishing, boating, jet skiing, etc;*
- *Loud noise generating activities, including blasting.*

Limited selective timber harvest to within 300 feet (91 meters) of the nest tree, after consultation with the Virginia Department of Game and Inland Fisheries (VDGIF)/USFWS biologists, may be possible outside the breeding/nesting season, if a forest canopy is maintained.

Secondary Management Zone—This zone is defined as an area between a 250-yard (229-meter) radius and a 440-yard (400 meters) radius of an occupied eagle's nest. The following activities should not occur at any time within this zone:

- *Development of multi-story buildings; high density housing (construction of single story, low density residential houses may be acceptable); large commercial, industrial, or agricultural facilities; high traffic roads; and facilities that would generate loud noise;*
- *Use of chemicals toxic to wildlife, such as pesticides and herbicides.*

The following activities should not occur during the breeding/nesting season (December 15-July 15), unless the nest is determined to be unoccupied in a particular year:

- *Aircraft flyovers within 1,000 vertical feet of the ground;*
- *Construction activities;*
- *Recreational activities that generate loud noise, such as motorized boats, jet skis, etc.;*
- *Other loud noise generating activities, including blasting.*

Outside of the breeding/nesting season, most other activities can be conducted within the secondary management zone as determined on a case-by-case basis by VDGIF/USFWS.

Figure 17 shows the locations of the proposed breakwaters and sills included with Alternative 1 and the bulkheads included with Alternative 2 that would be in proximity to the one original and the two recent eagles nest locations identified in the project area. As indicated in the figure, five breakwater/sill structure sites would fall within a 250-yard radius area of one of the nests and five additional breakwater/sill structure sites would fall within that area between a 250-yard radius and a 440-yard radius of one of the nests. Similarly, three bulkhead structure sites would fall within a 250-yard radius area, while another three would fall within the area between a 250-yard radius and a 440-yard radius.

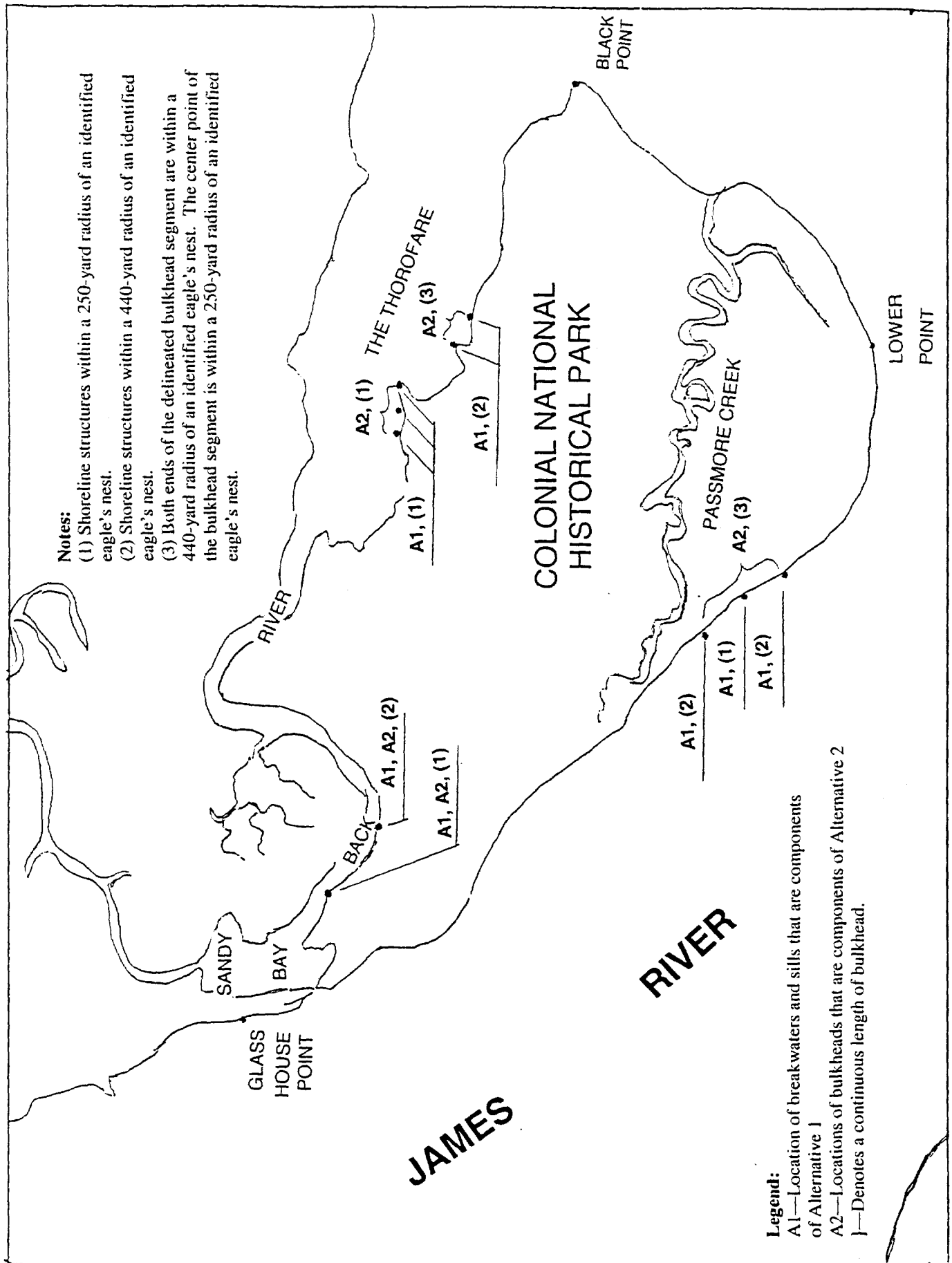


Figure 17. Shoreline Structures (Components of Alternatives 1 and 2) Located in the Vicinity of Identified Bald Eagles' Nests

National Park Service

The following recommendations for protecting the bald eagle, as compiled from the specific recommendations by DCR and USFWS, are considered appropriate for consideration with the possible construction of Alternatives 1 and 2. In cases where the recommendations of one agency are more restrictive than the recommendations of the other agency, the most restrictive recommendations were selected for inclusion in the list.

Year Round Restrictions (No activity at any time of the year)

- No construction activity or access to the area within a 250-yard radius of any bald eagle's nest, except for the use of existing roads, where travelers are to be encouraged not to stop while passing through area.
- Human activity discouraged within 100 yards landward and 300 yards riverward of forested shoreline to minimize disturbance to foraging bald eagles.

Time-of-Year Restrictions (No activity between November 15 and July 15)

- No use of motorized vehicles and heavy equipment or loud noise generating activities or human entry and activities within a 250-yard radius of any bald eagle's nest.
- No construction activity or large scale or loud activities such as road repair within the area between a 250-yard radius and a 440-yard radius of any bald eagle's nest.

The following DCR recommendation addresses the protection of the great blue heron:

Time of Year Restrictions (No activity between February 1 and August 30)

- No human activities within 300 yards of great blue heron nest.

As indicated in the above compiled recommendations, the year-round restrictions would not allow construction at those breakwater/sill and bulkhead sites located within a 250-yard radius of a bald eagle's nest at any time of year, while the time-of-year restrictions would not allow construction at those sites located outside of the 250-yard radius, but within a 440-yard radius of an eagle's nest during the period of November 15 to July 15 of any year. The recommendation regarding the construction at sites located outside of the 250-yard radius, but within the 440-foot nest radius (i.e., no construction between November 15 and July 15) will be adopted in conjunction with both Alternative 1 and Alternative 2. Stated differently, in order to mitigate any adverse impacts to the bald eagle, the construction of those breakwaters/sills and bulkheads that would be located in the area between a radius of 250 yards and 440 yards of any bald eagle's nest would take place during the period July 16 through November 14.

Mr. Eric Davis of USFWS and Mr. Jeffrey Cooper of VDGIF have been consulted (telephone conversation dated August 5, 2001 with both gentlemen and follow-up coordination with Mr. Davis on 16-17 April 2002) with regard to the recommended restrictions on the

construction sites located within the 250-yard nest radius of an eagle's nest for both Alternatives 1 and 2. Both gentlemen have concurred with the COE assessment that the construction of the Alternative 1 structures at these sites would not have an adverse impact on the eagles' nests, as construction of the breakwaters/sills would take place in the near shore water zone utilizing equipment operated from barges and not with onshore equipment. In this regard, they have recommended that construction at these sites be allowed, but that as an additional safeguard, the time-of-year restriction imposed on sites falling within the 440-yard nest radius is followed (i.e., no construction between November 15 and July 15). This recommendation will be adopted. Stated differently, in order to mitigate any adverse impacts to the bald eagle, the construction of the breakwaters/sills, components of Alternative 1, which would be located in the areas within a radius of 440 yards of any bald eagle's nest, would take place during the period July 16 through November 14.

With regard to the construction of the Alternative 2 structures that would be located within the 250-yard radius of any eagle's nest, the opportunity to mitigate the adverse impacts on the bald eagle is a challenge because the construction of the bulkheads would take place on the landward side of the shoreline. The movement of machines and equipment and activities associated with land-based construction would present a greater potential of disturbing the bald eagle during breeding, nesting, and foraging. However, while not completely eliminating the adverse impacts to the bald eagle, the adoption of the time-of-year restriction on the construction of the bulkheads that fall within a 250-yard radius of a bald eagle's nest would still provide some level of mitigation. Stated differently, in order to partially mitigate adverse impacts to the bald eagle, the construction of the bulkheads, components of Alternative 2, which would be located in the areas within a radius of 440 yards of any bald eagle's nest, would take place during the period July 16 through November 14.

While it is understood that the restrictions presented above are primarily focused on providing a safe distance between construction activities (noise) and human disturbance and the nests, as well as placing time-of-year limitations on these activities, it is also recognized that construction noise and human disturbance would also have the potential to impact eagles that will be foraging and traveling throughout the project area. It is believed that the above restrictions when applied to Alternative 1 structures would adequately provide a buffer zone for eagles that would be foraging and traveling throughout the project area. Much less of a buffer zone would be provided for Alternative 2 structures; however, it is believed that the eagles would eventually avoid those areas of noise and disturbance. In addition, any impacts would be further lessened by the short duration and periodic nature of the construction noise and disturbance.

The above recommendations that would be adopted to mitigate or partially mitigate adverse impacts to the bald eagle were also considered for the remaining RTE species. Although there are no construction sites located within a 300-yard radius of a great blue heron colony, in the event that one or more colonies are discovered prior to and during construction that are located within this radius, the above restriction disallowing any human activity within 300 yards of heron colonies from February through August would be followed. Although there are no known great egret or least bittern nests located within 250 yards or 440 yards of proposed construction sites, the same recommendations adopted above for the bald eagle would be applied to the great egrets and the least bitterns in the event that nests of either species are discovered

prior to and during construction that are located within the specified distances. The great egrets have been found in the great blue heron colonies, and the least bitterns have been found along the Passmore Creek shoreline.

3.4.4 Mitigation of Impacts to Wetlands

Alternative 1 would include compensation and mitigation for the impacts on vegetated and intertidal/subtidal wetland areas and the resultant impacts on habitat areas. The construction of sills, breakwaters, and accompanying fill would not only protect existing vegetated wetlands but would also provide intertidal areas for establishment of saltmarsh wetland habitat along the water's edge. Intertidal wetland areas (Cowardin type E2USN) impacted by the fill would be converted to emergent persistent intertidal wetlands (Cowardin type E2EM1). Compensation for these same intertidal habitat areas would be the structure rocks that provide substrate and shelter for sessile species and the establishment of emergent persistent intertidal wetlands on the landward side of the structures. There would be a net beneficial impact to vegetated wetlands with implementation of Alternative 1 and a net adverse impact to unvegetated intertidal and subtidal habitats. A mitigation plan is presented that provides for vegetated wetland compensation of slightly more than a 1:1 ratio. The plan would involve the creation of sand-filled areas landward of the breakwaters with sand obtained from a commercial borrow area. These areas would then be planted with *S. alterniflora* and *S. patens*. Replanting would be accomplished as needed during the first two planting seasons to ensure the viability of the wetland areas.

3.4.5 Mitigation of Impacts from Construction Activities

Mitigation measures to be enforced during construction include standard sound suppression devices for all mechanical equipment, deployment of an erosion control fence on the upland, and deployment of turbidity curtains in the marine environment. Because most of the work will be in remote areas, standard construction fencing will be used to keep the public away from the construction equipment on an as needed basis. The strict adherence to erosion and sediment control during construction and the proper handling of vegetative planting would also ensure protection against the growth and spread of invasive vegetation (i.e., common reed grass, phragmites).

The phasing of construction activities would also serve as mitigation measures. As indicated in Section 3.4.3, Mitigation of Impacts to the Bald Eagle, Great Blue Heron, Great Egret, and Least Bittern, the avoidance of construction in certain specified areas during specified times of the year would mitigate impacts to these species.

3.5 NPS Preferred Alternative—Alternative 1

A shoreline management system, utilizing breakwaters and sills, in combination with shoreline fill and the establishment of vegetative wetland fringes, would prove very effective in protecting Jamestown Island's infrastructure and historic and cultural resources, ecological habitat, and recreational resources from erosion damage. For the many reasons presented throughout this EA, the preferred alternative of NPS is Alternative 1, the Plan. This alternative would protect important ecological, cultural, and historical resources, while concurrently having minor or insignificant impacts to important socio-economic and ecological resources and park

operations. Alternative 1 is also consistent with current management guidelines and requirements.

3.6 Environmentally Preferred Alternative

The Environmentally Preferred Alternative, as defined by DO-12, is the alternative that causes the least damage to the biological and physical environmental and that best protects, preserves, and enhances historic, cultural, and natural resources (NPS, 2001). The environmentally preferred alternative is Alternative 1, the Plan. This alternative would protect important cultural and historic resources while having short-term and minor or insignificant adverse impacts to important environmental resources. The following table compares the contributions of each alternative to the 6 criterion found in Section 101 (42 USC § 4331) of the NEPA and provides support for the selection of Alternative 1 as the Environmental Preferred Alternative.

Table 1. Contributions of Each Alternative to The Six NEPA Criteria (1)

NEPA Criteria (1)	No Action Alternative	Alternative 1	Alternative 2
(1) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.	Would not ensure continued existence of natural, cultural, and historical environment of Jamestown Island by allowing continued erosion, except for implementation of stopgap measures.	Would ensure the continued existence of the natural, cultural, and historical environment of Jamestown Island by controlling erosion of the shoreline.	Would ensure the continued existence of the natural, cultural, and historical environment of Jamestown Island by controlling erosion of the shoreline.
(2) Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.	Would provide for least aesthetically and culturally pleasing surrounding at Jamestown Island over the long-term due to continued erosion and potentially non-compatible stopgap erosion control measures.	Would provide for a more aesthetically and culturally pleasing surrounding at Jamestown Island than do Alternative 2 or the No Action Alternative.	Would provide for a less aesthetically and culturally pleasing surrounding at Jamestown Island than Alternative 1 due to the aesthetically displeasing construction of vertical sheet-pile bulkheads.
(3) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.	Would provide for a narrower range of beneficial uses of Jamestown Island by allowing continued degradation (erosion).	Would provide for the widest range of beneficial uses of Jamestown Island by halting degradation (erosion) in a natural, aesthetically pleasing manner.	Would provide for the widest range of beneficial uses of Jamestown Island by halting degradation (erosion) in an aesthetically less pleasing manner.
(4) Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment that supports diversity and variety of individual choice.	Would not protect important historical and cultural resources as well as Alternatives 1 and 2, but could possibly contribute more to maintaining natural aspects of our natural heritage than Alternative 2, but less than Alternative 1.	Would protect important historical and cultural resources while maintaining the natural aspects of our national heritage (i.e., stone structures more compatible with natural setting of island).	Would protect important historical and cultural resources as with Alternative 1 but would contribute less to maintaining the natural aspects of our national heritage (i.e., vertical sheet-pile wall less compatible with natural setting of the island).
(5) Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.	N/A	N/A	N/A
(6) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.	N/A	N/A	N/A

(1) Found in Section 101 (42 USC § 4331) of NEPA.

3.7 Summary of Potential Impacts Associated with Each Alternative

The following table provides a comparison of the potential impacts of the alternatives considered.

Table 2. Summary of the Potential Impacts Associated with Each Alternative

Resources / Factors Used to Evaluate	No Action Alternative	Alternative 1— Revetments, Breakwaters, Sills and Vegetated Wetlands	Alternative 2— Bulkheads
Addresses the erosion problem of the study area in a technically- sound manner	Would provide erosion control through use of minimal stopgap measures taken in immediate response to the eminent loss of natural and cultural resources.	Would provide greatest positive erosion control for entire study area shoreline, as it would utilize best shoreline protection measures available today.	With the exception of Alternative 1, would provide the greatest positive erosion control for entire study area shoreline by a traditional shoreline protection measure.
Air Quality	Negligible, localized, short-term impact resulting from use of construction equipment.	Short-term, localized minor decrease in air quality from use of construction equipment.	Same as Alternative 1.
Water Quality	Short-term, localized decrease in water quality due to stopgap construction activities and continued erosion. Water quality would improve after completion of construction. Sediment from erosion would continue.	Short-term, localized decrease in water quality due to construction activity. Would return to normal after completion of work.	Same as Alternative 1.
Wetlands	Wind-wave erosion and boat wake currently results in loss of vegetated wetlands along much of Jamestown Island shoreline. This loss would continue but would be lessened by construction of stopgap measures.	Would reduce loss of shoreline wetlands by controlling erosion along study area shoreline and provide opportunities for creation of new wetland areas.	Would reduce extent of loss of shoreline wetlands by placement of bulkheads along shoreline. Would not provide significant opportunities for creation of new wetland areas.

**Table 2. Summary of the Potential Impacts Associated with Each Alternative
(Cont'd)**

Resources / Factors Used to Evaluate	No Action Alternative	Alternative 1— Revetments, Breakwaters, Sills and Vegetated Wetlands	Alternative 2— Bulkheads
SAV	Current erosion degrades water quality making it more difficult for SAV to become reestablished.	By reducing erosion, would reduce suspended solids entering water column and provide better water quality for SAV to reestablish.	Same as Alternative 1.
Aquatic Organisms	Continued erosion would have no measurable impact on existing river substrate or aquatic organisms that inhabit substrate. Adverse impacts from stopgap erosion control structures would be negligible and short-term.	Revetments, breakwaters, and sills would result in a substrate change that would have a net, long-term benefit in species abundance and diversity. Also, these structures provide habitat for aquatic organisms.	Bulkheads would result in a substrate change that would have no significant benefit in species abundance and diversity.
RTE species	No impact on the identified RTE, including the bald eagle.	No impact on the identified RTE, including the bald eagle. DCR and USFWS guidelines would be followed during construction activities	Same as for Alternative 1.
EFH	No change in any impacts.	Short-term and minor impacts due to construction activities.	Same as Alternative 1.
Terrestrial Flora and Fauna	No adverse impact, except in the Glasshouse parking overlook area where trees, shrubs, and habitat are currently being lost to erosion.	Moderate and long-term beneficial impact to terrestrial flora and fauna due to control of erosion.	Same as Alternative 1.

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**Table 2. Summary of the Potential Impacts Associated with Each Alternative
(Cont'd)**

Resources / Factors Used to Evaluate	No Action Alternative	Alternative 1— Revetments, Breakwaters, Sills and Vegetated Wetlands	Alternative 2— Bulkheads
Socio-Economic	Minor.	No measurable impact due to island's lack of population and isolation. Temporary increase in noise levels due to construction. No foreseeable impact to recreational resources.	Similar to Alternative 1. Would have a greater visual impact as bulkheads would appear obtrusive to the island's natural condition.
Historical and Archeological Resources and Cultural Landscape	Continued erosion would lead to loss of significant historical and archeological resources and impairment to park's cultural landscape by diminishing the island's natural characteristics.	Would protect cultural and historical resources identified by NPS. Structures would be low-lying and unobtrusive in nearshore zone and, thus, would not adversely impact park's cultural landscape.	Would protect cultural and historical resources identified by NPS. Structures would be placed at the high water line and would intrude on Park's natural environment and, thus, would adversely impact park's cultural landscape.
Coastal Zone Consistency	Inconsistent with Virginia's Coastal Management Program.	Consistent with Virginia's Coastal Management Program.	Consistent with Virginia's Coastal Management Program.
Visitor Use and Experience	Negligible impacts to visitors. Potential for cumulative impacts in conjunction with 400 th Anniversary Celebration.	Minor and, in general, short-term adverse impacts on visitor use and experience. Potential for cumulative impacts in conjunction with 400 th Anniversary Celebration.	Moderate and, in general, short-term adverse impacts on visitor use and experience. Potential for cumulative impacts in conjunction with 400 th Anniversary Celebration.

4.0 AFFECTED ENVIRONMENT

4.1 Introduction

This chapter describes the existing conditions of the project area, which includes Jamestown Island. Topics addressed in this section and subsequently analyzed in Section 5.0 (Environmental Consequences) were selected based on a determination of the importance of each in and adjacent to a coastal environment. A brief explanation of the rationale for selecting or not selecting a particular topic is presented in the paragraphs to follow.

4.2 Impact Topics Selected for Analysis

4.2.1 Geology, Soils, and Topography

All alternatives have some impact on these interrelated topics. The purpose of the action plans is to control erosion (prevention of loss of soil) of the study area shoreline for the purpose of protecting important archeological resources. The actions plans, and to a limited degree the No Action Alternative, all involve construction and fill activities in the area of the high water line and the near shore zone, which affects the topography of the area.

4.2.2 Ecological Resources (Including RTE Species, SAV, Wetlands, Aquatic Organisms, Terrestrial Flora and Fauna, and EFH)

The study area and vicinity lies within the ecosystem of the coastal plain of Tidewater, Virginia. It's location between the James and York Rivers, two of the largest rivers contiguous with the western shore of the Chesapeake Bay, and the presence of numerous streams, creeks, and ponds provide a unique natural habitat supporting many ecological resources. The action alternatives and the No Action Alternative have the potential to adversely affect the flora and fauna in the area through construction and fill activities. In addition, the action alternatives would create additional structure and habitat that could provide for long-term benefits to organisms inhabiting the near shore zone.

4.2.3 Air Quality

Each of the alternatives would result in some air emissions from construction equipment and dust from the handling and placement of fill.

4.2.4 Water Quality

All alternatives have the potential to increase the turbidity of the waters adjacent to Jamestown Island due to construction and fill activities. In addition, after construction is completed, hardened structures have the potential to focus wave energy in such a way that it does not dissipate as it would with a natural beach. The resultant scour and turbulence associated with higher wave energy around the structures could cause high levels of turbidity. This has the potential to affect the quality of the water surrounding the project area. The project area also falls within the area covered by CBPA, which has goals and incentives to reduce soil erosion and control sedimentation to protect water quality.

4.2.5 Coastal Zone Consistency

The Jamestown Island area lies within the coastal plain of Tidewater, Virginia, and, therefore, falls within the purview of the Coastal Zone Management (CZM) Program for the Commonwealth of Virginia. Virginia's program, which is authorized by the CZM Act (CZMA) of 1972, as amended in 1990, has established several goals and objectives for the management and protection of Virginia's coastal waters. Each of the alternatives has the potential to impact the Commonwealth's coastal water and related land resources.

4.2.6 Visitor Use and Experience (Including visitor access and transportation and aesthetics)

All alternatives have the potential to directly impact the experience and use of the historic area by visitors, thereby adversely affecting the local economy. This also relates to the ways in which people enter and move within the area and the temporary impacts of equipment noise during construction activities associated with the alternatives. The views of the Jamestown Island shoreline and adjacent water areas as well as the cultural/historical resources are important aesthetic components of the COLO natural landscape. All alternatives would have the potential to have some short-term or long-term impact on the natural appearance of the island and the cultural/historical resources.

4.2.7 Cultural Resources (Historical and Archeological Resources and Cultural Landscape)

The primary goal of the action alternatives is to protect and preserve the archeological and historical resources associated with Jamestown Island and COLO while preserving the elements of the cultural landscapes.

4.3 Impact Topics Eliminated from Further Evaluation

4.3.1 Rare, Threatened, and Endangered (RTE) Species (Excluding Bald Eagle, Great Blue Heron, Great Egret, and Least Bittern)

There are several species of plants and animals on the Virginia rare plant and animal list compiled by the Division of Natural Heritage that have been found or observed at least once either within or in the vicinity of COLO. The plant species are: the fibrous bladderwort (*Utricularia fibrosa*), the Florida adder's-mouth (*Malaxis spicata*), the loesel's twayblade (*Liparis loeselii*), the southern twayblade (*Listera australis*), the mountain camellia (*Stewartia ovata*), the Spanish moss (*Tillandsia usneoides*), and the sensitive joint-vetch (*Aeschynomene virginica*). Of the plant species listed only one is considered threatened or endangered and that is the sensitive joint-vetch, which is classified as threatened by the Federal Government. The southern twayblade has recently been removed from the rare species list because recent surveys have documented sufficient locations of this plant on Jamestown Island (none of which are in the project area). The fibrous bladderwort, Florida adder's-mouth, loesel's twayblade, mountain camellia, and sensitive joint vetch have all been found within the Park but are outside of the project area. Based on consultation with a natural resource specialist from NPS COLO (personal coordination with Mr. Charles Rafkind on October 19, 2000), it was found that the sensitive joint-vetch is located on the Neck-O-Land track on the mainland opposite Jamestown Island, which is outside of the project area. The nearest construction site included with any of the

considered alternatives is over 1,000 feet across the Back River from the nearest plant location. The Spanish moss is not located in the Park, but, rather, in the areas surrounding the Park.

The animal species on the Virginia rare plant and animal list are: the piping plover (*Charadrius melodus*) and the loggerhead sea turtle (*Caretta caretta*). The loggerhead sea turtle is classified as threatened by both the state and the Federal Government; the piping plover is classified as threatened by both the state and the Federal Government; and the least bittern is classified as rare by the state only. Although the piping plover is known to nest on the shores of the Craney Island Dredged Material Management Area, located approximately 30 miles down river from Jamestown Island, no piping plover nests have been documented in the Jamestown Island area. Similarly, while the loggerhead sea turtle, an oceanic and estuarine species, feeds within the Chesapeake Bay from spring through fall, there is no documentation of the loggerhead having been sighted in the area near Jamestown Island.

Although the above species have been found or observed either within or in the vicinity of the COLO, they were all outside of the project area. Therefore, they have been eliminated collectively as components of an impact topic for further consideration in this document.

4.3.2 Hazardous, Toxic, and Radioactive Waste

Based upon the historical use of the Jamestown Island area, it is not expected that continued erosion of the shoreline as is presently occurring would result in the identification and/or disturbance of hazardous, toxic, and radioactive waste. Additionally, the area does not contain any above ground storage tanks and is not known to contain any underground storage tanks that would be impacted by continued shoreline erosion or construction activities accomplished along the shoreline. Consequently, this impact topic is not addressed further in this document.

4.3.3 Prime and Unique Farmlands

The Jamestown Island area was the location of extensive farming, mostly tobacco and later grain production, during most of the 17th, 18th, and 19th Centuries. However, with the purchase of the property in the 1890's by the APVA and the mid-1930's by NPS, agricultural production ceased, and the island has been developed as a natural and historic area. Consequently, this impact topic is not addressed further in this document.

4.3.4 Floodplain Resources

Much of the study area shoreline falls within the 100-year floodplain, as defined and delineated by the Federal Emergency Management Agency. The 100-year floodplain is defined as that area that is subject to inundation by floodwaters, as a result of a hurricane or other coastal storm that has a 1 percent chance of occurring in any given year. Executive Order 11988 requires that Federal agencies avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid the direct and indirect support of floodplain development whenever there is a practicable alternative. The preferred method for satisfying this requirement is the avoidance of actions in the 100-year floodplain. If an action must take place in the 100-year floodplain, Executive Order 11988 requires that agencies minimize potential harm to people and property and to natural and beneficial floodplain values. None of the alternatives under consideration has the potential to

harm people or property or to impact the island's floodplain resources. In addition, shoreline structures, such as breakwaters and revetments are exempt under NPS Floodplain Management Guideline. Consequently, this impact topic is not addressed further in this document, and a statement of findings (SOF) for floodplains is not necessary.

4.3.5 Socio-Economic Resources

The Jamestown Island and COLO are major tourist attractions in the Tidewater, Virginia, area that contribute to the local economy of the area. However, socio-economic impacts are not expected to be an issue due to the lack of population at Jamestown Island and the island's remoteness and general isolation from the surrounding county. Consequently, this impact topic is not addressed further in this document.

4.3.6 Environmental Justice Issues

With regard to environmental justice issues, no Native American tribes or economically-disadvantaged communities are located within or in the vicinity of Jamestown Island or COLO and, therefore, environmental justice issues are not anticipated. Therefore, environmental justice issues have been eliminated as an impact topic for further consideration in this document.

4.3.7 Cultural Resources (Ethnographic Resources)

There are no identified sacred sites or other traditional places of ethnographic importance within COLO, although Native Americans have inhabited the area for over 400 years. Archeological investigations conducted by NPS have documented Native American occupation of Jamestown Island before 1607, which is the year that settlers from England arrived on the island. A review of recent studies and reports resulting from NPS, APVA, and Commonwealth of Virginia preparations for the 400th Anniversary of the founding of Jamestown Island has not resulted in the identification of any ethnographic resources within the study area. Therefore, ethnographic resources have been eliminated as an impact topic for further consideration in this document.

4.4 Geology, Soils, and Topography

4.4.1 Geomorphic Setting

Jamestown Island is surrounded by a subaqueous platform ranging in width from about 0.5 mile (0.8 kilometer) to less than 0.2 mile (0.3 kilometer). The island is divisible into four geomorphic regions as shown in Figure 18, which are characterized by distinctive, different-aged landforms, such as broad marshes, linear ridges and swales, and recurved spits. The various regions also are underlain by sediments of different lithology and ages, most of which are aggradational in nature and were created during periods of higher sea level in the past. The following is a brief description of the morphology of each region, which was taken from the literature by Johnson and Hobbs (1994).

a. Back River Marsh. This marsh trends east-west along the northern edge of Jamestown Island. Back River meanders through the marsh, which varies in width from 0.3 to 0.6 mile (0.5 to 1.0 kilometer) and is about 1.5 miles (2.4 kilometers) long. The marsh occupies the flooded and filled paleovalley of the late Pleistocene Powhatan Creek and is underlain by a thick sequence of Holocene fetid muds and sands estimated to be more than 50 feet (15.2 kilometers)

thick (Johnson and Hobbs, 1994). Sandy Bay, which lies at the western end of Back River marsh, is a shallow body of open water created when the isthmus connecting Jamestown Island to the mainland was breached early in the 18th Century. The marsh surface is cut by numerous shallow channels and is intertidal. The dominant plant is *Spartina*.

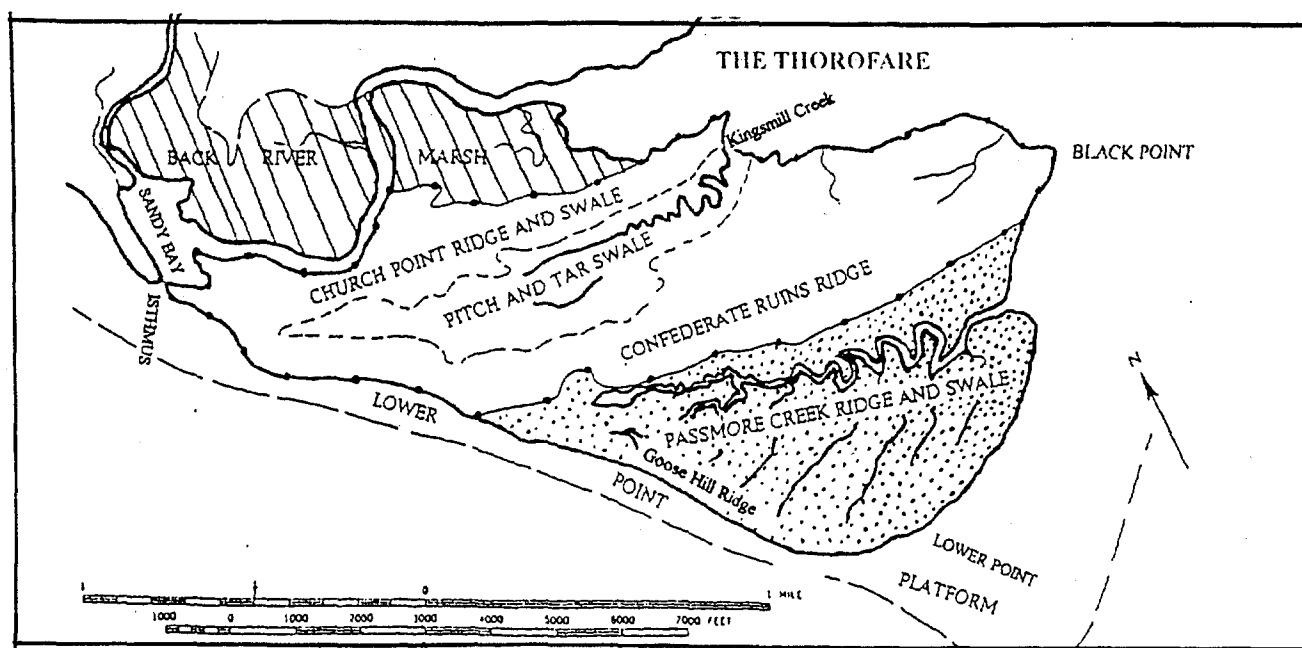


Figure 18. Geomorphic Features of Jamestown Island (after Johnson and Hobbs, 1994)

b. Central Uplands. The central uplands are the area of Jamestown Island most visited by tourists and the site of most cultural and agricultural activity by the early settlers. These land uses reflect the higher elevations, which have better-drained soils and provide protection from storms. The uplands are divisible into a northern complex, Church Point ridge and swale, a central Pitch and Tar swale, and a southern high ground, the Confederate Ruins ridge. The Church Point ridge and swale is comprised of a series of low, slightly curved ridges orientated northwest to southeast, mostly less than 12 feet (3.7 meters) above mean sea level. The ridges range in length from about 800 feet (244 meters) to more than 4,200 feet (1,280 meters) and are up to 500 feet (152 meters) in width. The northwestern termini of ridges along Back River are eroding. The ridges and swales are underlain by a basal sand sequence mantled by a thick clay-silt cap 5 to 8 feet (1.5 to 2.4 meters) thick. Pitch and Tar swale is comprised of the lowland occupied by Pitch and Tar Swamp as well as Kingsmill Creek and its tributaries. Most of the trough is covered by marsh, which divides the island into two parts and extends westward onto the APVA land. The wetlands probably impeded travel between the northern and southern parts of the island in the early days of English colonization. Main access was around the western end of the island near the ruins of the Jamestown town site. The area occupied by this lowland has increased during the last 400 years as sea level has risen. Confederate Ruins ridge lies between Pitch and Tar trough and a low scarp north of Passmore Creek. The main ridge trends in an east-west direction. The western end of the ridge is a broad platform about 1,050 feet (320 meters) wide, but to the east, short, arcuate ridges extend northeastward from the main ridge. The arcuate ridges are sand spits prograded eastward during the late Pleistocene. A clay-silt cap covers the ridges.

c. Passmore Creek Lowland. The landscape of the southern part of the island, the Passmore Creek lowland, is dominated by a series of generally east to northeast trending, straight to slightly curved ridges with intervening swales, and Goose Hill Ridge on the southwestern margin of the lowland. The swales are covered by brackish water marshes. Eight meandering tidal streams, which occupy the swales, flow northeastward into Passmore Creek. The morphology of the ridges varies from continuous to discontinuous, gently sloping to undulatory and is asymmetrical (usual state) to symmetrical in cross section. The ridges rise more than 5 feet (1.5 meters) above the marsh and generally decrease in height and length toward Lower Point. The ridges are underlain by late Pleistocene regressive beach or point bar deposits, and the marshes rest on Holocene fluvial-estuarine and paludal sediments. Goose Hill ridge extends from Jamestown town site southeast to Lower Point. The ridge, comprised of beach and dune deposits, is an undulatory landform. The higher elevations (5 to 15 feet or 1.5 to 4.6 meters mean low water) are dune-covered Pleistocene ridges, and the lower elevations are covered by beach and dune sands that have been swept over the swales and marsh deposits during the late Holocene. During major tropical storms and northeasters, most of the Passmore Creek lowland is inundated.

d. Lower Point Platform. This platform is a shallow-water shelf that surrounds Jamestown Island on the west, southwest, southeast, and east sides of the island. The water depth over the platform is less than 12 feet (3.7 meters) but averages about 4 feet (1.2 meters) deep. The shoreline of the island marks the upper grading of the platform, and the thalweg of the James constitutes its deeper margin. The platform is covered by a thin veneer of very recent

sediments over older Holocene fill or beveled Pleistocene sediments. The platform appears to be a planation surface cut mostly during the last 500 years. The principal agent for this erosion is storm-generated waves and current possibly augmented by boat wake and ship-propeller turbulence. At the west end of Jamestown Island, the platform is over 1,500 feet (457 meters) wide. It narrows to less than 400 feet (122 meters) at old Jamestown, and on the eastern end of the island, it increases to more than 2,000 feet (610 meters) wide. The James River thalweg is a discontinuous trough of deep water that lies 1,500 feet (457 meters) off the southwestern shore of Jamestown Island. The trough varies in depth from less than 25 feet (7.6 meters) to more than 55 feet (16.8 meters) and in width from about 2,000 feet (610 meters) to a shallow trough more than a mile (1.6 kilometers) wide. The thalweg represents the unfilled remnant of the Wisconsin glacial paleovalley of the James River.

4.4.2 Geologic Setting and Sea-Level Change

The topography of the Virginia Coastal Plain is a terraced landscape that stair-steps down to the coasts of the Chesapeake Bay and Atlantic Ocean and to the major tidal rivers, the Potomac, Rappahannock, York, and James. The plain is underlain by a thick wedge of sediments that increases in thickness from a few inches near the fall line to more than 4,000 meters (4,374 yards) under the continental shelf. These sediments rest on an eroded surface of Precambrian to early Mesozoic rock. Much of this wedge is comprised of late Jurassic and Cretaceous clay, sand, and gravel. This older strata is overlain by a sequence of thin, fossiliferous marine sands of Tertiary age, which was subsequently buried under about 1,200 meters (1,312 yards) of younger sediment. The latest Tertiary and Quaternary sand, silt, and clay, which cover much of the Coastal Plain, were deposited during interglacial highstands of the sea under conditions similar to those that exist in the modern Chesapeake Bay and its tidal tributaries.

Jamestown Island was built upon the Eastover Formation, which was deposited as muddy sand in a shallow sea that spread westward beyond what is now Richmond about 7 million years ago. When sea level subsequently fell, the Coastal Plain became emergent again. Between the time of emergence after the deposition of the Eastover in the Miocene and the Shirley Formation in the middle Pleistocene, the outer Coastal Plain was repeatedly flooded and exposed due to the growth and wastage of large continental glaciers during the late Pliocene and Pleistocene. The courses of major Coastal Plain Rivers, such as the James and its larger tributaries, were established during this time.

As the Illonian glaciers melted approximately 150,000 years ago, the Jamestown Island landscape was quite different, as the Chesapeake lowland was again inundated and relative sea level was about 18 feet above present. A major headland lay to the west, Powhatan Creek flowed southward directly into the James, and the site of Jamestown Island was shallow-water, estuarine bottom. Sand eroded from the headland and was carried eastward, building a spit across the mouth of Powhatan Creek. With time, the eastward growth of the spit deflected Powhatan Creek to an easterly course. The prograding spit eventually grew as far east and northeast as the mouth of Kingsmill Creek. This spit permanently diverted the course of Powhatan Creek through Back River and The Thorofare.

A minor withdrawal of the sea left the Proto-Jamestown Island emergent. The subsequent rise of sea level to about 10 feet (3 meters) above present level resulted in erosion along the southern edge of the island and the formation of the low scarp north of Passmore Creek. Erosion of the western headland began again. This time a series of curved ridges either point bar or regressive beaches were constructed successively to the west and south of the island, the oldest being in the north.

Following the formation of the Passmore Creek ridges and swales, sea level fell to more than 300 feet (91 meters) below present during the Wisconsin glaciation (approximately 18,000 years ago). In response to the lower base level, the James eroded a deep valley more than 100 feet (30 meters) below present sea level along the southern margin of the island. Streams on Jamestown Island, such as Powhatan and Passmore, responded by deepening their valleys. When the late Wisconsin continental glaciers began to melt, the resultant rise of sea level reduced the gradient of streams, such as the James River and Powhatan Creek, and caused them to fill their valleys with coarse sand and gravelly sediments. This event was time transgressive, probably beginning in the lower James' thalweg about 15,000 to 16,000 years ago and moving upstream to Powhatan Creek about 5,000 to 7,000 years ago. With the continued rise of sea level, the deeper valleys were flooded by tidal waters and finger marshes and fringing swamps developed.

The first human inhabitants apparently entered the Jamestown area when the James River was still a unidirectional freshwater stream and was entrenched more than 200 feet (61 meters) below the uplands to the north and south.

The change in sea level in the Chesapeake Bay was slow during most of the last millennium, rising less than 1.5 feet (0.5 meters) or approximately 2.2 inches (5.6 centimeters) per 100 years (Kearney, 1996). In the last 500 to 1,000 years, the James River spilled out of its thalweg and began the process of cutting the Lower Point platform. Recession of the bluff on the west and east ends of the island was faster than along the Goose Hill area, because of the greater exposure to waves and currents created by tropical storms and northeasters. The isthmus connecting the mainland and Jamestown Island was breached early in the 18th Century, changing the flow of Powhatan Creek and life on Jamestown Island. The slow rise in sea level continued until about 1850 when data indicate a sharp inflection point on the sea level curve (Kearney, 1996).

Sea level continues to rise today at a much higher rate than the last 1,000 years. Data from a Hampton Roads tide gage showed that between 1927 and 1980, the yearly means of sea level increased about 1.6 inches (4.1 centimeters) per decade or 16 inches (41 centimeters) per 100 years (ASCE, 1998). The beach and dune tract along Goose Hill continues to migrate northeastward under storm-generated waves and tides and in response to the rise of sea level. As a consequence, the Lower Point platform in this area is slowly widening. The Pleistocene ridges are being eroded and eventually the Passmore Creek lowland will be inundated.

4.4.3 Shoreline Processes

The present condition of the study area shoreline is the product of natural forces and anthropogenic effects acting over time. Anthropogenic effects include the past construction of

seawalls, revetments, and bridges, as well as the placement of fill material. These actions were taken in an effort to protect and maintain the eroding shoreline reaches and those important archeological and historical resources located landward of these reaches.

The primary natural force acting on the shoreline is the wave climate, which causes shoreline change and evolution. The wave climate acting on the Jamestown Island shoreline is a function of the effective fetch exposure, near shore bathymetry, and the high water levels and wave action associated with storm activity. It is during storm activity that shoreline erosion and sediment transport are most active.

The response of an estuarine shoreline to the wave climate and, therefore the rate of erosion experienced, is a function of the site-specific character of the sediments. The different amount of energy required to resuspend, hence erode, individual types of sediment determines the variations in erosion rates between sections of shore exposed to equal amounts of impinging energy. More energy, in terms of waves and currents, is required to resuspend silts, clays, coarse sands, and larger-sized sediments, than medium- and fine-grained sands. Thus, given equal exposure to waves and currents, the energy of the James River, shores consisting of medium- and fine-grained sands, will erode more rapidly than deposits of clays or silts, which exist in lagoonal, estuarine or marsh deposits.

Along the Jamestown Island shore on The Thorofare, the low upland banks (ridges) tend to erode faster than adjacent marsh (swale) shorelines. This is often why marshes become headland features as shoreline erosion proceeds through time (Hardaway, 1980). Sediments from eroding upland banks supply the beach zones found in front. Beaches and upland banks tend to orient themselves into the direction of dominant wave approach, especially if there is a "hard" point, an erosion resistant feature, upon which sand will accumulate on one side and the bank will cut on the other in the alongshore direction. Marsh shorelines erode irregularly and "reading" the morphology is more difficult especially when sand is lacking in the shore zone. However, small pocket beaches within the marsh system will indicate the direction of most recent wind/wave action. Jamestown Island is similar to several other island or point/bar features around Virginia's Chesapeake Bay estuarine system. These include: the Goodwin, Catlett, and Allen Islands in the York River; Mulberry Island and Ragged Point in the James River; and Belle Island and Parrot Island on the Rappahannock River.

The following paragraphs provide a description of the wave climate and transport of sediment for the study area shorelines.

Study Area Shoreline No. 1

These shoreline segments are exposed to the wind and wave action of the open fetch of the James from the northwest, west, southwest, and south. The southwest component has the highest frequency of impact on this shore. The net movement of sands alongshore is in the upriver direction and littoral processes are very much influenced by individual storm activity. The shorelines along Sandy Bay and Back River are fetch-limited, but tidal currents and potentially boat wakes can exacerbate shoreline erosion. See Plate 11.

Study Area Shoreline No. 2

This shoreline has effective fetches from the northwest, west, southwest, and south. As with the Plate 1 shoreline, the southwest component has the highest frequency of impact on this shore. The net movement of sands alongshore is in the upriver direction and littoral processes are very much influenced by individual storm activity. See Plate 12.

Study Area Shoreline No. 3

This shoreline has effective fetches from the east, southeast, and south. There is a zero net movement of sands alongshore indicating a general onshore-offshore movement of littoral materials. See Plate 13.

Study Area Shoreline No. 4

The wave climate along the north shore of Jamestown Island faces north and is most impacted by the northeast, north, and northwest wind fields. The shoreline along the Parkway faces south and becomes more exposed to a southerly wind field downriver. Shoreline morphology along the Parkway shoreline indicates a nodal point at the National Memorial Park. Pocket beaches between the marsh headlands at the outflow of the Glebe indicate an upstream movement of littoral material, and there is a dominant downriver movement of beach sand along the shoreline east of the National Memorial Park. There is little movement of beach sands along the northern shore of Jamestown Island. See Plate 14.

Study Area Shoreline No. 5

These shorelines are subjected to a wind and wave climate exposed to the southeast, south, and east, with the southerly wave condition dominating shore processes. Positive sand transport is upriver and negative transport is downriver with a net alongshore movement slightly downriver. See Plate 15.

4.5 Ecological Resources

4.5.1 Rare, Threatened, and Endangered (RTE) Species

The Virginia Division of Natural Heritage, under contract with NPS, has completed a biological survey of natural resources in all NPS units in Virginia, including COLO. The purpose of the survey was to identify RTE plants and animals that have been found or observed at least once either within or near the Park. All of the identified plant species and most of the animal species were found to have been observed or found outside of the project area and were, therefore, eliminated from further consideration as impact topics. The RTE species of animals that were found within the project area include: the bald eagle (*Haliaeetus leucocephalus*), the great blue heron (*Ardea herodias*), the great egret (*Casmerodius albus*), and least bittern (*Ixobrychus exilis*). These species are discussed in the following paragraphs.

Bald Eagles (*Haliaeetus leucocephalus*)

Bald eagles are the largest species of raptor found regularly in Virginia. Immature birds are brown with varying amounts of white mottling for 4 or 5 years before achieving the distinctive white head and tail of the adult. In addition to extensive forested areas required for nesting and roosting, bald eagles also need substantial stretches of forested shoreline for foraging. Bald eagles normally mate for life and usually nest in the same area each year. Mated

pairs may use two or more alternate nest sites in the same area from year to year. Although different pairs of eagles show different degrees of sensitivity to human activity, all bald eagles are vulnerable to human disturbance, especially if normal human activity patterns to which eagles have become habituated are suddenly changed or increased. Visual screening and distance buffers from human activity is essential to bald eagle reproductive and foraging success.

Bald eagles are uncommon throughout much of their range and are considered rare to very rare in Virginia. The species is listed as threatened by the Federal Endangered Species Act and endangered pursuant to Virginia Endangered Species Act. Although bald eagle populations have made a steady recovery since the ban on the use of certain persistent pesticides in the United States, the species continues to be threatened by habitat loss and human disturbance.

A pair of bald eagles (*Haliaeetus leucocephalus*) has been active on Jamestown Island since at least 1986. This corroborates with the information presented in a report entitled "Bald Eagle/Heron Survey Report for Colonial National Historical Park" prepared by the Center for Conservation Biology (1998), which references the presence of an active eagle's nest in 1987. This nest was, and still is, located in a large loblolly pine within one of the pine ridges that traverse the marsh system, which occupies most of the southern half of the island. VDGIF in cooperation with the College of William and Mary has monitored the nest site annually. The Jamestown Island eagles have defended their territory every year and have fledged one or two young at least half of the years they have occupied the site. Although the nest was not active in the 1993-1994 season, the territory was occupied. According to the Center for Conservation Biology report, the most impressive statistic for this nest is that in recent years it has become the earliest productive nest in Virginia, probably even in the Chesapeake Bay region.

During the spring of 2001, two new active eagle nests have been observed on Jamestown Island. Both nests are located about 1 mile apart in a continuous pine ridge, which runs along the southern end of the island.

An evaluation of the proximity of the proposed breakwater and sill sites identified in Figure 17 to the one original and two recent eagles nest locations indicates that five sites fall within a 250-yard radius of one of the nests. Five additional sites are located within a 440-yard radius of one of the nests.

Great Blue Herons (*Ardea herodias*), Great Egrets (*Casmerodius albus*), Least Bitterns (*Ixobrychus exilis*)

Great blue herons, great egrets, and least bitterns are members of the bird family Ardeidae, which includes herons and bitterns (Peterson, 1980). This family includes the medium to large wading birds with long necks and legs and spear-like bills. The great blue heron is a lean blue-gray bird, which at four feet tall, is the largest wading bird found in Virginia. The great egret is a slender white bird with black legs and feet and a yellow bill that is smaller (3-foot tall) than the great blue heron. The least bittern is a small, thin bird, which stands about 14 inches in height and is distinctively tan and white underneath and greenish black on the crown and back. All three birds inhabit marshes, ponds, shores, and mud flats.

Great blue herons are year-round residents in Virginia and are quite widespread in eastern Virginia with populations appearing to increase. This has put the species' status as a natural heritage resource under some deliberation. Although individuals are frequently encountered in wetlands of eastern Virginia, the species' habitat is limited and threatened by development pressures. Great blue heron's colonial nesting habits puts many individuals at risk to single disturbances. Great egrets are not as widespread in Virginia as the great blue heron and are limited to a fairly narrow band extending through the Tidewater region of Virginia. Least bitterns are considered very rare in the Commonwealth with only a few known breeding sites located in just eight counties. They are more common in some other parts of its breeding range, which includes most of the eastern United States.

The Center for Conservation Biology (1998) and Clark and Rafkind (1998) took a close look at the heron population on Jamestown Island. The report indicates that a heron colony has been present on the island since 1984 when it was first discovered with 19 active nests. The recent 1997 survey yielded 220 pairs of Great Blue Herons. Of interest with this colony are the population dynamics that it shares with the Hog Island heronry just across the James River. Annual changes in population size at the two sites suggest there are shifts in nesting pairs between the two areas. According to Clark and Rafkind (1998), 155 pairs of great blue herons were documented in the colony during a 1994 aerial survey by VDGIF and the College of William and Mary. Clark and Rafkind also reported that great egrets might be present in the heron colony. During a survey of 1991, Clark and Rafkind found a significant population (more than 30 individuals) of least bitterns occupying the herbaceous wetlands surrounding Passmore Creek.

4.5.2 Submerged Aquatic Vegetation (SAV)

SAV communities are those in which the plant life present requires complete submersion all or most of the time. In areas where the vegetation is not completely submersed at all times, only the tops of plants are exposed at periods of low tides, or when weather conditions cause the temporary removal of water from the water body in which they occur. The predominant form of SAV in the more saline portions of tidal tributaries of the Chesapeake Bay is eel grass (*Zostera marina*), which grows in dense patches on the benthos in the depth zone where light penetration is good (the phototrophic zone). SAV requires light for photosynthesis, and its growth, survival, and depth penetration is directly related to light availability.

VIMS conducts annual surveys of SAV's in the Chesapeake Bay and its tributaries. Since this baywide survey began in 1978, and until 1995, only one bed had been mapped in the main stem of the James River, at the mouth of Hampton River. This bed persisted and increased to four beds by 1996; and a fifth bed was mapped east of the Hampton Bridge in 1997. The Upper and Middle James River had no SAV mapped in 1997 (Orth, et al., 1998). In 1998, in the Middle James River segment, a fringing bed was discovered at the mouth of Mill Creek near Jamestown Island (see Figure 19, Orth, et al., 1999). Mill Creek is located on the north shore of The Thorofare, north of Jamestown Island. The paucity of SAV in this portion of the James is probably because of high concentrations of suspended sediments in this portion of the river.

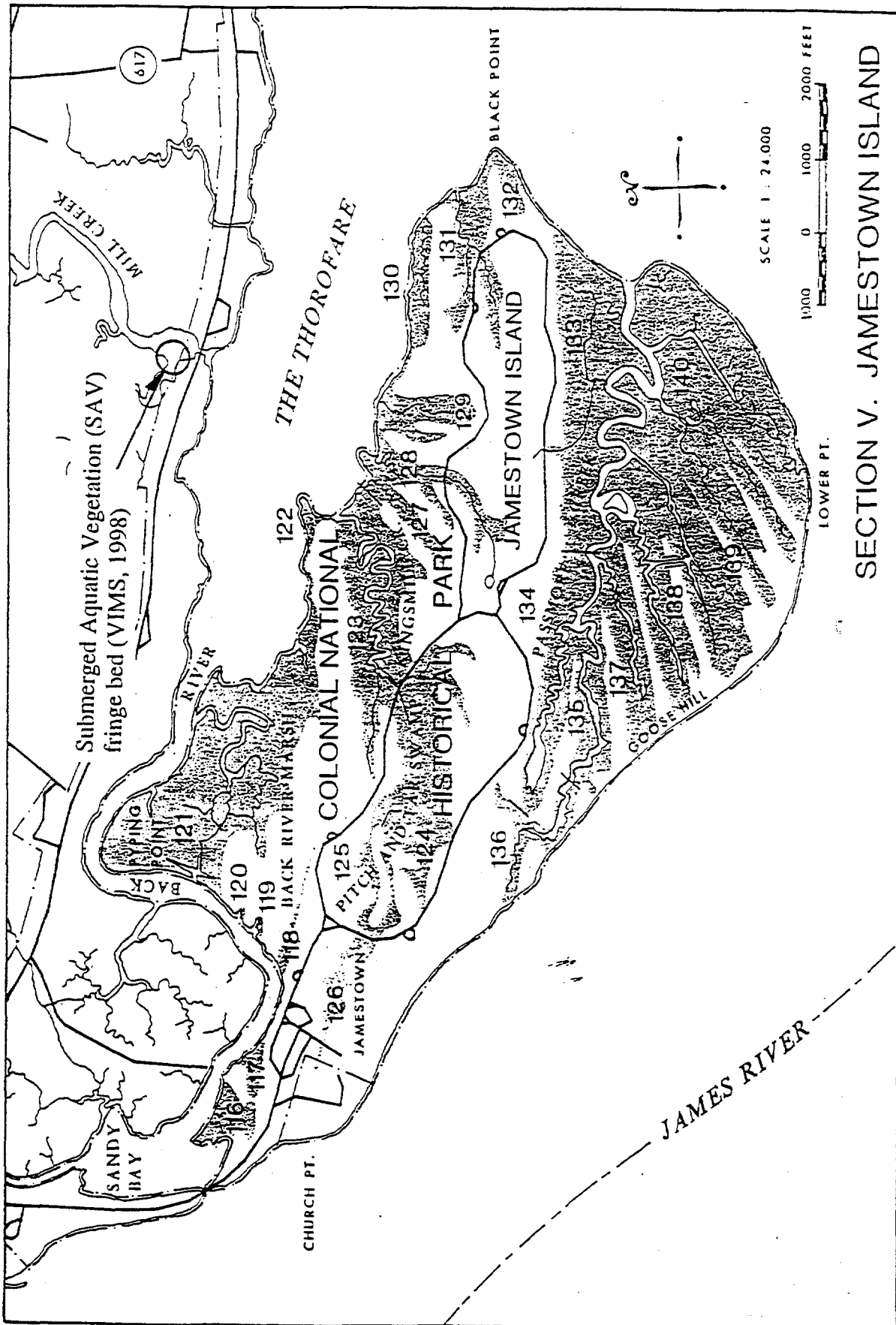


Figure 19. VIMS Tidal Marsh Inventory and Submerged Aquatic Vegetation

4.5.3 Wetlands

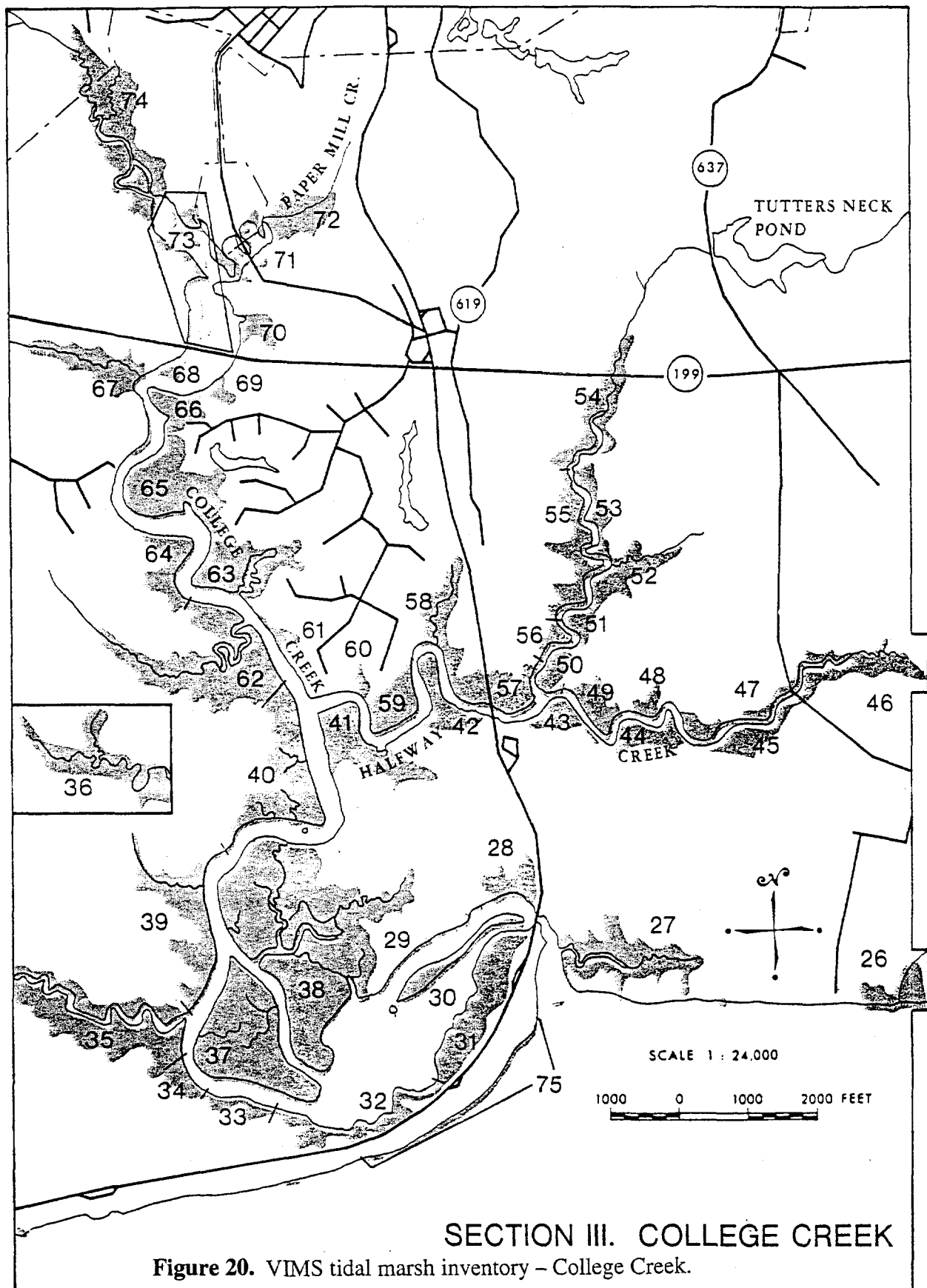
Mud flats are thick layers of fine-grained sediments that occur along the margins of relatively calm, highly saline waters. They are typically classified as non-vegetated wetlands, with a rich concentration of phytoplankton and other microscopic and submicroscopic life forms, as well as a large assortment of invertebrates. Mud flats are partially flooded on a daily basis. These mud flats are prevalent in the tidal creeks and guts that are prevalent in and around Jamestown Island.

Salt marshes are often found directly landward of mud flats and also occur in low-lying areas that are close enough to saline water bodies to be flooded on a regular basis. Vegetation in Jamestown Island salt marshes consists primarily of various species of cordgrass, saltgrass, and saltbushes. Maps have been prepared by VIMS, which depict the distribution of tidal wetlands in the project area (Figures 20 and 21). The following narrative is taken from the VIMS tidal marsh inventory for James City County (Moore 1980).

"Historic Jamestown Island, which contains over 706 acres of tidal wetlands, is located in a zone of the James River which marks the upper limits of saltwater. As such, one generally finds the waters surrounding the island to be quite fresh during the spring but somewhat brackish during the fall. This upper limit of saltwater intrusion is evident within the vegetative patterns of the various tidal creeks. In most of these areas freshwater species such as arrow arum dominate the upstream areas, while brackish water species such as big cordgrass and saltmarsh cordgrass are found near the mouths.

"Back River Marsh is one of the largest wetland areas on the island and it consists of extensive stands of wild rice and arrow arum as well as large areas of big cordgrass. Kingsmill Creek is dominated for most of its length by big cordgrass but grades to an upstream portion of reduced salinity known as Pitch and Tar Swamp, where such species as cattails and arrow arum are most abundant. At the most upstream section of this creek these marsh species are being replaced by pioneer swamp species including red maple and black gum.

"Passmore Creek contains the most extensive wetlands acreage on Jamestown Island. The lower sections of the creek system are for the most part again dominated by big cordgrass. At the heads of the numerous branches, which are located between a series of ancient beach ridges, arrow arum and wild rice dominate. Active erosion along the western face of the island is slowly truncating these ridge and marsh areas. But because the waves also maintain a shallow sand beach along this retreating shoreline, drainage continues east to Passmore Creek rather than directly into the James River."



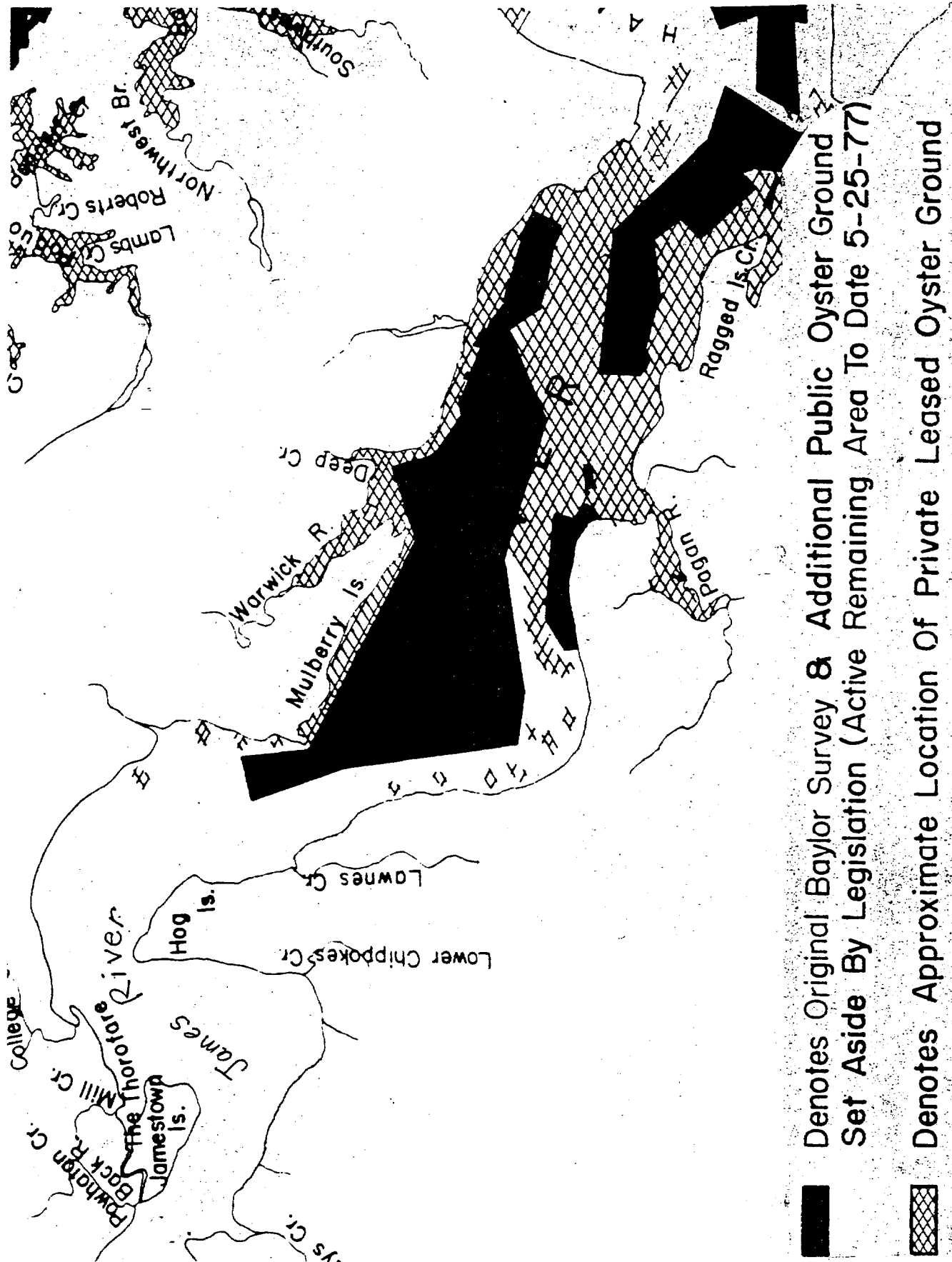


Figure 21. Public and leased oyster grounds -lower James River.

In addition to Jamestown Island proper, the College Creek shoreline on the James River to the east is also a proposed project site (see Appendix D, Plate 5). As depicted on Figure 17 (VIMS tidal marsh inventory for College Creek), location number 75 (project site) is described by the VIMS inventory as predominantly a Spartina cynosuroides, big cordgrass (30 percent), Spartina patens, saltmeadow grass (25 percent), and remainder a mixture of marsh mallow (Kosteletzkya virginica), marsh hibiscus (Hibiscus moscheutos), arrow arum (Peltandra virginica), and smartweed (Polygonum spp.). The high marsh fringe is mixed with myrtle and pine.

The salt marshes of Jamestown Island and vicinity are populated by a large variety of invertebrates, mammals, waterfowl, and other birds.

4.5.4 Aquatic Resources (Except fish and related habitat)

Numerous benthic surveys have been conducted in the Hampton Roads area, including the James River and vicinity (Boesch, 1971; Boesch, 1974; Dauer and Ewing, 1986; Diaz, 1988). The muck-type substrate, which predominates in these tidal waters is high in numbers of individual organisms but generally low in community diversity.

The lower James also contains some of the largest seed oyster beds in Virginia, totaling about 25,000 acres. Oyster abundance in Chesapeake Bay, however, is at its lowest level in history. Oyster beds in the James are not only important for the mature oyster harvest, but also for the seed oysters, which are transplanted to other rivers in order to ensure populations for future harvest. Oyster production is generally limited to the portion of the lower James between the mouth and the northern end of Rocklanding Shoal Channel, just off Mulberry Point on the east shore of the river. This is the approximate upstream limit of both privately leased and public oysters grounds in the James River. Jamestown Island is located approximately 14 miles upriver from this location.

There are no public or privately leased oyster grounds located in the vicinity of Jamestown Island. The closest public and leased grounds are located downriver in the vicinity of Mulberry Island as shown in Figure 19.

Another commercially valuable species is the hard clam, Mercenaria mercenaria, which has a patchy distribution in the Hampton Roads Harbor area. Haven, et al. (1981), researched its abundance and distribution in the harbor. Due to fecal coliform contamination in shellfish areas in some areas of the James and its tributaries, shellfish grounds have been condemned by the Virginia Department of Health, Division of Shellfish Sanitation, but may be used as source areas by those who obtain permits from the Virginia Marine Resources Commission (VMRC) to transfer the mollusks to clean water for harvesting after depuration.

Blue crabs are a commercially important estuarine species of the lower James and are harvested as both hard-shell and soft-shell crabs for the local seafood market, as well as exported from the Chesapeake Bay area. By Regulation 450-01-0100, the VMRC established the Hampton Roads Blue Crab Management Area and provisions to control the harvest of crabs from this area. The provisions of this regulation are in response to reduced abundance in the blue crab

stock and increased fishing pressure on this resource. The Hampton Roads Blue Crab Management Area consists of all tidal waters inshore and upstream of a line formed by the extreme south and north ends of the westbound span of the Hampton Roads Bridge-Tunnel. By this regulation, it is unlawful for any person, at any time, to dredge for crabs within this area. The regulation became effective March 2, 1995.

Principal nektonic species of commercial importance are listed in Appendix B of this document, and a general listing of benthic organisms common in and around the Jamestown Island area is also found in Appendix B. Micro- and macro-organisms in the planktonic community are numerous and include diatoms, dinoflagellates, foraminifera, skeleton shrimp, jellyfish, stinging nettles, and larval forms of fish, crustaceans, and other organisms.

4.5.5 Terrestrial Flora and Fauna

Many species of terrestrial flora and fauna are found throughout Jamestown Island. The predominant terrestrial flora includes approximately 4,800 acres of forest and over 1,100 acres of open field. The forest types include pine, mixed pine and hardwood, and hardwood types. The hardwood species found in the dry land areas include tulip poplar, white oak, will oak, black cherry, red oak, and hickory. Hardwood species found in the poorly drained soils include sweet gum, white ash, red maple, black walnut, black gum, and sycamore. The terrestrial flora provides habitat for a diverse body of terrestrial fauna. Common species include white-tailed deer, silver and red fox, beaver, raccoons, muskrat, and turkey.

Invasive species of flora have been observed in the study area, although they are not common and are in limited areas. The primary invasive plant is the common reed (Phragmites australis), which is a tall perennial wetland grass ranging in height from 3 to 15 feet. This plant thrives in sunny wetland habits and also grows along drier borders and elevated areas of brackish and freshwater marches and along riverbanks and lakeshores (DCR). Land disturbances and water pollution encourage the growth of these plants. The problem with phragmites is that it can quickly displace desirable plant species, which eliminates the diverse wetland plant communities, providing little food or shelter for wildlife.

4.5.6 Fish Resources and Essential Fish Habitat (EFH)

Resident fish species in the lower James River in the vicinity of Jamestown Island include Atlantic silversides, Atlantic croaker, striped anchovy, spot, weakfish, hogchoker, bluefish, naked goby, oyster toadfish, skilletfish, blackcheek tonguefish, summer flounder, and black seabass. Bluefish, flounder, and seabass are all considered to be commercially important species, and spot and croaker are also popular game fish. Temperature appears to be the major factor affecting distribution of resident fishes in these waters in winter, while food availability is the major factor in summer. Principal finfish uses of the lower James and its tributaries are (1) nursery and spawning grounds for both resident and anadromous fish, (2) adult feeding grounds, and (3) spawning grounds for important forage species, such as the bay anchovy and Atlantic silverside.

VIMS conducted seine surveys in the James River near Jamestown Island and found 48 species of fish representing 21 families. Although no RTE species were recorded in recent surveys, the Atlantic sturgeon is known to occur in the vicinity of Jamestown Island

(USFWS 1991). These reports all indicate the importance of the Jamestown Island area for fish nurseries and habitat for a variety of marine and anadromous fish species.

The lower James River supports the same anadromous species as those found in the upper portions of the river, but the individuals present occur at different life stages from those in the upper river. In general, anadromous fish larvae and juveniles move downstream (toward increasingly saline waters) as they mature, so that pre-adult and adult members of the species tend to be found in the lower reaches of the James. Adult members found in the upper portion of the river are there for procreation and do not survive in the fresh water long after spawning. River herring in general seem to be better adapted to spawning in more saline waters, and so the lower James serves as a nursery ground for these, as well as American shad and striped bass.

The 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act require Federal agencies to consult with the National Marine Fisheries Service (NMFS) regarding the potential effects of their actions on EFH. EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Step 1 of the consultation process was accomplished by notifying NMFS that this EA was being prepared. Step 2 is the preparation of an EFH Assessment by the Federal agency proposing the action. The EFH assessment shall include (1) a description of the proposed action, (2) an analysis of the effects of the action on EFH and associated species, (3) the Federal agency's views regarding the effects of the action on EFH, and (4) a discussion of proposed mitigation, if applicable. Step 3 of the consultation process is completed after NMFS reviews the EA for which the NMFS provides EFH Conservation Recommendations during the established comment period. The fourth and final step in the consultation process is the Federal agency's response to the EFH Conservation Recommendations within 30 days. This response in writing must either describe the measures proposed by the agency to avoid, mitigate, or offset the impacts of the action on EFH pursuant to NMFS' recommendations or must explain its reasons for not following NMFS' recommendations.

4.6 Air Quality

Air quality in the Hampton Roads area is in compliance with current Environmental Protection Agency (USEPA) criteria for sulfur dioxide, nitrogen oxides, carbon monoxide, airborne lead, and inhalable particulate matter. In 1991 Hampton Roads was considered a marginal non-attainment area for ozone. Marginal non-attainment is classified as having ozone levels of 0.121 parts per million (ppm) up to but not including 0.138 ppm. This means that the total emissions, including both direct and indirect, for any proposed activity must be less than 100 tons per year for ozone precursors (nitrogen oxides[NO_x] and volatile organic compounds [VOC]) to be considered as not having an adverse effect on air quality. On June 26, 1997, USEPA announced the Hampton Roads area is in attainment but is considered a maintenance area (VDEQ, 1999). A maintenance area, pursuant to the State Air Pollution Control Board's Air Regulations (9 VAC 5-160), requires that the total of direct and indirect emissions caused by a Federal action be less than 100 tons per year for both NO_x and VOC.

COLO is a class II air quality area. This means that under Virginia's implementation plan to achieve national ambient air quality standards (NAAQ's), the state may allow a moderate amount of new air pollution in and around the Park but cannot allow levels to exceed those

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specified in the NAAQ's or the maximum allowable increments over established baseline concentrations.

4.7 Water Quality

VDEQ, Division of Water Resources water quality standards (VR 680-21-00) describe the waters in this portion of the James River as estuarine waters (tidal water – coastal zone to fall line). Section VR 680-21-01.5 defines the state's seven classes (I-VII) and the dissolved oxygen (DO), pH, and maximum temperature that apply to each class. The classification of waters near Jamestown Island is Class II. The following standards apply to Class II waters. The surface waters within and surrounding the Park are generally of good quality.

Table 3. Water Quality Standards for Class II Waters

Dissolved Oxygen (mg/l)		PH	Maximum temperature
Minimum	Daily av.		
4.0	5.0	6.0-9.0	Any rise above natural temperature shall not exceed 3° C.

All proposed coastal construction work must also be accomplished in compliance with CBPA. Under the Act, the locality, James City County, has designated all of Jamestown Island as either a RPA or a Resource Management Area (RMA). RPA's are lands at or near the shoreline that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts that may result in significant degradation to the quality of state waters. RMA's are the lands outside of the RPA's that, if improperly used or developed, have the potential for causing significant water quality degradation or for diminishing the functional value of the RPA's. Efforts to reduce soil erosion and control sedimentation to protect water quality are goals and incentives of the CBPA. All proposed construction would be required to be coordinated with the locality and the Chesapeake Bay Local Assistance Department (Virginia state agency) prior to implementation.

4.8 Coastal Zone Consistency

As required by the CZMA of 1972, as amended in 1990, and the approved Coastal Management Program of the Commonwealth of Virginia, all proposed construction within the designated coastal area must be evaluated for consistency with coastal development policies. The Virginia Coastal Resources Management Program was approved as part of a National CZM Program, which is a voluntary partnership between the Federal Government and the US coastal states and territories authorized by the CZMA. The CZMA establishes a policy: 1) to preserve, protect, develop, and where possibly, restore and enhance the resources of the Nation's coastal zone; and 2) to encourage and assist states in their responsibilities in the coastal zone through development and implementation management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and aesthetic values, as well as the needs for compatible economic development (16 U.S.C. 1452).

The VDEQ serves as the lead agency for Virginia's networked CZM Program, which is reauthorized every four years by Executive Order signed by Virginia's Governor. The goals of the Virginia program include:

- the prevention of environmental pollution and protection of public health,
- the prevention of damage to the Commonwealth's natural resource base,
- the protection of public and private investment in the Coastal Zone,
- the promotion of resources development and public recreation opportunities,
- and the provision of technical assistance and information.

4.9 Visitor Use and Experience (Including visitor access and transportation and aesthetics)

According to NPS statistical information, COLO received an average of over 3.1 million visitors annually between 1995 and 1999. APVA and NPS representatives clearly understand the importance of the quality of the visitor experience to the continued sustainability of this historic area. They work diligently to maintain and improve on an exciting and memorable visitor experience by focusing on the area's unique historic and natural setting, as well as its archeological and cultural resources. Closely related to the visitor experience are issues regarding image and attractiveness, vehicular and pedestrian movement, parking, and concession and service facilities. APVA and NPS representatives are taking a close look at these issues in conjunction with the ongoing planning for the 400th Year Anniversary Celebration of the founding of Jamestown.

4.10 Cultural Resources (Historical and Archeological Resources and Cultural Landscapes)

4.10.1 Historical Overview

Jamestown Island, which is part of COLO, is the site of the first permanent English settlement in North America. Although most of the island is owned by NPS, 22.5 acres along the southwestern side are owned by APVA, which acquired the property in the 1890's. The APVA property contains the only remaining aboveground structure from the 17th Century, the tower, which was constructed in 1639.

Colonial National Monument was established in 1930 by congressional legislation for the preservation of the Park's historic structures; the name was changed to COLO in 1936. Other elements of the Park include Yorktown, Colonial Parkway, Green Spring plantation site, Cape Henry memorial, Swann's Point, and Tindall's Point. The Jamestown National Historic Site and COLO were both placed on the National Register of Historic Places (NRHP) on October 15, 1966.

The first settlement on Jamestown Island occurred along the southwestern shore of the island with a group of 104 men and boys, who constructed the original fort during the first month of settlement in 1607. As the first decade of English colonization in Virginia ended, occupation on Jamestown Island began to shift outside of the fortified settlement. By 1618, land outside of the fort had been opened to development, and lots were laid out in what became known as "New Town" by surveyor William Claiborne by 1623. By 1649 the developed portion of Jamestown covered the entire western end of the island, and areas outside "New Town" were parceled into

tiny lots in a regular pattern. From its beginnings through the 1660's, Jamestown was the Virginia colony's main commercial center as well as its capital. The fortunes of the town began to suffer because of both natural and manmade calamities. Chief among these was the burning of the church, statehouse, and many houses as part of Bacon's Rebellion. Although the church, statehouse, and some of the houses were repaired, the town never seemed to recover its former vitality. The final blow came with the shifting of the capital from Jamestown to Middle Plantation (renamed Williamsburg) at the end of the 17th Century. During the second half of the 17th Century, development at Jamestown Island became consolidated into a series of larger and fewer landholdings so that by the mid-18th Century much of the island had been absorbed into two major plantations with a handful of urban lots at the western end of the island. Agriculture came to dominate the landscape of the island with tobacco predominating first and then grain production. For most of the 19th and early 20th Centuries Jamestown was owned by a succession of private individuals until APVA and NPS purchased the property in the 1890's and mid-1930's, respectively.

4.10.2 Archeological Overview

There have been three different periods of archaeological study at Jamestown Island before the latest investigations of the past 8 years. The earliest occurred at the beginning of the 20th Century with excavations at the church ruin. Observations of artifacts and traces of buildings were made during the construction of the seawall from 1900-1901. The second period of investigation occurred from 1934 to 1941 and took place primarily in the town area. The third period, which was conducted between 1954 and 1956, focused on the town but also explored several locations elsewhere on the island. The excavations at the town site consisted of 6 miles of trenches on a 50-foot interval grid. The investigations also documented Native American occupation of the island before 1607.

In 1992, a 5-year study to reevaluate the island's archaeology, sponsored by NPS, was initiated. This study, conducted by the Colonial Williamsburg Foundation and the College of William and Mary, brought together a multidisciplinary team to develop a revised understanding of the entire human history of the island. One of the goals of this study was to inventory all archaeological sites on NPS lands at Jamestown Island, which resulted in the identification of 58 archaeological sites spanning the Paleo-Indian period through the 20th Century. Of these 58 sites, 45 have 1 or more components that potentially hold information important to history or prehistory and, thus, are considered potentially eligible for the NRHP. Among the components, 15 are Native American and 39 are from the historic period. This identification survey determined that there is essentially no portion of the island that does not contain archaeological resources, including the wetlands areas, and that the most significant threat to these sites on the island is shoreline erosion. While this survey covered the entire Jamestown Island, it did not cover areas along the Colonial Parkway, one of which is included in this project.

Until this survey was conducted, very little was known about the human habitation of the island prior to 1607. The survey found prehistoric sites on essentially every part of the island, including areas that are now under water. As sea level has risen, the upland portion of the island has decreased, which leaves more of the accessible sites along the higher ground. Areas where more of the sites were found include island margins, which overlook wetlands and streams, and the heads of narrow wetland "guts," which intrude into the upland ridges. Although they are

now filled with tidal marsh, many represent former springheads that fed small tributary streams. Prehistoric artifacts that were found include sherds, hafted bifaces, debitage, and fire-cracked rock.

In addition to the overall survey of the island, investigations of certain specific areas have also been carried out to include the shoreline in the vicinity of the Glasshouse Point area, New Town, and Black Point. The survey at the Glasshouse Point area resulted in the identification of three sites potentially eligible for NRHP and seven areas of isolated artifacts or clusters of modern and/or redeposited artifacts that were not judged to be eligible for listing on NRHP. The New Town survey resulted in the identification of three portions of the shoreline that should be considered significant with the remaining areas slightly less significant. The archaeological features found in this area indicate the possible presence of 17th Century structures associated with the waterfront and shipping as well as homes and outbuilding. The primary recommendation of this study was for any construction in this area to build out from the present shoreline instead of cutting into the shoreline. The work at Black Point consisted of archaeological data recovery at site 44JC895. The results of the investigation helped to identify and describe the function and structure of a Middle Woodland camp (ca. 500 B.C.-900 A.D.) with four activity areas. An additional but less well defined Late Archaic component (ca. 3000-1000 B.C.) was also found at the site. The artifacts found consist of fire-cracked rock, debitage, tools, and ceramics.

In addition to NPS sponsored work, the APVA initiated the Jamestown Rediscovery Project in 1994 to find archaeological evidence of the 1607 Jamestown Fort. To date over 250,000 artifacts have been recovered, many dating to the first quarter of the 1600's. Evidence of the original fort has also been found.

Twenty-eight of the archeological sites identified in the previous paragraphs are located in the shoreline protection study area, which are fairly well distributed along the shoreline of the island. Of these 28 sites, which are listed in the following table have been determined potentially eligible for listing on the NRHP, 6 were recommended not eligible, and no determination has been made for 1 site. At least nine of the sites listed have high research potential, with the potential to shed light on prehistoric settlement patterns in the Jamestown area and provide new information on the early history of the island, particularly for the portions not associated with the original fort on the southwestern side of the island.

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Table 5. Known Archeological Sites in the Shoreline Protection Study Area

Site Number	Location	Significant Component(s)	National Register Eligibility	Research Priority
44JC106	Glasshouse Point	Late Archaic, Middle-Late Woodland, 17th c.	Potentially eligible	High
44JC886	The Thorofare	Late Woodland; 17th c.	Potentially eligible	High
44JC888	The Thorofare	None	Not eligible	None
44JC889	The Thorofare	Late Archaic, Late Woodland, 17th c.	Potentially eligible	High
44JC893	Black Point	Civil War	Potentially eligible	Low
44JC895	Black Point	Late Archaic	Potentially eligible	Highest
44JC896	Black Point	Paleoindian	Not eligible	Low
44JC899	The Thorofare	None	Not eligible	None
44JC903	The Thorofare	Early Archaic	Potentially eligible	Highest
44JC904	The Thorofare	None	Not eligible	None
44JC910	Back River	M.-L. Woodland, 19th c.	Potentially eligible	Moderate
44JC915	The Thorofare	17th c.	Potentially eligible	Very high
44JC916	The Thorofare	17th c.	Potentially eligible	High
44JC918	Goose Hill	None	Not eligible	None
44JC920	Lower Point	17th c., L. Woodland	Potentially eligible	Very High
44JC923	Goose Hill	17th-18th c.	Potentially eligible	Moderate
44JC924	Goose Hill	18th c.	Potentially eligible	Low
44JC928	Back River	17th c.	Potentially eligible	Moderate
44JC931	Church Point	17th c.	Potentially eligible	Moderate
44JC932	Back River	Civil War (?)	Potentially eligible	Low
44JC933	The Thorofare	None	Not eligible	None
44JC935	Back River	None	Not eligible	None
44JC936	Lower Point	17th c., M.- L. Woodland	Potentially eligible	Low
44JC937	Lower Point	17th c., Late Woodland	Potentially eligible	High
44JC940	Moderate	18th c., M.-L. Woodland	Potentially eligible	Moderate
44JC942	Goose Hill	Civil War	Potentially eligible	Low
44JC943	Lower Point	Prehistoric	Potentially eligible	Moderate
None	College Creek	Civil War	Undetermined	Unknown

4.10.3 Cultural Landscape

According to NPS Director's order 28, a cultural landscape is a geographic area, including both natural and cultural resources, associated with a historic event, activity, or person. NPS recognizes 13 character-defining elements to a cultural landscape. These include natural systems and features, spatial organization, land use, cultural traditions, topography, vegetation, circulation, buildings and structures, cluster arrangements, views and vistas, constructed water features, small-scale features, and archeological sites.

Information regarding the subject of cultural landscaping is available from a recent report prepared by NPS for THE JAMESTOWN PROJECT, the official NPS project underway in preparation for the 400th Anniversary Celebration. The information to follow is taken from that draft report.

The study area for the cultural landscape encompasses all NPS and APVA property, including the Colonial Parkway, Glasshouse Point, Neck of Land, and the entire Jamestown Island. It also includes Back River, Sandy Bay, and viewsheds reaching to the Surry County shoreline.

The draft report for THE JAMESTOWN PROJECT defines three cultural landscape types in the study area. The report points out that the features associated with these landscape types are directly linked to key development periods and are delineated by APVA and NPS property boundaries. These three types are:

- a. The first landscape is that which most accurately reflects the 17th Century historic scene -- the existing natural environment on the island and its defining bodies of water. This includes marshes, rivers, and historic boundary ditches found throughout the island, as well as the dense woodland that sustained the indigenous people of the island and were in place at the arrival of the Virginia Company in 1607.
- b. The second landscape type reflects the period of memorialization of Jamestown Island on APVA property between the end of the 19th Century and the first half of the 20th Century. The location of remaining landscape features and overall design of the site still reflect a park-like commemorative landscape.
- c. The third landscape type consists of the mid-20th Century interpretive landscape built by NPS in New Towne, the remaining portion of the island, and Glasshouse Point. It includes the Colonial Parkway and Loop Drive. This landscape represents the Mission 66 period of development, which was a large scale, 10-year planning and construction campaign by NPS initiated in the early 1950's in response to the tremendous increase in park visitation at that time. With its use of modern visitor facilities and services and improved interpretive programs, Mission 66 represented a very bold departure from the characteristic and widespread rustic style of park design and construction.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 Introduction

NEPA requires that environmental documents disclose the environmental impacts of the proposed Federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. This section analyzes the environmental impacts of the three project alternatives as related to the topics discussed at the beginning of the previous section (Affected Environment).

NEPA requires consideration of both the intensity and duration of impacts, indirect impacts, cumulative impacts, and measures to mitigate for impacts. The following definitions were used to evaluate the intensity, duration, and cumulative nature of impacts associated with project alternatives:

Duration is a measure of the time period over which the effects of an impact persist. The duration of an impact may be *short-term*, when impacts last less than 1 year, or *long-term*, when impacts last 1 year or longer.

Impact types. Impacts are classified as beneficial if they would produce a net positive impact with regard to the environmental impact topic under consideration and adverse if they would produce a net negative impact with regard to the environmental impact topic.

5.2 Intensity of Impacts

Intensity is a measurement of the severity of an impact. The following paragraphs present the appropriate definitions for the various levels of intensity of impact for the impact topics under consideration.

Intensity of Impact Definitions for Geology, Soils, and Topography, Air Quality, Water Quality, Coastal Zone Consistency, and Visitor Use and Experience

The sources of information on geology, soils, and topography; air quality; water quality; coastal zone consistency; and visitor use and experience are presented in Sections 4.4; 4.6; 4.7; and 4.8, respectively. The definitions for the intensities of the impacts are defined as follows:

Major Impact--the impact is severely adverse and highly noticeable.

Moderate Impact--the impact is readily apparent and appreciable.

Minor Impact--the impact is localized and slight but detectable.

Negligible Impact--the impact is localized and at the lower levels of detection.

Intensity of Impact Definitions for Submerged Aquatic Vegetation (SAV) and Wetlands

The sources of information on SAV and wetlands are presented in Sections 4.5.2 and 4.5.3, respectively. The definitions for the impacts are defined as follows:

Major Impact – Work will cause a direct impact of over 0.5 acre of non-tidal wetlands, greater than 0.1 acre of tidal wetlands, and greater than 0.1 acre of SAV's.

Moderate Impact - Work will cause a direct impact of between 0.1 to 0.49 acre of non-tidal wetlands, between 0.01 and 0.09 acre of tidal wetlands, and between 0.1 to 0.49 acre of SAV.

Minor Impact - Work will cause a direct impact of less than 0.1 acre for non-tidal wetlands, less than 0.01 acre for tidal wetlands, and less than 0.01 acre of SAV. Negligible Impact – Work would cause indirect impacts only.

Intensity of Impact Definitions for RTE Species, Aquatic Organisms, Terrestrial Flora and Fauna, and Essential Fish Habitat

The sources of information on RTE Species, aquatic organisms, terrestrial flora and fauna, and EFH are presented in Sections 4.5.1; 4.5.4; 4.5.5; and 4.5.6, respectively. The definitions for the impacts are defined as follows:

Major Impact – An action that would have drastic consequences for species population numbers, dynamics between multiple species, habitat area or important habitat attributes, or the existing physical environment within the Park. A species population, plant and animal communities, habitats, or natural system function would be permanently altered from normal levels under existing conditions, and species would likely be extirpated within the Park.

Moderate Impact – An action that would cause measurable effects on: (1) a relatively moderate number of individuals with a species population, (2) the existing dynamics between multiple species, (3) a relatively large habitat area or important habitat attributes, or (4) a large area of the natural physical environment within the Park. A species population, plant and animal communities, habitats, or natural system function might deviate from normal levels under existing conditions, but all species would remain indefinitely viable within the Park.

Minor Impact – An action that would affect a relatively small number of individuals of species population, or affect the existing physical environment within the Park. The change would require considerable scientific effort to measure, be limited to relatively few individuals of the populations, be very localized in area, and have barely perceptible consequences to the populations or natural system function.

Negligible Impact – An action that would affect very few individuals of species populations, or affect the existing physical environment within the Park. The change would be so small or localized that it would have no measurable or perceptible consequence to the populations or natural system function.

Intensity of Impact Definitions for Cultural Resources (Historical and Archeological Resources and Cultural Landscape)

The sources of information on cultural resources including historical and archeological resources and cultural landscape are presented in Sections 4.10. The National Historic Preservation Act requires agencies to take into account the impacts of their actions on the

properties listed or eligible for listing on NRHP. If an action could change in any way the characteristics that qualify the resource for inclusion on the National Register, it is considered to have an effect. No historic properties affected means that no cultural resources are impacted. No adverse effect means there could be an impact, but the effect would not be harmful to those characteristics that qualify the resource for inclusion on the National Register. Adverse effect means the impact could diminish the integrity of the characteristics that qualify the resource for the National Register. The properties of COLO are listed on NRHP. The definitions for the impacts are defined as follows:

Adverse Effect--Major Impact – The impact on cultural resources is substantial, noticeable, and permanent. The impact is severe or of exceptional benefit. For a National Register eligible or listed historical, cultural landscape, or archeological sites, the impact changes a character defining feature of that resource, diminishing the integrity of the resource to the extent that it is no longer eligible for listing in the National Register.

No Adverse Effect--Moderate Impact – The impact is measurable and perceptible. The impact changes one or more character defining features of a cultural resource but does not diminish the integrity of the resource to the extent that its National Register eligibility is jeopardized.

No Adverse Effect--Minor Impact – The impact on cultural resources is measurable or perceptible, but it is slight and localized within a relatively small area of a site or group of sites. The impact does not affect the character defining features of a NRHP eligible or listed site and would not have a permanent effect on the integrity of a site.

No Adverse Effect--Negligible Impact – The impact on cultural resources is at the lowest levels of detection, barely perceptible and not measurable.

5.3 Impairment of Park Resources and Values

In addition to determining the environmental consequences of the preferred and other alternatives, *NPS Management Policies* (NPS 2000) and Director's Order 12, *Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2001), require analysis of potential effects to determine if actions would impair park resources.

The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid or minimize to the greatest degree practicable adverse impacts on park resources and values. However, the laws do give NPS management discretion to allow impacts on park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given NPS this management discretion, that discretion is limited by the statutory requirement that NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including opportunities that otherwise would be present for the enjoyment of those resources or values. An impact on any park resource or value may constitute an impairment. However, an impact would be most likely to constitute an impairment if it affected a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the Park
- Key to the natural or cultural integrity of the Park or to opportunities for enjoyment of the Park, or
- Identified as a goal in the Park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the Park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the Park. A determination of impairment is made within each conclusion for each impact topic in this "Environmental Consequences" section.

5.4 Cumulative Impacts on Park Resources and Values

Cumulative impact assessment is the evaluation of the effects that other past, present, or reasonably foreseeable future actions, alternatives, or plans might have on the environment when considered in conjunction with the proposed impacts they could result from a certain proposed action, alternative, or plan. In other words, this assessment attempts to answer the question "What are the expected combined impacts of the alternatives under consideration in this EA (i.e., No Action Alternative, Alternative 1, and Alternative 2) and any past, present, or future actions, alternatives, or plans of other Federal or non-Federal agencies?"

Cumulative impacts can be either additive or interactive. Additive impacts are impacts of a similar nature that can collectively have a profound effect on a given resource due to the collective magnitude of the effect. Interactive impacts are impacts that accrue as a result of assorted similar or dissimilar actions, alternatives, or plans that tend to have similar effects relevant to the resource in question.

The major effort of the cumulative impact assessment is determining the "cumulative scenario" -- the past, present, and reasonably foreseeable future actions, alternatives, or plans in the project area and then applying this to the impacts already identified for each resource area, as presented in the following paragraphs.

Past actions. Past actions include the overall effort to develop Jamestown Island into the major historical tourist attraction it has become today. These actions include the construction and maintenance of the entire infrastructure -- the existing vehicular road system, the visitors center and parking facilities, pedestrian walkways, bridges, Colonial Parkway, roadside stops, and all other structures needed to serve the visiting populous. These actions undoubtedly had a substantial adverse impact on the gently balanced ecosystem of Jamestown Island over the years; however, the island has had decades to reach some level of balance with these impacts and,

therefore, they are not considered to be major concerns at this time. In this regard, it is not expected that the implementation of the two action alternatives (Alternatives 1 and 2), or the continuation of the No Action Alternative, would result in any substantial (measurable) cumulative impacts (either additive or interactive) to the resources of Jamestown Island.

Present and reasonably foreseeable future actions. Present and foreseeable future actions are discussed in Section 2.5, Relationship to Other Plans, Studies, and Projects. Those that are considered important to the assessment of cumulative impacts are summarized as follows:

(a) There are three shoreline protection projects in the study area that are currently being evaluated for stability and functionality -- two were constructed by NPS and one constructed by COE. The COE project is the 1,500-foot long concrete seawall along the southern edge of the Jamestown Island shoreline. The 2 NPS projects are the low revetment (later converted to a sill) that lies along the Glasshouse shore at the southwestern side of the study area and the 2,000-foot long stone revetment immediately downstream of the COE seawall. These three structures are being evaluated to determine the need for major rehabilitation, which could lead to some level of construction within the next few years. Although this would be a project of limited scope, there is still the potential for minor and short-term adverse impacts resulting from construction activities. As with other planned or proposed construction activities, the use of best construction and management practices, the adherence to management recommendations of DCR when working in areas adjacent to sensitive habitats, and the appropriate scheduling of construction activities will go a long way toward minimizing adverse impacts to important resources.

(b) As part of the JAMESTOWN PROJECT, NPS is considering several alternatives to prepare the historic area for 2007 and beyond, which includes the 400th Anniversary Celebration of the founding of Jamestown Island. Each alternative would involve the construction of numerous facilities and infrastructure to accommodate the magnitude of anticipated visitors. The proposed construction that is of concern with regard to this EA are the construction of as many as three boat piers and a new, pile-supported bridge connecting Neck of Land to the townsite. In order to mitigate the potential impacts that could result from the implementation of any of the considered alternatives, NPS has proposed strongly enforced construction sediment and erosion control plans and the implementation of speed limits on boat traffic to reduce boat wake. NPS also proposes to support the protection of eroding shorelines through a shoreline management plan. As these considered construction projects, including the shoreline management project, could conceivably proceed to construction within the next few years, the appropriate scheduling of construction activities would also help to minimize adverse impacts to important resources.

In addition to the above present and foreseeable future actions, there are actions that could potentially have cumulative impacts on water quality of the study area. Jamestown Island is located in a unique area between the James and York Rivers. More than 30 miles of shoreline of the island extend along these two rivers. In addition, approximately 24 miles of perennial streams and 30 miles of intermittent streams and drainage's flow through the Park. As most of the water bodies within the Park have major portions of their drainage basins upstream and outside of the Park boundaries, the quality of the water within the Park is influenced by those activities that take place in those drainage basins. Although no specific present or future plans in

these drainage basins are known at this time, any activities that have the potential to introduce oil, sediments, or chemicals into the drainage basins have the potential to result in either additive or interactive cumulative impacts to the resources of the Park.

A determination of cumulative impact is made within each conclusion for each impact topic in this "Environmental Consequences" section. It is expected that any such impact would occur from present and reasonably foreseeable future actions in the Park and vicinity.

5.5 Specific Impacts to Geology, Soils, and Topography

5.5.1 No Action Alternative

Under the No Action Alternative, the ongoing natural and historic geologic process of shoreline erosion at Jamestown Island will continue as it has since the formation of the Jamestown Island feature long ago. This is in compliance with NPS policies that mandate that natural shoreline processes be allowed to continue. However, the No Action Alternative, by allowing erosion to continue, would lead to the impairment of the Park's resources and values, as discussed in the next paragraph. Those extensive segments of shoreline not protected by existing shoreline structures (existing stone revetments and concrete seawalls) would continue to erode in response to this process leading to a recession in the water line and to a gradual change in the near shore topography due to the deposition of the eroded soils. Adding to the continued recession of the shoreline due to erosion is the continued recession of the shoreline in response to sea-level-rise (recession rate currently estimated between 0.1 to 0.16 foot per year). Small-scale, stopgap erosion control measures undertaken by NPS would tend to slow the rate of erosion; however, these actions would have a negligible impact on the current littoral drift mechanisms, which are major components of the geologic process. Therefore, the No Action Alternative, while not impacting the geologic process, would have a moderate adverse and long-term impact on the island's soil and topographic resources.

Should the impacts discussed in the previous paragraph be allowed to continue over the long-term future, they would constitute an impairment of the Park's resources and values. By not protecting the Park's topographic and soil resources, the No Action Alternative would (1) conflict with the purposes of the Park; (2) damage or alter resources or values that are key to the natural or cultural integrity of the Park or to opportunities for visitor enjoyment; and (3) conflict with a goal in the Park's general management plan or other planning documents.

There is the potential for cumulative adverse impacts to soils and topography resulting from the No Action Alternative in conjunction with proposed construction associated with the JAMESTOWN PROJECT (see description in Section 2.5.4). In particular, if the construction of boat piers and a new, pile-supported bridge were undertaken as part of that project, there would be a loss of the riparian buffer, which would contribute to erosion along the adjacent shorelines. There would also be a removal of trees, which would lead to the destabilization of soils. There is also the possibility that boat wake from the boat traffic to and from the piers would exacerbate the erosion problem. All of this would suggest that the construction of the boat piers and bridge would have at least a moderate, short-term adverse impact on the topography and soils of the affected shoreline. There is, therefore, a significant potential that the adverse impacts of the construction of the boat piers and bridge in combination with the moderate adverse and long-

term impact on the island's soil and topographic resources that would be associated with the No Action Alternative would have a major additive adverse and long-term impact on the topography and soils of the entire island. Plans by NPS to mitigate the impacts of the construction of the boat piers and bridge, if undertaken, through (1) strongly enforced construction sediment and erosion control plans, and (2) the implementation of speed limits on boat traffic to reduce boat wake would reduce these major adverse additive impacts. Based on these proposed mitigation measures, it is anticipated that cumulative adverse impacts would be moderate and long-term and extend over a greater portion of the island than with either the No Action Alternative or the construction of the boat piers and bridge alone.

5.5.2 Alternative 1 (Preferred)

Alternative 1 would greatly reduce or halt the geologic erosional process along the Jamestown Island shoreline resulting in a change in the erosion of soils and the topography at Jamestown Island. Modifying the shoreline topography and geologic erosional process would not be in compliance with NPS policies that mandate that natural shoreline processes be allowed to continue; however, Alternative 1 would prevent impairment to important park resources and values by protecting those resources and values from erosion. The near shore slope and high water line would be reconfigured in response to the grading and placement of stone and rubble to form the breakwaters and sills. Shoreline topography would be permanently modified as the breakwaters trap littoral material, moving both perpendicular and parallel to the shoreline, on their landward sides. Although the breakwater segments would be spaced in such a way as to minimize impacts to the shoreline topography and the movement of littoral material, the reduction in the amount of sediment in the littoral system would have a moderate and long-term adverse impact on the littoral drift mechanisms in the immediate vicinity of the study area. The possibility of minor short-term adverse impacts during and immediately after construction due to erosion as a result of shoreline adjustments would also exist. With regard to long-term projections of sea level rise, two factors are important in connection with the use of breakwaters and sills. First, these stone structures have been designed for a long project life with limited maintenance requirements. Secondly, the structures have been designed with a wide base to allow for the placement of additional stone and rubble in the future, as needed, in response to sea level rise at a fraction of the cost of initial construction.

The moderate and minor impacts discussed in the previous paragraph would not constitute an impairment of the Park's resources and values. Modifying the shoreline topography and geologic erosional process to protect the Park's topographic and soil resources would not (1) conflict with the purposes of the Park, (2) damage or alter resources or values that are key to the natural or cultural integrity of the Park or to opportunities for visitor enjoyment, or (3) conflict with a goal in the Park's general management plan or other planning documents.

As discussed for the No Action Alternative, there is the potential for cumulative adverse impacts to soils and topography resulting from the implementation of Alternative 1 in conjunction with proposed construction associated with the JAMESTOWN PROJECT. In particular, if the construction of boat piers and a new, pile-supported bridge were undertaken as part of that project, there would be (1) a loss of the riparian buffer, which would contribute to erosion along the adjacent shorelines; (2) a removal of trees, which would lead to the destabilization of soils; and (3) the possibility that boat wave from the boat traffic to and from

the piers would exacerbate the erosion problem. There is, therefore, a potential that the construction of the boat piers and bridge and the implementation of Alternative 1 would have an additive adverse impact on the topography and soils of the project area. However, NPS intends to mitigate the impacts of the construction of the boat piers, if undertaken, through strongly enforced construction sediment and erosion control plans and the implementation of speed limits on boat traffic to reduce boat wake. NPS also proposes to support the protection of eroding shorelines through a shoreline management plan. Based on these proposed mitigation measures, it is anticipated that cumulative adverse impacts would be minor and short-term.

5.5.3 Alternative 2

Alternative 2 would greatly reduce or halt the geologic erosional process along the Jamestown Island shoreline. As with Alternative 1, modifying the shoreline topography and geologic erosional process would not be in compliance with NPS policies that mandate that natural shoreline processes be allowed to continue; however, as was the case with Alternative 1, Alternative 2 would prevent impairment to important park resources and values by protecting those resources and values from erosion. The near shore slope and high water line would be reconfigured in response to the grading and filling of the shoreline and the construction of the bulkheads. Vertical bulkheads tend to reflect wave forces striking them leading to a deepening of the water immediately in front of the bulkheads, resulting in a permanent modification to the shoreline topography. Bulkheads would also permanently contain sediment located landward of the bulkheads, thus, reducing the amount of material in the littoral system. This would be expected to have a moderate and long-term adverse impact on the littoral drift mechanisms in the immediate vicinity of the study area. The possibility of minor short-term adverse impacts during and immediately after construction due to erosion as a result of shoreline adjustments also exists. With regard to long-term projections of sea level rise, two factors are important in connection with the use of bulkheads. First, bulkheads, whether constructed of timber or steel, would have a relatively short project life and would require replacement or major rehabilitation in 20 to 25 years after construction. Secondly, unlike breakwaters, bulkheads cannot be designed to allow for modification in response to sea level rise. To address sea level rise, the top elevation of the bulkheads would be increased at such time as they undergo replacement and/or major rehabilitation, which would represent a major financial investment of similar magnitude to the cost of initial construction.

The moderate and minor impacts discussed in the previous paragraph would not constitute an impairment of the Park's resources and values. Modifying the shoreline topography and geologic erosional process would not (1) conflict with the purposes of the Park; (2) damage or alter resources or values that are key to the natural or cultural integrity of the Park or to opportunities for visitor enjoyment; or (3) conflict with a goal in the Park's general management plan or other planning documents.

As with Alternative 1, there is the potential for cumulative adverse (additive) impacts to soils and topography resulting from the implementation of Alternative 2 in conjunction with proposed construction associated with the JAMESTOWN PROJECT (i.e., construction of boat piers and new, pile-supported bridge). Based on the proposed mitigation measures by NPS in connection with the boat piers and bridge, it is anticipated that cumulative adverse impacts would be minor and short-term.

5.6 Specific Impacts to Rare, Threatened, and Endangered (RTE) Species

5.6.1 No Action Alternative

The continued and uncontrolled shoreline erosion of Jamestown Island as would occur with the No Action Alternative would lead to the continued loss of areas, which provide or have the potential to provide breeding, nesting, and foraging habitat for bald eagles and other RTE species. This affect would be one of a long-term and moderate adverse impact on the RTE species. However, the ultimate loss of habitat would be reduced somewhat by the small, stopgap erosion control measures that would eventually be implemented by the NPS. The adherence to DCR and USFWS recommendations regarding the bald eagle as detailed earlier in Section 3.4 entitled "Mitigation—Avoidance, Minimization and Compensation" would further reduce the impact to the RTE species. The resulting affect would thus be a long-term and minor to moderate adverse impact on the RTE species, which is not considered to constitute an impairment of these park resources and values. The level of impact would not greatly affect the natural integrity of the Park or reduce opportunities for visitor enjoyment. No cumulative adverse impacts would be anticipated from the implementation of this alternative.

5.6.2 Alternative 1 (preferred)

Alternative 1 would not adversely affect the bald eagle, the great blue heron, or other identified RTE species. The construction of Alternative 1 structures would consist of the placement of large quantities of quarry stone in the offshore zone from water-based equipment (i.e., barge and crane with clamshell bucket). The resultant levels of noise and disturbances would be much lower than those levels with comparable land-based equipment. The noise and disturbances would be localized and short-term as it is expected that the RTE species would avoid foraging in the areas where construction was underway, but would return once construction was completed. In addition, the recommendations of DCR and the USFWS regarding the bald eagle and the great blue heron as detailed earlier in Section 3.4 would be adhered to during any construction activities in the vicinity of the bald eagle, great blue heron, great egret, and least bittern nesting areas. The recommendations would require that the construction of those breakwaters/sills that would be located within 440 yards of any bald eagle nest would take place during the period July 16 through November 14. Although no great egret or least bittern nests have been identified in the project area, the same construction restriction would be adopted in the event that nests for any of these species are found prior to and during construction. The specified construction dates indicated correspond with the breeding and nesting periods for these species. For the great blue heron, the recommendations would require that the construction of those breakwaters/sills that would be located within 300 yards of a great blue heron nest would take place between August 1 and February 28, which corresponds with the heron's breeding and nesting period.

Direct beneficial impacts in connection with Alternative 1 would accrue to the significant maritime scrub community and associated rare and threatened species identified by DCR by preventing further erosion of shoreline, which potentially could be utilized as habitat by nesting bald eagles and other species of plants and animals. Therefore, moderate, long-term beneficial impacts to threatened species would be anticipated with the implementation of Alternative 1. No impairment of park resources and values would occur as a result of the alternative as the natural integrity of the Park would remain and the opportunities for visitor enjoyment would not be

lessened. In addition, no cumulative impacts would be expected to result from the implementation of this alternative.

5.6.3 Alternative 2

The construction of Alternative 2 structures (bulkheads) in the vicinity of identified bald eagle nests, in general, would be expected to have an adverse impact on this endangered species due to the noise and disturbance resulting from land-based construction activities (i.e., pile driving equipment, vehicle traffic, movement of construction workers, etc.). The management recommendations identified for Alternative 1 would be adhered to during any construction activities in the vicinity of the bald eagle nesting areas. Additionally, the recommendations would also be adopted for the great egret and the least bittern in the event that nesting areas are identified for these species prior to and during construction. The recommendations would require that the construction of those bulkheads that would be located within a radius of 440 yards of any bald eagle, great egret, or least bittern nest, would take place during the period July 16 through November 14th. Similarly, construction at sites located within 300 yards of any great blue heron nest (none identified at this time) would take place between August 1st and February 28. These dates correspond with the breeding and nesting periods for these species. Because construction of Alternative 2 structures would take place mainly from the landward side of the shoreline, which would create more potential for disturbance (noise and activity), adherence to the above recommendations would not completely mitigate the adverse impacts to these species. Alternative 2 would, therefore, be expected to have a moderate and short-term adverse impact on the bald eagles, great blue herons, great egret, least bitterns, or their habitats. As with Alternative 1, moderate, long-term beneficial impacts to rare and threatened species would be anticipated with the implementation of Alternative 2, as areas protected from continued erosion would provide habitat for rare and threatened species. This beneficial impact would tend to offset the adverse impact. No impairment of park resources and values would occur as a result of the alternative as the natural integrity of the Park would remain and the opportunities for visitor enjoyment would not be lessened. In addition, no cumulative impacts would be expected to result from the implementation of this alternative.

5.7 Specific Impacts to Submerged Aquatic Vegetation (SAV)

5.7.1 No Action Alternative

As indicated earlier in Section 4.5.2, there is a very limited distribution of SAV's in and around Jamestown Island. The only identified area of SAV's is the small fringing bed located at the mouth of Mill Creek, north of and across the Thorofare from Jamestown Island (see Figure 19). The continued shoreline erosion that is occurring under the No Action Alternative is not having an adverse impact on the small bed of SAV's at Mill Creek and would not impact other existing SAV's because none exist.

The general lack of SAV's in this portion of the James River is very likely due to the high concentrations of suspended sediments, which limits light penetration into the water column necessary for SAV establishment. The continued shoreline erosion (under the No Action Alternative) is releasing eroded soils into the water column, which are contributing to the already high sediment load and, thus, helping to promote water quality conditions that would not support SAV establishment. Therefore, the resultant impacts of the No Action Alternative with regard to

SAV's would be the adverse impacts of not promoting water quality conditions that would support SAV reestablishment. These adverse impacts would be considered moderate and long-term.

The moderate impact to the reestablishment of SAV would not constitute an impairment of the Park's resources and values. The failure of SAV to reestablish in and around the island due to shoreline erosion would not (1) conflict with the purposes of the Park; (2) damage or alter resources or values that are key to the natural or cultural integrity of the Park or to opportunities for visitor enjoyment; or (3) conflict with a goal in the Park's general management plan or other planning documents.

There is the potential for cumulative adverse (additive) impacts to the reestablishment of SAV's resulting from the implementation of the No Action Alternative in conjunction with proposed construction associated with the JAMESTOWN PROJECT. The construction of boat piers and a new, pile-supported bridge would release sediments in the waters surrounding Jamestown Island that would add to the existing high suspended sediment load. Based on the proposed mitigation measures by NPS in connection with the boat piers and bridge that would control soil erosion during construction and reduce boat wake-generated erosion, it is anticipated that these adverse impacts from the JAMESTOWN PROJECT would be minor and short-term. Therefore, the cumulative impacts would still be considered moderate and long-term, primarily as a result of the No Action Alternative.

5.7.2 Alternative 1 (Preferred)

As there is no construction proposed in the vicinity of the small fringing SAV bed at the mouth of Mill Creek, no adverse impacts would be anticipated with Alternative 1. Shoreline erosion control, in general, is expected to be beneficial to the reestablishment of SAV's in and around Jamestown Island. Suspended sediment hinders the penetration of light in the water column, which limits SAV distribution. The proposed construction of breakwaters and offshore sills at Jamestown Island would reduce the level and extent of suspended solids entering the water column and would provide water quality conditions more conducive to SAV reestablishment and growth. This reduction in suspended solids would outweigh any minor and short-term adverse impacts that would be associated with sedimentation resulting from construction activities. The resultant beneficial impacts to SAV reestablishment would be considered moderate and long-term. No impairment to park resources and values would occur under the alternative for the same reasons as indicated under the No Action Alternative. In addition, no cumulative adverse impacts would be expected to result from the implementation of this alternative in the same general timeframe as the proposed boat pier and bridge construction under the JAMESTOWN PROJECT. As discussed under the No Action Alternative above, the mitigation measures proposed by NPS would reduce any adverse impacts from the JAMESTOWN PROJECT to minor and short-term.

5.7.3 Alternative 2

As with Alternative 1, the proposed construction of vertical sheet-pile bulkheads at Jamestown Island would reduce the suspended solids entering the water column and would provide water quality conditions more conducive to SAV reestablishment and growth. As with Alternative 1, this reduction in suspended solids would more than outweigh any minor and short-

term adverse impacts that would be associated with sedimentation resulting from construction activities. The resultant beneficial impacts to SAV reestablishment would be considered moderate and long-term. For the same reasons as discussed under Alternative 1, no impairment to park resources and values would occur, and no cumulative impacts would be expected to result from the implementation of Alternative 2 in conjunction with proposed boat pier and bridge construction associated with the JAMESTOWN PROJECT.

5.8 Specific Impacts to Wetlands

5.8.1 No Action Alternative

Currently, wind-wave erosion (on the James River and the Thorofare) and boat wake (on Back River) results in the loss of vegetated wetlands along much of the Jamestown Island shoreline. The continued erosion of the Jamestown Island shoreline, as is currently occurring under the No Action Alternative, would continue to result in the loss of existing vegetated wetlands. Small-scope stopgap erosion control measures that would eventually be undertaken by NPS in response to the potential loss of important known archeological sites would tend to reduce this loss of wetlands. The resultant adverse impacts to the existing vegetated wetlands would be considered moderate and long-term, with a tendency toward minor and long-term as stopgap erosion control measures are implemented. These impacts would not constitute an impairment of the Park's resources and values. The loss of vegetated wetlands due to shoreline erosion would not (1) conflict with the purposes of the Park; (2) damage or alter resources or values that are key to the natural or cultural integrity of the Park or to opportunities for visitor enjoyment; or (3) conflict with a goal in the Park's general management plan or other planning documents. It is possible that construction activities undertaken in connection with the JAMESTOWN PROJECT could result in cumulative impacts to the wetlands with this alternative. However, the timing of all construction activities would greatly reduce this potential.

5.8.2 Alternative 1 (Preferred)

Nonvegetated estuarine intertidal and subtidal habitats would be affected to varying degrees with the implementation of Alternative 1. These habitat zones will be adversely impacted as a result of the fill required for the vegetative fringe (in the intertidal zone) of approximately 2.66 acres and the placement of rock structures (in the subtidal zone) of approximately 3.06 acres. All of the structures will provide protection to existing vegetated wetland areas as well as increase the acreage of estuarine intertidal emergent wetland habitat (salt marsh). Currently, wind-wave erosion (on the James River and the Thorofare) and boat wake (on Back River) results in the loss of vegetated wetlands along much of the Jamestown Island shoreline. Construction of sills, breakwaters, and accompanying fill will not only protect existing vegetated wetlands but will also provide intertidal areas for establishment of saltmarsh wetland habitat along the water's edge. Table 6 presents a break down of wetland impacts as well as the proposed intertidal emergent wetland acreages.

**Table 6. Wetland and Deepwater Habitat Impacts
Related to Shoreline Protection Plan**

Location Plate (Appendix D)	Impacted (ft ²)		Establish (ft ²) (proposed)	
	E2USN* (intertidal wetland)	E1UB2* (deepwater habitat)	E2RS2* (intertidal wetland)	E2EM1* (intertidal wetland)
I**	55,100	37,700	14,500	58,000
II	17,050	33,220	7,550	13,980
III	13,770	28,850	7,650	19,200
IV	23,990	27,060	7,275	20,850
V	6,000	6,600	1,500	4,575
Total	115,910	133,430	38,475	116,605
Total (acres)	2.66	3.06	0.88	2.68

*(Cowardin, et al. 1979) Wetland Type or Deepwater Habitat Type:

E2USN = Estuarine, Intertidal, Unconsolidated Shore, Regularly Flooded Wetland

E1UB2 = Estuarine, Subtidal, Unconsolidated Bottom, Sand (deepwater habitat)

E2EM1 = Estuarine, Intertidal, Emergent Wetland, Persistent

E2RS2 = Estuarine, Intertidal, Rocky Shore, Rubble

** Erosion of the shoreline located on Plate I is primarily caused by boat wake.

Intertidal wetland areas (E2USN) impacted by the fill will be converted to emergent persistent intertidal wetlands (E2EM1). Compensation for these same intertidal habitat areas will be the structure rocks (E2RS2, 0.88 acres) that provide substrate and shelter for sessile species and the establishment of emergent persistent intertidal wetlands (E2EM1, 2.68 acres) landward of the structures. The compensation wetlands will be created from existing estuarine subtidal (i.e., nonwetland) habitat. They are, therefore, new wetland habitat above and beyond the intertidal wetland habitat (E2USN) that currently exists. Conversion of existing intertidal unconsolidated shore wetland (E2USN) to intertidal emergent wetland (E2EM1), as proposed in this project, is not counted as part of the compensation acreage.

There will be a net beneficial impact (moderate and long-term) to vegetated wetlands with implementation of the proposed Plan and a net adverse impact (moderate and long-term) to unvegetated intertidal and subtidal habitats. A mitigation plan is presented that provides for establishment of 3.56 acres of new wetland habitat to compensate for the loss or alteration of 2.66 acres of wetlands (a compensation ratio of 1.34:1). While there may be some minor increases in erosion between the breakwater structures, where no sill is proposed, the long-term benefits of erosion protection to existing wetlands and the creation of the proposed wetlands far outweigh these effects. These impacts would not constitute an impairment of park resources and values as the natural integrity of the Park and the opportunities for visitor enjoyment would continue. It is possible that construction activities undertaken in connection with the JAMESTOWN PROJECT could result in cumulative impacts to the unvegetated wetlands with this alternative. However, the timing of all construction activities would greatly reduce this potential.

5.8.3 Alternative 2

The implementation of Alternative 2 along the Jamestown Island shoreline would result in a net adverse impact to vegetated wetlands as the result of grading and filling associated with site preparation prior to the placement of the bulkhead. There would also be a net adverse (moderate), long-term impact to unvegetated intertidal and subtidal habitats as a result of the site preparation activities. Unprotected wetland areas located between sections of bulkheads could eventually be damaged or destroyed as continued erosion could flank the ends of the bulkheads. However, these impacts would not constitute an impairment of the Park's resources and values. The loss of wetlands due to construction activities and placement of bulkheads would not (1) conflict with the purposes of the Park; (2) damage or alter resources or values that are key to the natural or cultural integrity of the Park or to opportunities for visitor enjoyment; or (3) conflict with a goal in the Park's general management plan or other planning documents. It is possible that construction activities undertaken in connection with the JAMESTOWN PROJECT could result in cumulative impacts to the unvegetated wetlands with this alternative. However, the timing of all construction activities would greatly reduce this potential.

5.9 Specific Impacts to Aquatic Organisms

5.9.1 No Action Alternative

The continued erosion of the Jamestown Island shoreline as would occur under the No Action Alternative would have no measurable impact on the existing sandy river bottom substrate surrounding the island. Those aquatic organisms that currently inhabit the study area as presented in Section 5.9 of this EA will continue to do so in the foreseeable future. The eventual construction of stopgap erosion control measures by NPS could result in adverse impacts to the surrounding aquatic organisms due to small, temporary increases in turbidity as a result of limited construction activities. Increased turbidity has the potential to lower the level of DO available to aquatic organisms and to reduce light penetration, which affect primary productivity and may inhibit zooplankton-feeding activity within the turbid plume. These adverse impacts would be negligible and short-term due to the small scale of the construction and the dynamic nature of the James River in the vicinity of the study area shoreline. No impairment of park resources and value would occur as a result of the alternative. No cumulative impacts would be anticipated with this alternative.

5.9.2 Alternative 1 (Preferred)

General Information. The ecological changes resulting from breakwater construction was assessed in a study conducted by COE (COE, 1990) between the period December 1988 and June 1990. The study looked at the changes occurring at four locations on the James River, where erosion control structures (breakwaters) had recently been constructed, and at two older breakwater sites on the York River, where more established conditions existed. Two of the locations, Chippokes and Hog Island, are located on the south side of the James River directly across the river from Jamestown Island. The observations and conclusions of this study were as follows:

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- *"Following placement, sessile organisms rapidly and heavily colonize intertidal rock surfaces. Colonization is greatest within the first year. As the coverage approaches 100%, the rate of colonization must, of course, decline.*
- *"Juvenile fish species appear to congregate more between individual breakwater structures (cove areas) than they do directly adjacent to the breakwater structures. The attraction may be attributed to be the relatively higher quantity of algae (e.g. Ulva, Enteromorpha, Cladophora) and disattached marsh and submerged aquatic vegetation (e.g. Spartina, Zostera) and attendant microfauna, which accumulates in these areas.*
- *"Most of the fish captured were juveniles; all were less than 4 inches in length. Larger fish have a greater escape capability.*
- *"Benthic organism species and numbers seem to be dictated more by bottom sediment type than by proximity to breakwater structures. Coarser grained bottoms, consisting of gravel and shell material, support little if any infaunal species, while bottoms ranging between clayey-silt and silty-sand are the most productive.*
- *"Rock breakwaters offer a substrate, which does not naturally occur at these reaches in the James or York Rivers. Combined with the flora and fauna, which associate with these structures, the breakwaters provide a sheltered and stable habitat favorable for breeding, larval development, and juvenile growth of fish species, which provide food for fish species of higher trophic levels. Even if placed as freestanding structures, not necessarily for the purpose of combating shoreline erosion, the ecological contributions of rubble mound structures in the James and York Rivers would have obvious economic benefit to commercial and recreational fisheries."*

Specific to Alternative 1. Breakwater and sill construction and beach nourishment (including dredging and fill operations) would result in increased turbidity and substrate changes that have the potential to adversely affect the aquatic organisms of the study area.

As indicated under the No Action Alternative, increased turbidity has the potential to lower the level of DO available to aquatic organisms and to reduce light penetration, which affect primary productivity and may inhibit zooplankton-feeding activity within the turbid plume. In addition, the benthic organisms in the area fringing the borrow site or sites for the beach nourishment material could also be impacted by light burial (Hobbs, et al, 1982). Naturally high densities of phytoplankton, zooplankton, and larval organisms found in coastal waters are not significantly impacted by dredging activities. Due to the dynamic nature of the James River in the vicinity of the study area shoreline, the adverse impacts to the benthic species of the marine ecosystem from turbidity would be local and temporary (minor and short-term) and definitely not permanent (US Department of Interior, *unpublished*).

The effect of discharge is minimal when material placed on the shoreline is similar (in grain size and other physical characteristics) to that which already comprises the shoreline and

intertidal bottom. This would be the case for most fill material used at the shoreline management sites. The placement of material between the breakwaters/sills and the shoreline would result in some loss of bottom dwelling organisms by burial. However, liquefaction of indigenous sediments often occurs during deposition, which could allow for motile species (amphipods, decapods, etc.) to escape burial. Near shore turbidity impacts are directly related to the quantity of fines (silt and clay) in the nourishment material. It is assumed that the beach fill would consist of mostly coarse-grained material, of similar grain size and composition of indigenous river sands; therefore, turbidity impacts would be short-term, minor, and spatially limited to the vicinity of the fill placement.

A permanent substrate change from sandy river bottom to hard rock would occur in the vicinity of the breakwaters/sills and, therefore, would have irreversible impacts on these areas. The adverse effects would only impact those benthic areas that are under the footprint of the breakwaters. Several studies of ecosystem changes due to breakwater/jetty construction (Van Dolah, R.F., et al., 1987; Manny, B.A., et al., 1985) have reported that there is a net biological productivity increase due to the presence of hard substrate. Hard substrate is a limited habitat along the mid-Atlantic coast; therefore, rapid colonization is expected by opportunistic species. cursory examination of existing nearby jetties and breakwaters indicate that they support sessile species such as oysters, mussels, barnacles, anemones, hydroids, bryozoans, and algae. Other species that utilize breakwaters and jetties are those found nestled in-between the boulders themselves, which provide refuge from predators and/or foraging areas. Such species include the blue crab and juvenile fishes. The scientific community in general, and the several studies referenced earlier in this EA, conclude that a net beneficial increase in species abundance and species diversity would occur as a result of this habitat substrate change. Although adverse short-term impacts would occur to some benthic (i.e., bottom dwelling) organisms associated with burial, it is anticipated that net long-term benefits (moderate) would accrue to aquatic organisms due to this habitat substrate change.

It is anticipated that all levels of the food chain would benefit from a new habitat type and subsequent colonization by a diversity of species to the study areas. Avian fauna would likely utilize the exposed portions of the breakwaters as resting areas and utilize surrounding waters as a food source. It is common to see coastal birds (i.e., terns, egrets, skimmers, and gulls) feed adjacent to rock structures in the Mid-Atlantic region. It is anticipated that net moderate and long-term beneficial impacts would accrue to the biota in the study area with the placement of these structures.

The proposed action for the Glasshouse parking overlook (See Powhatan Creek – Site 1, Plate 1) would be to build out the bank with fill and regrade the fill to a more stable slope and install a rock revetment at the base of the bank. No wetlands would be impacted with this activity. The temporary increase in turbidity due to the construction associated with the grading and rock revetment would have a minor and short-term adverse impact on benthic species of the marine ecosystem.

None of the impacts to aquatic organisms that would occur under this alternative would constitute an impairment of park resources and values as the natural integrity of the Park and the

opportunities for visitor enjoyment would continue.. No cumulative impacts would be anticipated with this alternative.

5.9.3 Alternative 2

As with Alternative 1, Alternative 2 would result in a permanent change in substrate from a sandy river bottom to hard rock in those areas of shoreline where the sections of bulkheads are constructed; however, the substrate change would be much less extensive than would occur with Alternative 1, as most of the construction for Alternative 2 would take place at or near the water line, while construction activities for Alternative 1 would take place further offshore (in the near shore zone). This substrate change would be expected to result in a net beneficial increase in species abundance and diversity. This long-term beneficial impact would essentially compensate for the adverse short-term impact to benthic organisms located in the footprint of the bulkheads.

The proposed action for the Glasshouse parking overlook (See Powhatan Creek – Site 1, Plate 1), as with Alternative 1, would be to build out the bank with fill and regrade the fill to a more stable slope and installing a rock revetment at the base of the bank. This action would require the removal of some trees and shrubs, which are now falling into the creek because of bank erosion. There would be some terrestrial habitat and vegetation lost as a result of this grading. No wetlands would be impacted with this activity. The temporary increase in turbidity due to the construction associated with the grading and rock revetment would have a minor and short-term adverse impact on benthic species of the marine ecosystem.

None of the impacts to aquatic organisms in Alternative 2 would constitute an impairment of park resources and values. The natural integrity of the Park and the opportunities for visitor enjoyment would continue. No cumulative impacts would be anticipated with this alternative.

5.10 Specific Impacts to Terrestrial Flora and Fauna

5.10.1 No Action Alternative

In general, the No Action Alternative would have no impact on the terrestrial flora of Jamestown Island, as the project area is located in the immediate shoreline area of the Park some distance from the forested and open areas in the upland portions of the Park. Similarly, the terrestrial fauna that inhabit the forested and open areas would not be adversely impacted, as they would have the mobility to move away from the shoreline and back into the forested and open areas. One possible exception to this is the Glasshouse parking overlook (See Powhatan Creek – Site 1, Plate 1) area where some trees and shrubs are currently falling into the water due to erosion. The continued erosion would have a long-term and major impact on the trees and habitat located in this area. However, it would be very likely that at some point in the future NPS would choose to fund and implement a stopgap erosion control measure at this location, thereby eliminating the impact. The duration and intensity of the adverse impact to the trees and habitat at this location under the No Action Alternative, therefore, would be dependent on the actions of NPS. With regard to invasive plant species, while common reed grass (also known as phragmites) is not currently considered a problem at Jamestown Island, it is possible that continued erosion and resultant increase in sedimentation could provide habitat that would encourage the growth and spread of this destructive weed. Under the most likely future

condition, the No Action Alternative would not constitute impairment to park resources as the natural integrity of the Park and the opportunities for visitor enjoyment would continue. No cumulative impacts would be anticipated with this alternative.

5.10.2 Alternative 1 (Preferred)

Alternative 1 would be located in the immediate offshore area of the Park and would have the beneficial impact of protecting the forested and open land areas of the Park that would be susceptible to erosion. This beneficial impact would be considered long-term and moderate. Protecting the shoreline and reducing sedimentation would also discourage the growth and spread of phragmites in the project area. The strict adherence to sediment and erosion control during construction and the proper handling of vegetative plantings would ensure protection from this invasive species of plant. In the Glasshouse parking overlook (See Powhatan Creek – Site 1, Plate 1) area, where some trees and shrubs are currently falling into the water due to erosion, Alternative 1 would provide for the regrading of the bank to a more stable slope and the installation of a rock revetment at the base of the bank. This action would require the removal of some trees and shrubs, and some terrestrial habitat and vegetation would be lost as a result of this grading. However, this moderate and short-term adverse impact over a limited area would be outweighed by the moderate and long-term beneficial impact of protecting the trees, scrubs, and terrestrial habitat over a much larger area. This action would not constitute impairment to park resources as the natural integrity of the Park and the opportunities for visitor enjoyment would continue. No cumulative impacts would be anticipated with this alternative.

5.10.3 Alternative 2

Alternative 2 would be located directly along the shoreline area of the Park and would have the beneficial impact of protecting the forested and open land areas of the Park that would be susceptible to erosion. This beneficial impact would be considered long-term and moderate. However, in several construction areas some trees and scrubs would be lost due to the actual placement of the bulkhead sections or the grading that would be required in some areas in preparation for the placement of bulkhead sections. This adverse impact would be long-term and moderate, but would, in general, be outweighed by the long-term and moderate beneficial impact of protecting the trees and scrubs and the terrestrial habitat. As with Alternative 1, protecting the shoreline and reducing sedimentation would also discourage the growth and spread of phragmites in the project area. The strict adherence to sediment and erosion control during construction would ensure protection from this invasive species of plant. As with Alternative 1, in the Glasshouse parking overlook (See Powhatan Creek – Site 1, Plate 1) area, where some trees and shrubs are currently falling into the water due to erosion, Alternative 2 would provide for the regrading of the bank to a more stable slope and the installation of a rock revetment at the base of the bank. This action would require the removal of some trees and shrubs, and some terrestrial habitat and vegetation would be lost as a result of this grading. However, this moderate and short-term adverse impact over a limited area would also be outweighed by the moderate and long-term beneficial impact of protecting the trees, scrubs, and terrestrial habitat over a much larger area. This action would not constitute impairment to park resources. The natural integrity of the Park and the opportunities for visitor enjoyment would continue. No cumulative impacts would be anticipated with this alternative.

5.11 Specific Impacts to Essential Fish Habitat (EFH)

5.11.1 No Action Alternative

As the No Action Alternative would not result in any changes in impacts to EFH, no assessment is determined to be required. No cumulative impacts would be anticipated in conjunction with this alternative. No impairment of park resources and values would occur.

5.11.2 Alternative 1 (Preferred)

Appendix C describes the species and at which life stage EFH has been determined by the NMFS in the vicinity of the project. No Habitat Areas of Particular Concern (HAPC's) are present within the project area. HAPC's are described in regulations as subsets of EFH, which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmental stressed area. Potential adverse effects to EFH species include increased turbidity, direct encounters with construction equipment, and the physical placement of breakwater/sills boulders and rocks, as well as sandy fill material. Increased turbidity has the potential to lower DO. Placement of breakwater/sill rocks and boulders could affect fish throughout the water column by direct encounters with falling boulders, but most fish would be able to avoid these encounters.

The Department of the Army's views regarding the effects of Alternative 1 on EFH is that adverse effects on EFH species due to construction would be short-term and minor. It is highly unlikely that any adverse effects would be caused from physical placement of the breakwater/sill structures due to the nektonic mobility of the EFH designated species. In fact, study results from Murrells Inlet, South Carolina, found that the quarry stone jetties attracted species that are normally associated with reef structures, species that are commonly found around estuarine inlets, and species that seasonally migrate along the coast (Van Dolah, R.F., et al., 1987). The Murrells Inlet study also noted increased recreational fishing around the inlet jetties in which anglers sought red drum, flounder, spot, bluefish, king mackerel, black sea bass, and smooth dogfish, all of which are similar species found in the Jamestown Island study area. A study of breakwaters at West Harbor, Ohio, reported increases in the number of fish eggs and larvae on and near breakwaters after construction (Manny, B.A., et al., 1985). The West Harbor study also concluded that high levels of turbidity and suspended particulate matter at the time of breakwater construction and channel dredging had no lasting detrimental effects in biota near the mouth of West Harbor. Similar effects of these two studies are expected in the Jamestown Island study area.

In view of the above assessment of the effects of Alternative 1 on EFH, it is determined that mitigation is not applicable. No cumulative impacts would be anticipated in conjunction with this alternative. Any impacts to EFH species that would occur as a result of the alternative would not constitute an impairment of park resources and values.

5.11.3 Alternative 2

As indicated for Alternative 1, there are no HAPC's present within the project area. Potential adverse effects to EFH species include increased turbidity, direct encounters with construction equipment, and the physical placement of bulkheads, and sandy fill material. It is

very unlikely that the placement of the bulkheads would affect fish throughout the water column due to the location of the bulkheads along the shoreline.

The Department of the Army's views regarding the effects of Alternative 2 on EFH is that adverse effects on EFH species due to construction would be short-term and minor. It is highly unlikely that any adverse effects would be caused from physical placement of the bulkheads due to the location of the bulkheads at or near the high water line. Unlike Alternative 1, it is not expected that Alternative 2 would attract any considerable level the certain species of fish found in the Jamestown Island study area. High levels of turbidity and suspended particulate matter at the time of bulkhead construction are not expected to have any lasting detrimental effects on biota in the area.

In view of the above assessment of the effects of Alternative 2 on EFH, it is determined that mitigation is not applicable. No cumulative impacts would be anticipated in conjunction with this alternative. Any impacts to EFH species that occur as a result of the alternative would not constitute an impairment of park resources and values.

5.12 Specific Impacts to Air Quality

5.12.1 No Action Alternative

The continuation of erosion at Jamestown Island, as is presently occurring under the No Action Alternative, has no impact on the existing air quality of the area. The implementation of stopgap erosion control measures by NPS would have a very minor and short-term adverse impact on air quality as the result of construction activities. This is basically referring to the release of the by-products of the combustion of petroleum fuels into the air (i.e., generators, compressors, other construction equipment). Coordination with the local office of VDEQ indicates that a conformity determination would not be required for the proposed stopgap construction. The minor and short-term impacts of the No Action Alternative on air quality would not constitute an impairment of park resources and values. No cumulative impacts would be anticipated.

5.12.2 Alternative 1 (Preferred)

The proposed construction activities of Alternative 1 have been evaluated under the Clean Air Act (CAA) Amendments of 1990. The conformity determination considered direct and indirect effects and has concluded that the air emissions relevant to the proposed construction of shoreline protection features at Jamestown Island would be in compliance with the NAAQ's in place for the Hampton Roads Air Quality Maintenance Area. The action would comply with Section 176 © (1) of the CAA Amendments of 1990. Alternative 1 would have a very minor and short-term adverse impact on local air quality as the result of construction activities (combustion by-products), which would not constitute an impairment of park resources and values. No cumulative impacts would be anticipated.

5.12.3 Alternative 2

As with Alternative 1, the air emissions relevant to the construction of bulkheads at Jamestown Island as proposed under Alternative 2 would be in compliance with the NAAQ's in place for the Hampton Roads Air Quality Maintenance Area. Alternative 2 would have a very

minor and short-term adverse impact on local air quality as the result of construction activities (combustion by-products), which would not constitute an impairment of park resources and values. No cumulative impacts would be anticipated.

5.13 Specific Impacts on Water Quality

5.13.1 No Action Alternative

The No Action Alternative involves no placement of fill or other construction materials in the waters surrounding Jamestown Island and would, therefore, leave the near shore water quality unchanged from its current quality condition. However, continued erosion of the shoreline, as is presently occurring under the No Action Alternative, continues to result in the natural release of, and resuspension of, solids into the water column. Generally, the volumes of sediment involved are relatively low, and the organisms inhabiting the waters and bottom areas near the island generally remain undisturbed, generally indicative of a negligible, long-term adverse impact on near shore water adjacent to Jamestown Island. The continued erosion is also inconsistent with CBPA goals and incentives to reduce soil erosion and control sedimentation to protect water quality. The implementation of stopgap erosion control measures over time would generally indicate a minor, long-term beneficial impact on near shore water adjacent to Jamestown Island. While a step in the right direction, these measures would only have limited agreement with the CBPA goals and incentives. The minor, long-term beneficial impacts would not constitute an impairment of park resources and values. Any planned or unplanned activities in the drainage areas upstream of the Park that might involve the release of oil, sediment, or chemicals have the potential to result in cumulative impacts to water quality with this alternative. Similarly, construction activities that would be associated with the JAMESTOWN PROJECT have the potential to result in cumulative impacts to water quality. The appropriate phasing of all construction activities and the adherence to sound erosion control practices would greatly reduce this potential.

5.13.2 Alternative 1 (Preferred)

Placement of rock breakwater, sill structures, and fill material may result in the resuspension of solids into the water column as is now occurring naturally as the island shoreline erodes and sediments move into the water column. Construction of the shoreline stabilization features may cause some temporary turbidity increases, but the long-term stabilization of the shoreline would have a beneficial effect on water quality. Animals and plants common to the James River and its naturally variable environments are well adapted to changing sediment conditions and can withstand the temporary stresses associated with construction activities. Additionally, although it is difficult to quantify, the presence of construction equipment on-site (construction would take place from water-based equipment) would create the potential of limited contamination of near shore waters by petroleum products. Alternative 1 would, thus, have a moderate, short-term adverse impact on near shore water quality in the waters adjacent to Jamestown Island due to construction activities that would be more than offset by a moderate, long-term beneficial impact due to erosion control. Alternative 1 is also consistent with the CBPA goals and incentives to reduce soil erosion and sedimentation to protect water quality. It would be coordinated with the locality and the Chesapeake Bay Local Assistance Department (Virginia state agency) prior to its implementation. None of the identified impacts associated with Alternative 1 would constitute an impairment of park resources and values. Impacts of

construction activities on water quality would not (1) conflict with the purposes of the Park, (2) damage or alter resources or values that are key to the natural or cultural integrity of the Park or to opportunities for visitor enjoyment, or (3) conflict with a goal in the Park's general management plan or other planning documents. Any planned or unplanned activities in the drainage areas upstream of the Park that might involve the release of oil, sediment, or chemicals have the potential to result in cumulative impacts to water quality with this alternative. Similarly, construction activities that would be associated with the JAMESTOWN PROJECT have the potential to result in cumulative impacts to water quality. The appropriate phasing of all construction activities and the adherence to sound erosion control practices would greatly reduce this potential.

5.13.3 Alternative 2

The placement of the steel sheet-pile bulkheads under Alternative 2 would exhibit the same adverse and beneficial impacts to water quality as discussed under Alternative 1 and would also be consistent with the CBPA goals and incentives to reduce soil erosion and sedimentation to protect water quality. No impairment of park resources and values would occur as a result of the alternative for the same reasons presented for Alternative 1. Any planned or unplanned activities in the drainage areas upstream of the Park that might involve the release of oil, sediment, or chemicals have the potential to result in cumulative impacts to water quality with this alternative. Similarly, construction activities that would be associated with the JAMESTOWN PROJECT have the potential to result in cumulative impacts to water quality. The appropriate phasing of all construction activities and the adherence to sound erosion control practices would greatly reduce this potential.

5.14 Visitor Use and Experience (Including visitor access and transportation and aesthetics)

5.14.1 No Action Alternative

In general, the No Action Alternative would allow continuation of current visitor access to all tourist attractions and facilities with negligible adverse impacts to visitor use and experience. The periodic erosion of the shoreline would proceed basically unnoticed by the general touring public and there would, therefore, be no measurable (negligible), if any, adverse impacts expected from a visual/aesthetic and access standpoint. There would be some noise resulting from limited construction activities associated with the implementation of stopgap erosion control measures by NPS that would be alien to the natural setting of the area; however, these adverse impacts would be expected to be short-term and negligible. The assessment is that No Action Alternative would have negligible and short-term adverse impacts on visitor use and experience. This would not constitute an impairment to park resources or values as the opportunities for visitor enjoyment would not be lessened. Any construction proposed in connection with the JAMESTOWN PROJECT would have the potential to result in cumulative impacts to visitor use and experience in conjunction with this alternative. This would result from the additive impacts from noise and potential limits on access to the public in the event that construction of the stopgap measures were underway concurrently with construction activities associated with the JAMESTOWN PROJECT. The appropriate phasing of all construction activities and the adherence to sound erosion control practices would greatly reduce this potential.

5.14.2 Alternative 1 (Preferred)

Adverse impacts on visitor use and experience that would result from Alternative 1 would occur in the areas of aesthetics (visual), noise levels, access, and transportation. Rubble-mound and stone structures would tend to blend well with the island's natural condition and would be viewed in general by the public as aesthetically pleasing. Construction activities would result in some temporary increases in noise levels, but this would be short-term and minor in a worst-case scenario because much of the construction of Alternative 1 would take place from water-based equipment. During construction, sites would be restricted to authorized personnel, and this could pose some temporary and minor inconvenience to the public from an access and transportation standpoint. The assessment is that Alternative 1 would have minor and, in general, short-term adverse impacts on visitor use and experience. This would not constitute an impairment to park resources or values. Any construction proposed in connection with the JAMESTOWN PROJECT would have the potential to result in cumulative impacts to the visitor use and experience in conjunction with this alternative. This would result from the additive impacts from noise and potential limits on access to the public in the event that construction of Alternative 1 was underway concurrently with construction activities associated with the JAMESTOWN PROJECT. The appropriate phasing of all construction activities and the adherence to sound erosion control practices would greatly reduce this potential.

5.14.3 Alternative 2

As with Alternative 1, adverse impacts on visitor use and experience that would result from Alternative 2 would occur in the areas of aesthetics (visual), noise levels, access, and transportation. These visual changes would be expected to be greater than with Alternative 1, as extensive lengths of vertical bulkheads would appear more obtrusive to the island's natural condition than would the stone structures proposed under Alternative 1. The general public would tend to find bulkheads less aesthetically pleasing than stone or rubble-mound structures, although this could be lessened over time (for repeat visitors). Construction activities would result in some temporary increases in noise levels, but this would be short-term and moderate in a worst-case scenario because the construction of Alternative 2 would take place from land-based equipment. During construction, sites would be restricted to authorized personnel, and this could pose some temporary and minor inconvenience to the public from an access and transportation standpoint. The assessment is that Alternative 2 would have moderate and, in general, short-term adverse impacts on visitor use and experience. This would constitute an impairment to park values. Any construction proposed in connection with the JAMESTOWN PROJECT would have the potential to result in cumulative impacts to the visitor use and experience in conjunction with this alternative. This would result from the additive impacts from noise and potential limits on access to the public in the event that construction of Alternative 1 was underway concurrently with construction activities associated with the JAMESTOWN PROJECT. The appropriate phasing of all construction activities and the adherence to sound erosion control practices would greatly reduce this potential.

5.15 Specific Impacts to Cultural Resources (Historical and Archeological Resources and Cultural Landscapes)

5.15.1 No Action Alternative

The resultant continued erosion of the shoreline, as would continue to occur under the No Action Alternative, would lead to the damage or complete destruction of many of the 28 known archeological sites. In addition, there would be the loss of research potential for the nine sites that have been determined to have high research potential. Some of these sites have already suffered damage from erosion, and this process would continue without some type of action to arrest it. In the absence of a comprehensive shoreline protection plan, it is expected that NPS would implement small-scale, stopgap methods of protection at such time that erosion damage to the archeological sites becomes imminent. While these stopgap measures would provide protection to the threatened archeological sites, it is expected that this protection would be of a limited, low level, representative of an immediate response action. The threatened site would most likely remain susceptible to damage from moderate to major storm activity. The No Action Alternative over time, thus, would be expected to result in moderate and long-term adverse impacts to the historical and archeological resources of the study area. With regard to the cultural landscapes of the study area (see Section 4.10), the No Action Alternative would have the potential to impact the first landscape -- that which most accurately reflects the 17th Century historic scene -- the natural environment on the island including marshes, rivers, historic boundary ditches, and the dense woodlands that existed in 1607. While the continued erosion of the shoreline would represent the continuation of a natural process that was in place during the time of the early settlers and, therefore, is characteristic of the natural environment that existed in 1607, the reality is that the shoreline has changed significantly since 1607 and that continued erosion, even with the implementation of stopgap measures, would gradually result in the loss of those characteristics. This would eventually lead to diminished characteristics of the natural environment. Therefore, the No Action Alternative would have an adverse effect on the cultural landscape of the study area. No cumulative impacts would be expected with this alternative.

The island's archeological resources are believed to be key resources, which substantially contribute to the cultural integrity of the Park. The loss of these resources would conflict with the purposes for which COLO was established and would be inconsistent with the goals in the Park's general management plan. Thus, if erosion of the shoreline were to continue under the No Action Alternative, resulting in the damage or loss of many of the island's archeological sites, the Park's resources and values would likely be impaired. Under legislative mandates and NPS policies, this would be an unacceptable situation.

5.15.2 Alternative 1 (Preferred)

Alternative 1 would provide protection to 25 of the 28 known archaeological sites located within the project area, thereby preserving them for future research. Table 7 indicates that type of protective structure proposed for each site. In accordance with Section 106 of the National Historic Preservation Act, Alternative 1 has been determined to have no adverse effect on the significant archeological and historical resources, which have been identified during the course of the various studies discussed in this report. With regard to the cultural landscapes of the study area (see Section 4.10), Alternative 1 would have the potential to impact the first landscape -- that which most accurately reflects the 17th Century historic scene -- the natural environment on the

island including marshes, rivers, historic boundary ditches, and the dense woodlands that existed in 1607. The placement of breakwaters, sills, and spurs would have the potential to alter the characteristics of the natural environment of the island; however, by preventing the loss of these characteristics through erosion protection, the structures, which would be low-lying and unobtrusive in the near shore zone, would not diminish those characteristics. Therefore, Alternative 1 would not have an adverse effect on the cultural landscape of the study area.

No impairment to park resources and values would occur as a result of the alternative. No cumulative impacts would be expected with this alternative. Consultation between NPS and the Virginia Department of Historic Resources (VDHR) has occurred and will continue with the review of this EA.

5.15.3 Alternative 2

As with Alternative 1, Alternative 2 would provide protection to 25 of the 28 known archeological sites located within the project area, thus preserving them for future research (See Table 7). In accordance with the Section 106 of the National Historic Preservation Act, Alternative 2 has been determined to have no adverse effect on the significant cultural and historical resources, which have been identified during the course of the various studies discussed in this report. With regard to the cultural landscapes of the study area (see Section 4.10), Alternative 2 would have the potential to impact the first landscape -- that which most accurately reflects the 17th Century historic scene -- the natural environment on the island including marshes, rivers, and historic boundary ditches, and the dense woodlands that existed in 1607. The placement of bulkheads would have the potential to alter the characteristics of the natural environment of the island due to their placement along the shoreline at the water line. Although these structures would prevent the loss of these characteristics through erosion protection, if implemented in their entirety, they would represent a significant intrusion to the natural environment of the Park, which would diminish those characteristics. Therefore, Alternative 2 would have an adverse effect on the cultural landscape of the study area.

Due to its adverse effect on the cultural landscape of the study area, Alternative 2 would constitute an impairment to park resources and values as it would diminish the natural integrity of the Park and could possibly reduce opportunities for visitor enjoyment. This designation could be eliminated by the prudent substitution of other shoreline protection structures, such as breakwaters and sills, for the bulkheads along some portions of the project shoreline. However, this would result in a project that would be very similar to Alternative 1. No cumulative impacts would be expected with Alternative 2.

Table 7. Archeological Sites Protected by Alternatives 1 and 2

Site Number	Location	Significant Component(s)	National Register Eligibility	Research Priority	Proposed Protection
44JC106	Glasshouse Point	Late Archaic, Middle-Late Woodland, 17th c.	Potentially eligible	High	Sill
44JC886	The Thorofare	Late Woodland; 17th c.	Potentially eligible	High	Sill
44JC888	The Thorofare	None	Not eligible	None	Breakwaters
44JC889	The Thorofare	Late Archaic, Late Woodland, 17th c.	Potentially eligible	High	Breakwaters and sill
44JC893	Black Point	Civil War	Potentially eligible	Low	No new construction
44JC895	Black Point	Late Archaic	Potentially eligible	Highest	Spur and sill
44JC896	Black Point	Paleoindian	Not eligible	Low	Reef breakwater
44JC899	The Thorofare	None	Not eligible	None	Sill
44JC903	The Thorofare	Early Archaic	Potentially eligible	Highest	Breakwater
44JC904	The Thorofare	None	Not eligible	None	Sill
44JC910	Back River	M.-L. Woodland, 19th c.	Potentially eligible	Moderate	Sill
44JC915	The Thorofare	17th c.	Potentially eligible	Very high	Sill
44JC916	The Thorofare	17th c.	Potentially eligible	High	Sill
44JC918	Goose Hill	None	Not eligible	None	Breakwater and spurs
44JC920	Lower Point	17th c., L. Woodland	Potentially eligible	Very High	Reef breakwater
44JC923	Goose Hill	17th-18th c.	Potentially eligible	Moderate	Spur
44JC924	Goose Hill	18th c.	Potentially eligible	Low	No new construction
44JC928	Back River	17th c.	Potentially eligible	Moderate	Sill
44JC931	Church Point	17th c.	Potentially eligible	Moderate	No new construction
44JC932	Back River	Civil War (?)	Potentially eligible	Low	Sill
44JC933	The Thorofare	None	Not eligible	None	Sill with spur
44JC935	Back River	None	Not eligible	None	Sill
44JC936	Lower Point	17th c., M.-L. Woodland	Potentially eligible	Low	Reef breakwater
44JC937	Lower Point	17th c., Late Woodland	Potentially eligible	High	Reef breakwater
44JC940	Moderate	18th c., M.-L. Woodland	Potentially eligible	Moderate	Reef breakwater
44JC942	Goose Hill	Civil War	Potentially eligible	Low	Spurs
44JC943	Lower Point	Prehistoric	Potentially eligible	Moderate	4 Reef Breakwaters
None	College Creek	Civil War	Undetermined	Unknown	3 Breakwaters

5.16 Coastal Zone Consistency

5.16.1 No Action Alternative

The No Action Alternative has been evaluated for consistency with coastal development policies and has been determined to be inconsistent with the approved Coastal Management Program of the Commonwealth of Virginia. This determination is based on the failure of the No Action Alternative to meet certain goals specified in the program including: (1) failure to prevent damage to the Commonwealth's natural resource base and (2) failure to protect public and private investment in the Coastal Zone.

5.16.2 Alternative 1 (Preferred)

The proposed construction of Alternative 1 at Jamestown Island has been determined to be consistent with the approved Coastal Management Program of the Commonwealth of Virginia. This determination is based on the success of the alternative in addressing certain goals of the program, including: (1) prevention of damage to the Commonwealth's natural resources base and (2) protection of public and private investment in the Coastal Zone. This EA and a joint permit application will be coordinated with VDEQ, VMRC, the local wetlands board, and other state and local agencies to determine concurrence of these agencies in the consistency determination in this EA. The applicable permits have not been applied for at the time of the preparation of this EA but will be obtained prior to construction. A Section 404 (b) (1) Evaluation (Public Law 92-500, as amended) has been prepared for this project and appears following this assessment.

5.16.3 Alternative 2

Alternative 2 has also been found to be consistent with Virginia's approved Coastal Management Program for the same reasons identified for Alternative 1. A Section 404 (b) (1) Evaluation was not prepared for Alternative 2.

5.17 Unavoidable Adverse Effects

Unavoidable adverse impacts from implementing any of the construction alternatives (Alternatives 1 and 2) include:

- Destruction of existing vegetation in the footprint of construction.
- Limited temporary degradation of near shore water quality from sedimentation.
- Minor and temporary loss of benthic organisms in the construction footprint.
- Very limited temporary reduction in air quality from construction activities and the consumption of energy.

The greatest potential unavoidable impact from the No Action Alternative would be the likelihood of the loss of significant archeological resources due to the continuation of uncontrolled erosion.

6.0 ENVIRONMENTAL LAWS AND STATUTES

Coordination with the USFWS has (to date) yielded no formal consultation requirements pursuant to Section 7 of the Endangered Species Act. With implementation of management recommendations, USFWS does not indicate that any of the proposals that are being recommended would adversely impact any endangered species or their habitat, as specified by the Endangered Species Act of 1973, as amended, or any other significant resources.

The proposed project (Alternative 1) has been evaluated under CAA Amendments of 1990. The conformity determination considered direct and indirect effects and has concluded that the air emissions relevant to the proposed construction activities are safely below the final rule's *de minimus* levels. A full-scale CAA conformity determination, therefore, will not be performed. The action would comply with Section 176 (c) (1) of the CAA Amendments of 1990.

A Section 404 (b) (1) Evaluation (Public Law 92-500, as amended) has been prepared for this project and appears following this assessment. The evaluation describes the impact to water quality as required by the Clean Water Act. Water quality may be temporarily impacted by construction, but all necessary precautions would be taken in order to minimize this impact. State Water Quality Certification under Section 401 of the Clean Water Act, as amended, will be applied for and obtained from VDEQ prior to construction.

The relationship of the proposed project to various environmental requirements and protection statutes is summarized in the following narrative.

COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

1. Preservation of Historic and Archaeological Data Act of 1974, as amended, 16 USC. 469 et seq.

Compliance: The State Historic Preservation Officer (SHPO) and the VDHR have been coordinated with concerning historic and/or archaeological resources in the project area. VDHR indicates that there would be no adverse effect to these resources associated with the proposed project. The project is designed to protect historic resources. Continued coordination with VDHR and the SHPO, where required, will lead to compliance.

2. Clean Air Act, as amended, 42 USC. 7401 et seq.

Compliance: Submission of this EA to the Regional Administrator of USEPA for review pursuant to Sections 176 (c) and 309 of CAA signifies compliance.

3. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972 and Water Quality Act of 1987) PL 100-4, 33 USC. 1251 et seq.

Compliance: A Section 404(b)(1) Evaluation and Compliance Review have been incorporated into this report. An application will be filed for a Virginia Water Protection Permit pursuant to Section 401 of the Clean Water Act.

4. Coastal Zone Management Act of 1972, as amended, 16 USC. 1431 et seq.

Compliance: Submission of this document to VDEQ, Office of Environmental Impact Review, and VMRC, the state agencies, which oversee CZM, and the issuance of applicable permits and a Federal Consistency Determination will confirm compliance.

5. Endangered Species Act of 1973, as amended, 16 USC. 1531 et seq.

Compliance: Coordination with USFWS and NMFS signifies compliance. The USFWS participated in a project site visit on March 15, 2000. A Section 7 consultation was initiated via letter to the USFWS dated March 23, 2000. The USFWS and the NMFS will be provided copies of EA for comment.

6. Fish and Wildlife Coordination Act, as amended, 16 USC. 661 et seq.

Compliance: Coordination with the USFWS, NMFS and VDGIF signifies compliance with this act.

7. National Historic Preservation Act of 1966, as amended, 16 USC. 470 et seq.

Compliance: Coordination with the SHPO and the VDHR, and their response indicates that the proposed project would have no adverse effect on historic properties. Significant cultural and historical resources would be protected and preserved with implementation of the proposed Plan at Jamestown Island. Agency concurrence with the findings of this EA will confirm further compliance and no impact.

8. National Environmental Policy Act of 1969, as amended, 42 USC. 432 et seq.

Compliance: Preparation of this EA and public coordination and comment signifies partial compliance with NEPA. Full compliance is noted with the signing and issuing of the Finding of No Significant Impact (FONSI).

9. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC 9601-9675.

Compliance: Project has been evaluated in reference to this act. No evidence indicates that there are any hazardous substances on terrestrial or subaqueous lands necessary for project construction, operation, and maintenance. Project is in compliance with this act following state and Federal agency concurrence with the findings of this EA.

10. National Park Service Organic Act (1916), As Amended

Compliance: Through this act, Congress established NPS and mandated that it "shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Project has been evaluated in reference to this act. The proposed project would not violate any component of this Act.

11. National Park Service Management Policies and Guidelines

Compliance: The Constitution, public laws, proclamations, executive orders, rules and regulations, and directives of the Secretary of the Interior and the Assistant Secretary guide the management of the national park system and NPS programs for Fish and Wildlife and Parks. NPS Management Policies and Guidelines provide the recommended procedures for implementing service-wide policy consistent with these laws, regulations, etc., as articulated by the Director of NPS. The following table presents the policies and guidance applicable to the shoreline protection alternatives under consideration at Jamestown Island.

Table 8. National Park Service Policies and Guidelines Pertaining to the Alternatives Presented in this Environmental Assessment

NPS Policies and Guidelines	References	Purpose of Policies and Guidance
Federal Agencies agreement on Ecosystem Management in the Chesapeake Bay (1994), and Federal Agencies Chesapeake Bay Ecosystem Unified Plan (1998)		NPS is committed to cooperate with states, Federal agencies, and other Chesapeake Bay Program partners to manage the Chesapeake Bay watershed as a cohesive ecosystem, outlining a series of specific goals in areas such as watershed protection, living resources and habitat stewardship, nutrient and toxics prevention and reduction, and sustainability.
Chesapeake Bay Riparian Buffer Plan (1999)		NPS is committed to help conserve existing forests along streams and shorelines within its Chesapeake Bay parks and to restore riparian forests on 35 miles of streams and shorelines in the watershed by 2010.
Cultural Resources Management Guidelines	Director's Order 28	Describes NPS policy in regard to the preservation and treatment of archeological, cultural, and historic properties and ethnographic resources included within a park.
Interpreting the National Park Service Organic Act	Director's Order 55	Interprets NPS policy regarding NPS Organic Act and NPS General Authorities Act as stating the laws prohibiting the impairment of park resources and values.
NEPA Guidelines	Director's Order 12	Provides NPS guidance on NEPA compliance consistent with CEQ regulations and on approaches to environmental documentation.
Natural Resources Management Guidelines	Director's Order 77	Provides the guidance from the bureau on addressing and managing natural resources within park boundaries.
Park Planning	Director's Order 2	Directs the decision making process that results in the goals and actions specific to each unit of the national park system and those units of the national trails system administered by NPS.
Wetland Protection	Director's Order 77-1	Directs NPS to avoid adverse impacts to wetlands if undertaking new development or land use activities and provides guidelines to meet requirements of Executive Order 11990, Protection of Wetlands.

Implementation of the proposed Plan (Alternative 1) at Jamestown Island is consistent with *National Park Service Management Policies*. As directed by Procedural Manual 77-1, a SOF has been prepared and will be circulated with this EA to document compliance of policies and procedures related to the adverse impacts on wetlands.

Executive Orders

1. Executive Order 11988, Floodplain Management, 24 May 1977, as amended by Executive Order 12148, 20 July 1979.

Compliance: The proposed project would not stimulate development in the floodplain. Circulation of this report for public review fulfills the requirements of Executive Order 11988, Section 2(a)(2).

2. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Impacts to wetlands have been avoided to the greatest extent practicable. Significant tidal wetlands would be preserved, protected and/or created with implementation of the proposed project. Circulation of this report for public review fulfills the requirements of Executive Order 11990, Section 2(b).

3. Executive Order 12898, Environmental Justice in Minority Populations and Low-Income Populations, 11 February, 1994.

Compliance: No impacts are expected to occur to any minority or low-income communities. A public notice will be issued in a local newspaper. This EA will be made available for comment to all individuals who have an interest or may be affected by the proposed project.

Executive Memorandum

1. Analysis of Impacts of Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: There would be no adverse impact to prime or unique agricultural lands with the implementation of the proposed Plan (Alternative 1) at Jamestown Island.

7.0 FUTURE COMPLIANCE REQUIREMENTS

This assessment considered permits and regulatory authorizations that are relevant to, and applicable in, analyzing impacts and making decisions regarding the proposed shoreline protection plan. The proposed project shoreline is directly affected by several state and Federal regulatory requirements and permits. The following permits must be applied for and obtained prior to the construction of shoreline protection structures, via the Joint Permit Application process:

- A VDEQ Virginia Water Protection permit pursuant to Sec. 401 of the Clean Water Act;
- A VMRC permit for encroaching on state bottom pursuant to Title 28.2 and 62.1 of the Code of Virginia; and
- A permit from COE pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act.
- All proposed coastal construction work must also be accomplished in compliance with CBPA. All proposed construction would be required to be coordinated with the locality and the Chesapeake Bay Local Assistance Department (Virginia state agency) prior to implementation.

8.0 COORDINATION

During the process of developing the Plan (Alternative 1) for Jamestown Island over the last 3 years, discussions have taken place in various forums with many different Federal, state, and local representatives. Table 9 shows some of the coordination meetings and site visits that have taken place and the agencies that were involved in these meetings.

Table 9. Shoreline Management Plan (Alternative 1) – Coordination Meetings

Date	Participants	Topic of Meeting
14- Aug-96	NPS-COLO, HRPDC, VIMS, COE	Shoreline Conservation Informational Meeting
5-Aug-97	NPS-COLO, APVA, VIMS, HRPDC, Jamestown-Yorktown Foundation	Shoreline Conservation Kick-Off Meeting
17-Feb-98	NPS-COLO, CWF Arch., COE	Jamestown/Newtowne revetment
23-July 99	NPS-DSC, COLO, APVA, VIMS, CWF, William & Mary CAR, COE	Value Analysis of Shoreline Protection Alternatives
2-Feb-99	NPS-DSC, COLO, VIMS, COE	Project Scoping and Agreements
25-Aug-99	NPS-DSC, COLO, VIMS, COE	Presentation of Plan Results
28-Oct-99	NPS, COLO, COE	EA, Cultural Resources
9-Dec-99	NPS and advisors	Develop Advisory Board Meeting, Washington, DC
22-Feb-00	NPS, COLO, COE	EA, Natural Resources
15-Mar-00	COE, VIMS, USFWS	Field Evaluation of Proposed Project Sites. ESA, Section 7 consultation was initiated via a letter to USFWS dated March 23, 2000 (Appendix E).

HRDPC – Hampton Roads Planning District Commission

CWF --

National Park Service

As part of the NEPA process, this EA will be provided to (at least) the following Federal, state, and local agencies/organizations for review and comment. Should the preparation of a FONSI be appropriate, it would be made accessible to the public through mailings and notification by use of local media (i.e., newspaper).

Federal

USFWS

USEPA

NMFS

National Oceanic and Atmospheric Administration

Natural Resources Conservation Service

US Coast Guard

US Geological Survey

NPS

Commonwealth of Virginia

VMRC

VDEQ

DCR

Department of Agriculture & Consumer Services

VDGIF

VDHR

Department of Health

Department of Transportation

Department of Forestry

Department of Mines, Minerals, and Energy

Department of Emergency Services

Chesapeake Bay Local Assistant Department

VIMS

Local/Other

James City County

APVA

Hampton Roads Planning District Commission

9.0 REFERENCES

Agbe-Davies, Anna, March 2000. "Jamestown Waterfront Assessment," prepared by Colonial Williamsburg Foundation (Management Report in Preparation).

Blanton, Dennis B. and Patricia Kandle, 2000. "Jamestown Archaeological Assessment, 1992-1996: Archaeological Survey of Jamestown Island," prepared by Colonial Williamsburg Foundation and the College of William and Mary for the Colonial National Historic Park.

Center for Conservation Biology, 1988. Bald Eagle/Heron Survey Report for Colonial National Historical Park. College of William and Mary, Williamsburg, VA.

Clark, K. H., and C. D. Rafkind. 1998. Conservation Planning for the Natural Areas of Colonial National Historical Park, Virginia. Natural Heritage Technical Report 98-14. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 100 pages plus appendices.

Hardaway, C. S., Jr. and M. Hudgins. 1999. Colonial National Historical Park, Shoreline Management Plan for Jamestown Island, Powhatan Creek, Sandy Bay, Back River, The Thorofare, and James River Shorelines. Prepared by Virginia Institute of Marine Science and US Army Corps of Engineers for National Park Service, Colonial National Historical Park.

Hawthorne, S.D. and D.M. Dauer, 1983. Macrobenthic Communities of the Lower Chesapeake Bay. *Int. Revue ges. Hydrobiol.* 68: 193-205.

Hirsch, N.D., L.H. Disalvo and R.K. Peddicord, 1978. Effects of Dredging and Disposal on Aquatic Organisms. Technical Report DS-78-5, US Army Engineer Waterways Experiment Station, Vicksburg, MS. 41 pp.

Hobbs, C. H., et al., 1982. "Final Report to the Coastal Erosion Abatement Commission Commonwealth of Virginia concerning the Inventory of Sand Resources in the Southern Portion of the Chesapeake Bay," Virginia Institute of Marine Science.

Jones, Joe B., February 2000. "Archaeological Survey of the Glasshouse Point Area near Jamestown Island, Colonial National Historical Park, James City County, Virginia," (draft) prepared by William and Mary Center for Archaeological Research.

Manny, B. A., et al., 1985. "Ecological Effects of Rubble-Mound Breakwater Construction and Channel Dredging at West Harbor, Ohio (Western Lake Erie)," Technical Report EL-85-10, prepared by US Fish and Wildlife Service for US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Moore, Kenneth A., 1980. James City County Tidal Marsh Inventory. Spec. Rept. in Appl. Mar. Sci. and Ocean Eng., No. 188, Virginia Institute of Marine Science, Gloucester Pt., VA.

National Park Service

National Oceanic and Atmospheric Administration/National Marine Fisheries Service, March 1999, "Guide to Essential Fish Habitat Designations in the Northeastern United States, Volume V: Maryland and Virginia."

Opperman, A. F. and Polk, H., II. 1989. "Phase I Archeological Surveys for Fort Eustis and Jamestown Island, Cities of Newport News and Virginia Beach, Virginia," prepared by MAAR Associates, Inc. Williamsburg, VA and Newark, DE.

Orth, R.J., J.F. Nowak, D.J. Wilcox, J.R. Whiting and L.S. Nagey. 1998. Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay – 1997. Virginia Institute of Marine Science, Gloucester, VA.

Orth, R.J., J.F. Nowak, D.J. Wilcox, J.R. Whiting and L.S. Nagey. 1999. Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay – 1998. Virginia Institute of Marine Science, Gloucester, VA.

Pullins, Stevan C. and Dennis B. Blanton. 1999. "Prehistoric Settlement on Jamestown Island, *Archaeological Data Recovery at Site 44JC895 on Black Point, Jamestown Island, James City County, Virginia*," (draft) prepared by William and Mary Center for Archaeological Research.

Thompson, J. R., January 1973. "Ecological Effects of Offshore Dredging and Beach Nourishment: A Review," Miscellaneous paper No. 1-73, US Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.

US Army Corps of Engineers, 1990. Chesapeake Bay Shoreline Erosion Study, Appendix A - Modeling and Monitoring Program. US Army Corps of Engineers, Baltimore District.

US Department of Interior, National Park Service, 1993. General Management Plan, Colonial National Historical Park. US Department of Interior, National Park Service, Denver Service Center.

US Fish and Wildlife Service, US Department of the Interior, 1988, "Fish Species Composition in Selected Streams in Colonial National Historical Park

Van Dolah, R.F., et al. 1987. "Ecological Effects of Rubble Weir Jetty Construction at Murrells Inlet, South Carolina; Volume III: Community Structure and Habitat Utilization of Fishes and Decapods Associated with the Jetties," Technical Report EL-84-4, prepared by South Carolina Wildlife and Marine Resources Department, Charleston, S.C., for US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Virginia Department of Environmental Quality, 1999. Website:
<http://www.deq.state.va.us/programs/sips.html>.

Watts, Bryan D. and D. M. Whalen, 1997. Interactions Between Eagles and Humans in the James River Bald Eagle Concentration Area. Prepared by College of William and Mary, Center for Conservation Biology, for Virginia Department of Game and Inland Fisheries, Nongame and Endangered Wildlife Program.

SECTION 404 (b) (1) EVALUATION

Breakwater Construction
Jamestown Island
James City County, Virginia

I. Project Description

- a. Location – James City County, Jamestown Island, Virginia (Figure 1).
- b. General Description - The proposed project at Jamestown Island involves construction of breakwaters, sills, and wetlands to provide shoreline protection along the 14 mile shoreline.
- c. Authority and Purpose – Work will be accomplished by NPS.
- d. General Description of Dredged or Fill Material - Fill material is rock and stone (breakwaters), and sandy backfill.
- e. Description of the Proposed Discharge Site
 - (1) Location (map) - See Figure 1 and Plates (Appendix D).
 - (2) Size – 11,613 linear feet, variable width (15-25 feet).
 - (3) Type of site - Open Water/Intertidal/Upland.
 - (4) Type of habitat – Open water and intertidal river shoreline.
 - (5) Timing and duration of discharge - Construction may take place at any other time during the year, for a duration of up to 8 months.
- f. Description of Placement Method - Barged or truck hauled to placement sites.

II. Factual Determination

- a. Physical Substrate Determinations
 - (1) Substrate elevation and slope - Semi-confined open water (0-5 feet depth).
 - (2) Sediment type - Predominantly sand and rock (breakwaters/sill).
 - (3) Dredged/fill material movement – Minor.

National Park Service

(4) Physical effects on benthos - Loss of benthos at placement site; fairly rapid recovery of adjacent bottom areas and rock surfaces.

(5) Other effects - Minor and short-term changes.

(6) Actions taken to minimize impacts - None required.

b. Water Circulation, Fluctuation, and Salinity Determinations.

(1) Water. Consider effects on:

(a) Salinity - No effect.

(b) Water chemistry - Minor and temporary effect on DO and biological oxygen demand during construction; temporary turbidity increase.

(c) Clarity - Minor and temporary turbidity may be generated during construction.

(d) Color - Minor and temporary change due to turbidity.

(e) Odor - No change.

(f) Taste - No change.

(g) Dissolved gas levels - Minor and temporary reduction in DO.

(h) Nutrients - Minor and temporary increase.

(i) Eutrophication - No change.

(j) Temperature - Minor or no changes anticipated.

(k) Others as appropriate - None.

(2) Current patterns and circulation

(a) Current patterns and flow - Minor effect near shoreline in vicinity of structures.

(b) Mean velocity - Minor effect near shoreline in vicinity of structures.

(c) Stratification - No measurable change.

(d) Hydrologic regime - Estuarine, no change.

(3) Normal water level fluctuations - No change.

(4) Salinity gradients - No change.

(5) Actions that would be taken to minimize impacts – None.

c. Suspended Particulates/Turbidity Determinations

(1) Expected changes in suspended particulates and turbidity levels in vicinity of placement site - Minor and temporary during construction

(2) Effects (degree and duration) on chemical and physical properties of the water column - Temporary during construction.

(a) Light penetration - Minor decrease during construction; temporary effect.

(b) DO - Minor decrease during construction; temporary effect.

(c) Toxic metals and organics - None present; no effect.

(d) Pathogens - None present; no effect.

(e) Aesthetics - Minor degradation during construction; some temporary disturbance of natural conditions but overall improvement in presently eroding shoreline.

(3) Effects on biota.

(a) Primary production, photosynthesis - Temporary increase in suspended solids would reduce light transmission and photosynthesis.

(b) Suspension/filter feeders - Would be temporarily affected by minor increase in suspended solids.

(c) Sight feeders - Would be temporarily affected by minor increase in suspended solids.

(4) Actions taken to minimize impacts – None.

d. Contaminant Determinations – N/A. All fill material (rock and sand) will be derived from clean borrow sites.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on plankton - Would be temporarily affected by increases in suspended solids.

(2) Effects on benthos - Loss of benthos at construction site.

(3) Effects on nekton - Would be temporarily affected by increase in suspended solids and minor disturbance to benthic feeding areas.

(4) Effects on aquatic food web - Would be temporarily affected by minor loss of benthos and increase in suspended solids in water column.

(5) Effects on special aquatic sites.

(a) Sanctuaries and Refuges - None affected.

(b) Wetlands - No effect.

(c) Mudflats - No effect.

(d) Vegetated shallows - None present at site

(e) Riffle and pool complexes - N/A

(6) Threatened and endangered species – DCR and USFWS management recommendations will be implemented to avoid impacts to Federally-threatened pair of bald eagles which nest on Jamestown Island.

(7) Other wildlife - Resident wildlife may be disturbed at the construction site(s) temporarily. Will return upon completion of project.

(8) Actions to minimize impacts – None.

f. Proposed Disposal Site Determinations.

(1) Mixing zone determinations.

(a) Depth of water - At construction site: 0-3 feet; average 2.5 feet.

(b) Current velocity – James River = 1 to 10 f.p.s.

(c) Degree of turbulence – Negligible.

(d) Stratification – Negligible.

(e) Discharge vessel speed and direction - N/A.

(f) Rate of discharge - N/A.

(g) Dredged material characteristics - N/A.

(h) Number of discharge actions per unit time - N/A.

(2) Determination of compliance with applicable water quality standards - All applicable water quality standards will be complied with.

(3) Potential effects on human use characteristic

(a) Municipal and private water supply - Proposed project would not affect municipal or private water supply.

(b) Recreational and commercial fisheries - Short-term and minor turbidity increases and minor impact to benthos from construction would minimally affect fisheries. Recreational and commercial fishing vessels will have adequate depths and shoreline erosion control features would not adversely affect boating.

(c) Water-related recreation - No impact.

(d) Aesthetics - No impact, proposed improvements would not change aesthetic quality of project area.

(e) Parks, national and historical monuments, national seashores, wilderness areas, etc. - The Jamestown Island unit of COLO, and associated natural and cultural resources will be protected from erosion with the proposed construction.

g. Determination of Cumulative Effects on the Aquatic Ecosystem - The proposed project involves stone and rock placement to construct breakwaters/sills, and associated fill placement. Cumulatively, construction activities may have a more pronounced impact than they do separately. Some benthic habitat will be disturbed or lost with construction but aquatic resources should benefit with improved water quality and the feeding and hiding niches provided by the rock breakwaters and sills. Wetlands will be protected and restored.

h. Determination of Secondary Effects on the Aquatic Ecosystem - None anticipated.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

1. The evaluation of the proposed breakwater construction projects at Jamestown Island, James City County, Virginia, was made consistent with 404 (b) (1) Guidelines.

2. The proposed plan was selected because of its ability to meet the shoreline management needs expressed by NPS and because the environmental impacts associated with the recommended Plan were comparable to impacts associated with other alternatives. There were

several different alternative shoreline protection measures recommended in the final array as described in the accompanying EA. The recommended (comprehensive) management plan was selected based on its acceptability from an environmental, social, engineering, and economic perspective.

3. The planned construction at Jamestown Island would not violate any applicable state water quality standards. A 401 Virginia Water Protection Permit will be applied for and would be obtained prior to construction. There would be a short-term increase in suspended solids in the water column during construction. Construction activities would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

4. Use of the selected sites for construction would not harm any endangered species or their critical habitat.

5. The proposed construction would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Effects on aquatic ecosystem diversity, productivity, and stability would be limited and localized; significant adverse impacts to recreational, aesthetic, and economic values would not occur.

6. Appropriate steps would be taken to minimize potential adverse impacts to aquatic systems resulting from construction activities.

7. On the basis of the guidelines, the proposed sites for construction of shoreline protection features at Jamestown Island and vicinity is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

APPENDIX A

PRELIMINARY ANALYSIS OF ALTERNATIVES

VALUE ANALYSIS - Mini VA

Park: Colonial NHP
Project: Jamestown Island Shoreline Stabilization
Package: COLO 248
Date: 8/3/99

Component Evaluated: Shoreline Protection Methods

Phase I - Information:

Background Information/Special Concerns/Constraints/Previous Decisions/Description of Present Proposal/Design Assumptions

Shoreline Management Plan
Chesapeake Bay Agreement
DOI-NPS Guidelines, Policies, and Standards for protection of historic and archeological resources
Limited landside access
In-progress design project for Black Point
Established load limits for bridge providing access Jamestown Island
Off Shore Soil Bearing Properties

Functional Analysis/Description of the Present Proposal:

Active Verb	Noun
1. protect	cultural resources
2. preserve	natural resources
3. maximize	habitat
4. maintain	1607 environment
5. prevent	erosion
6. protect	infrastructure

Phase II - Creativity (Alternatives):

#	Alternative (Brainstormed)	Disposition of Alternative
1	Rubble-mound Breakwaters/Stone Revetments/Stone Sills with Vegetated Wetlands	Evaluated by CBA process
2	Bulkheads (wooden, steel)	Evaluated by CBA process
3	Sand Nourishment	Evaluated by CBA process
4	Groins (stone, timber)	Evaluated by CBA process
5	Gabions	Not evaluated by CBA process – not aesthetically suited to site; high installation and maintenance costs.
6	Concrete Armor	Not evaluated by CBA process – not aesthetically acceptable; high installation and maintenance costs
7	Geo-tubes	Not evaluated by CBA process – highly susceptible to vandalism and storm damage; semi-high maintenance costs; “short term fix”; not UV resistant; better suited to beach restoration; not aesthetically acceptable

Phase III - Evaluation

Evaluation Sub-Factors or Variables:

#	Evaluation Variables or Sub-factors	Definition of Variable or Sub-factors
1	Protection and Improvement of Resources	Protect and improve shoreline resources (archeological and historical sites, habitat, infrastructure, cultural landscapes, viewsheds, Colonial Parkways and overlooks).
2		
3	Provide Visitor Services and Educational Opportunities	Preserve opportunities for interpretation of historical sites and the 1607 appearance of Jamestown Island. Preserve opportunities for visitor education resulting from future archeological investigations.

		Preserve opportunities for visitor education regarding water level changes, environmental sensitivity, and species composition.
4	Protect Public Health, Safety, and Welfare	Protect visitors from injury due to eroding, caving, or scarping soils, exposed tree roots, and falling trees.
5	Improve Operational Efficiency and Sustainability	Prevent loss or damage to park infrastructure, including parkway overlooks. Minimize requirements for compliance, archeology, maintenance, and curatorial services. Develop holistic solutions.
6	Protect Employee Health, Safety, and Welfare	Protect park employees from injury due to eroding, caving, or scarping soils, exposed tree roots, and falling trees. Minimize risk to employees due to impacts or required maintenance of shoreline protection solutions.
7	Other Advantages	Develop solutions that can be monitored and used in the future at other park sites. Support Partnership with Association for the Preservation of Virginia Antiquities (APVA) Support the Chesapeake Bay Agreement (CBA).
8		
9		

Colonial NHP – Jamestown Island Shoreline Stabilization

Choosing by Advantages

COMPONENT: Shoreline Protection Methods		FUNCTION: Shoreline Protection			
FACTOR		ALTERNATIVES			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
PROTECT CULTURAL AND NATURAL RESOURCES		•	•	•	•
FACTOR 1 - Prevent Loss of Resources Total Points = 100					
Advantages		- Minimal damage to underwater resources during installation - Provides good protection to landside resources	- Could potentially damage underwater resources during installation - Provides moderate protection to landside resources - Installation requires potentially disturbing vibration and noise	- No damage to underwater resources - Easiest to install - Most vulnerable to storm events - Provides good protection to resources when in place	- Minimal damage to underwater resources during installation - Moderately vulnerable during storm events - Effectiveness of this system most difficult to predict
		90	30	50	0
		Significantly superior to Alternative 4 as this system is more durable, storm resistant, and predictable in protecting shoreline and can be installed without damaging underwater resources	Nominally superior to Alternative 4 as performance of this system is more predictable and stable during storms	Moderately superior to Alternative 4 as this system provides acceptable protection and can be installed without damaging resources	Least Preferred Set of Attributes as risk to resources highest due to poor predictability of the effectiveness of this solution in controlling erosion and it's vulnerability to storms
FACTOR 2 – Maintain and Improve Condition of Resources Total Points = 80					

COMPONENT: Shoreline Protection Methods		FUNCTION: Shoreline Protection			
FACTOR		ALTERNATIVES			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Attributes		Most significant improvement of habitat	Negligible improvement of habitat	Moderate improvement of habitat	Minimal improvement of habitat
Advantages		80 Significantly superior to Alternative 2 as this solution contributes substantially to improving habitat and does not adversely impact resources during installation	0 Least Preferred Set of Attributes as this solution could potentially impact underwater resources during installation and provides the least degree of benefit to habitat	40 Moderately superior to Alternative 2 as this solution contributes to a degree to improving habitat and does not adversely impact resources during installation	10 Nominally superior to Alternative 2 as this solution will contribute to some degree in the improvement of habitat
PROVIDE FOR VISITOR ENJOYMENT					
FACTOR 3 - Provide Visitor Services and Educational Opportunities					
Total Points = 70					
Attributes		- Provides educational opportunities related to water level changes, species composition, environmental issues - Shows NPS in role of protecting resources	This type of shoreline protection system is the least natural and most intrusive on the natural and historic scene	Provides minimal opportunities for visitor education	This type of shoreline protection system is perceived as moderately unnatural and has a negative public image
Advantages		60 Significantly superior to Alternative 2 as this solution blends well with natural setting and provides opportunities for education of visitors	0 Least Preferred Set of Attributes as this solution is perceived as the most intrusive to the natural and historic scene	30 Moderately superior to Alternative 2 as this solution blends well with the natural setting.	10 Nominally superior to Alternative 2 as the appearance of this solution is slightly more natural and compatible with the natural and historic scene
FACTOR 4 - Protect Public Health, Safety and Welfare					
Total Points = 50					

COMPONENT: Shoreline Protection Methods		FUNCTION: Shoreline Protection			
FACTOR	ALTERNATIVES				
	Alternative 1		Alternative 2	Alternative 3	Alternative 4
Attributes	- Removes some existing safety hazards - Introduces few new safety hazards		- Removes some existing safety hazards - Introduces few new safety hazards	Beaches are an "attractive nuisance" that will draw visitors to these sites for the purposes of sunbathing, partying, etc.	- Introduces Navigational Hazard - Moderate safety hazard as structure extends further into waterways
Advantages	20 Moderately superior to Alternative 3 as this solution will not introduce any significant hazards and will eliminate some existing hazards	20	20 Moderately superior to Alternative 3 as this solution will not introduce any significant hazards and will eliminate some existing hazards	0 Least Preferred Set of Attributes as this solution introduces characteristics to the site (beaches) that would invite unwelcome activities	10 Noninally superior to Alternative 3 as this solution introduces only minor navigational and slipping hazards
IMPROVE EFFICIENCY OF PARK OPERATIONS					
FACTOR 5 - Improve Operational Efficiency and Sustainability Total Points = 60					
Attributes	Lowest requirement for maintenance, compliance, and other operational demands on park staff		Moderate operational demands on park staff to maintain, monitor, and replace.	- Highest operational demands on park staff to coordinate replacement every 3-5 years. - Highest demand on (law enforcement) staff due to anticipated beach activities	High demand on park staff to maintain

COMPONENT: Shoreline Protection Methods		FUNCTION: Shoreline Protection			
FACTOR	Protection Methods	ALTERNATIVES			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Advantages		50 Significantly superior to Alternative 3 as this solution has a substantially longer projected lifespan and requires little maintenance	20 Moderately superior to Alternative 3 as this solution has a considerably longer projected lifespan	0 Least Preferred Set of Attributes due to the high demands on park staff for replacement of sand after storms and to patrol beaches	10 Nominally superior to Alternative 3 as this solution has a slightly longer projected lifespan but requires some maintenance
FACTOR 6 - Protect Employee Health, Safety and Welfare Total Points = 50					
Attributes		- Some reduction of safety hazards - Minimal (new) risk to employees	- Some reduction of safety hazards - Minimal (new) risk to employees	- Some reduction of safety hazards - Least risk to employees	- Some reduction of safety hazards - Some risk to employees due to the system's higher maintenance requirements and more vulnerable position in waterways
Advantages		20 Moderately superior to Alternative 4 as this solution removes some existing hazards to employees and introduces few new hazards	20 Moderately superior to Alternative 4 as this solution removes some existing hazards to employees and introduces few new hazards	30 Substantially superior to Alternative 4 as this solution removes a significant amount of the existing hazards to employees and introduces no new hazards	0 Least Preferred Set of Attributes as this solution requires the most dangerous type of maintenance activities
PROVIDE COST-EFFECTIVE, ENVIRONMENTALLY RESPONSIBLE, AND OTHERWISE BENEFICIAL DEVELOPMENT FOR THE NPS					
FACTOR 7 - Provide Other Advantages to the National Park System Total Points = 40					

COMPONENT: Shoreline Protection Methods		FUNCTION: Shoreline Protection			
FACTOR		ALTERNATIVES			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	
Attributes	- State of the Art Shoreline Protection Methodology for Chesapeake Bay - Matches the solutions of the most recent successful shoreline protection efforts in VA-MD area.	"Old standard technology"	Simple, most natural solution.	"Old standard technology"	
Advantages	Substantially superior to Alternative 4 as this solution provides the most generally approved and commonly used methodology for protecting shorelines in the Chesapeake Bay today	Minimally superior to Alternative 4 as this solution would not negatively impact the navigational characteristics of the impacted waterways	Moderately superior to Alternative 4 as this solution is an environmentally friendly approach that could potentially also support local dredging efforts	Least Preferred Set of Attributes as this solution can negatively impact the navigational characteristics of adjacent waterways and contributes to deposition of material behind structures	0
TOTAL IMPORTANCES OF ADVANTAGES	360	100	180	40	
Initial Cost (Net)	\$37,000	\$29,000	\$15,000	\$22,000	
Importance/Initial Cost Ratios	9.7	3.5	12.0	1.8	
Life Cycle Cost (Net)	\$41,790	\$58,800	\$50,710	\$33,828	
Importance/LCC Ratio	8.6	1.7	3.6	1.2	
TOTAL					

Phase IV - Development (Summary of Preferred Alternatives Advantages):

Using a combination of rubble-mound breakwaters, stone revetments, and stone sill structures (with vegetated wetlands) was the preferred alternative for a shoreline protection system because:

- The Importance to Life Cycle Cost ratio is highest for this alternative.
- It is the most effective alternative in preventing loss of cultural and natural resources.
- It is the most effective alternative in improving condition of natural resources.
- It is the most effective alternative in enabling NPS to provide visitor services and educational opportunities.
- It is the most effective alternative in protecting public health, safety and welfare.
- It is as effective or superior to other alternatives in improving operational efficiency and sustainability.
- It is superior to other alternatives in providing a cost effective, environmentally responsible, and otherwise beneficial development for the NPS.

Phase V & VI - Presentation & Implementation (Recommendations and Options for Implementation):

Value Analysis Team:

Alec Gould, Superintendent, Colonial NHP
Skip Brooks, Chief of Maintenance, Colonial NHP
Jim Burnett, Chief Ranger, Colonial NHP
Jane Sundberg, Cultural Resource Specialist, Colonial NHP
Diane Stallings, Supervisory Park Ranger/Historian for Jamestown Unit, Colonial NHP

Chuck Rafkind, Natural Resources Specialist, Colonial NHP*
Dorothy Geyer, Landscape Architect, Colonial NHP
Mark Hudgins, US Army Corps of Engineers
Donna Milligan, Virginia Institute of Marine Science
Scott Hardaway, Virginia Institute of Marine Science

Facilitator: Patrick Macdonald, NPS-DSC-PM

A-10

*Was not in attendance for entire analysis due to other commitments

APPENDIX B

PLANT AND ANIMAL SPECIES COMMON TO
LOWER JAMES RIVER

APPENDIX B. COMMERCIALLY IMPORTANT FISH SPECIES COMMON TO
LOWER JAMES RIVER AND CHESAPEAKE BAY

Common name	Scientific name
Croaker	<i>Micropogon undulatus</i>
Spot	<i>Leiostomus xanthurus</i>
Bluefish	<i>Pomatomus saltatrix</i>
Rockfish (Striped Bass)	<i>Morone saxatilis</i>
Speckled trout	<i>Cynoscion nebulosus</i>
Grey trout	<i>C. regalis</i>
Bay anchovy	<i>Anchoa mitchilli</i>
Alewives	<i>Alosa pseudoharengus</i>
Menhaden	<i>Brevoortia tyrannus</i>
American shad	<i>Alosa sapidissima</i>
Blueback herring	<i>Alosa aestivalis</i>
American eel	<i>Anguilla rostrata</i>
White perch	<i>Morone americana</i>
Winter flounder	<i>Pseudopleuronectes americanus</i>
Summer flounder	<i>Paralichthys dentatus</i>

APPENDIX B . BENTHIC ORGANISMS COMMON TO LOWER JAMES RIVER
AND CHESAPEAKE BAY

Common name	Scientific name
<u>Aquatic Plants</u>	
Blue-green algae	<i>Lyngbya</i> <i>Oscillatoria</i>
Green algae	<i>Ulva</i> <i>Enteromorpha</i> <i>Cladophora</i>
Brown algae	<i>Gracilaria</i> <i>Fucus</i>
Red algae	<i>Ceramium</i>
Eelgrass	<i>Zostera marina</i>
Widgeon grass	<i>Ruppia maritima</i>
Wild celery	<i>Vallisneria americana</i>
<u>Animal Benthos</u>	
Barnacle	<i>Balanus</i>
Spider crab	<i>Libinia</i>
Hermit crab	<i>Pagurus</i>
Blue crab	<i>Callinectes</i>
Starfish	<i>Asterias</i>
Slipper shell	<i>Crepidula</i>
Mud snail	<i>Nassarius</i>
Oyster drill	<i>Urosalpinx</i>

APPENDIX C

NMFS ESSENTIAL FISH HABITAT (EFH) DESIGNATIONS

Summary of Essential Fish Habitat (EFH) Designations

10' x 10' Square Coordinates:

Boundary	North	East	South	West
Coordinate	37° 20.0' N	76° 40.0' W	37° 10.0' N	76° 50.0' W

Square Description (i.e. habitat, landmarks, coastline markers)

York River waters within the square affecting the following: Grays Creek, Crouch Creek, Pleasant Pt., Cross Creek Landing, Swans Pt., Mt. Pleasant, VA., Jamestown I., Church Pt., Powhatan Creek, Back River, and Glasshouse Pt.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic cod (<i>Gadus morhua</i>)				
haddock (<i>Melanogrammus aeglefinus</i>)				
pollock (<i>Pollachius virens</i>)				
whiting (<i>Merluccius bilinearis</i>)				
red hake (<i>Urophycis chuss</i>)				
white hake (<i>Urophycis tenuis</i>)				
redfish (<i>Sebastes fasciatus</i>)	n/a			
witch flounder (<i>Glyptocephalus cynoglossus</i>)				
winter flounder (<i>Pleuronectes americanus</i>)				
yellowtail flounder (<i>Pleuronectes ferruginea</i>)				
windowpane flounder (<i>Scophthalmus aquosus</i>)				
American plaice (<i>Hippoglossoides platessoides</i>)				
ocean pout (<i>Macrozoarces americanus</i>)				
Atlantic halibut (<i>Hippoglossus hippoglossus</i>)				
Atlantic sea scallop (<i>Placopecten magellanicus</i>)				
Atlantic sea herring (<i>Clupea harengus</i>)				
monkfish (<i>Lophius americanus</i>)				
bluefish (<i>Pomatomus saltatrix</i>)			X	X
long finned squid (<i>Loligo pealeii</i>)	n/a	n/a		
short finned squid (<i>Illex illecebrosus</i>)	n/a	n/a		
Atlantic butterfish (<i>Peprilus triacanthus</i>)			X	X
Atlantic mackerel (<i>Scomber scombrus</i>)				
summer flounder (<i>Paralichthys dentatus</i>)		X	X	X
scup (<i>Stenotomus chrysops</i>)	n/a	n/a		
black sea bass (<i>Centropristus striata</i>)	n/a		X	X
surf clam (<i>Spisula solidissima</i>)	n/a	n/a		
ocean quahog (<i>Artica islandica</i>)	n/a	n/a		
spiny dogfish (<i>Squalus acanthias</i>)	n/a	n/a		
tilefish (<i>Lopholatilus chamaeleonticeps</i>)				
king mackerel (<i>Scomberomorus cavalla</i>)	X	X	X	X
Spanish mackerel (<i>Scomberomorus maculatus</i>)	X	X	X	X
cobia (<i>Rachycentron canadum</i>)	X	X	X	X
red drum (<i>Sciaenops ocellatus</i>)	X	X	X	X
sandbar shark (<i>Charcharinus plumbeus</i>)		X	X	X

APPENDIX D

SHORELINE MANAGEMENT PLAN
PLATES

Existing Conditions

Note: Net movement of sands alongshore is in the upriver direction and littoral processes are very much influenced by individual storm activity.

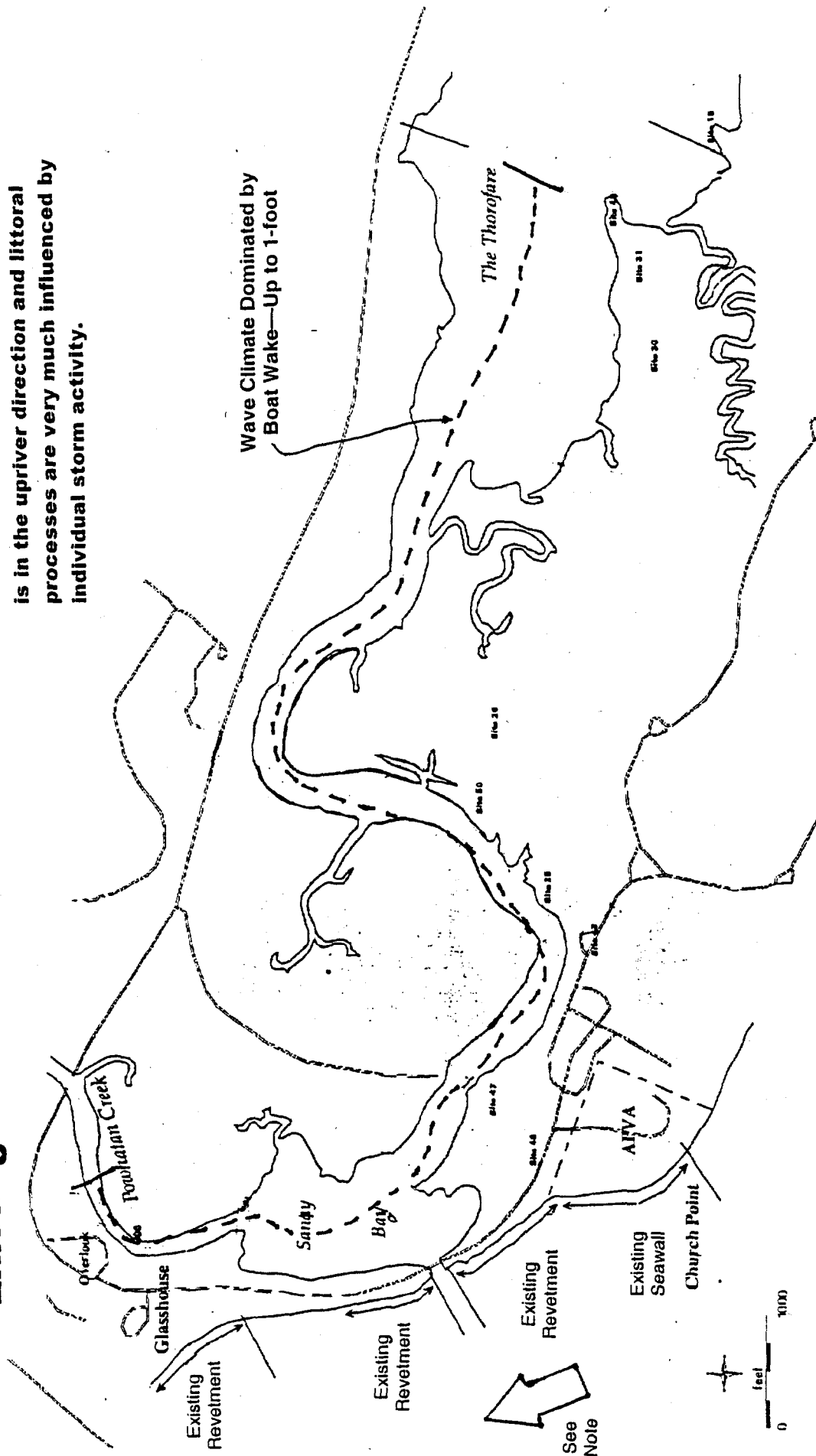


Plate 1—Study Area Shoreline #1

Existing Conditions

Church Point

New Towne

APWA

Sta. 30

Sta. 32

Sta. 34

Sta. 36

Sta. 51

Sta. 52

Sta. 53

Sta. 55

Inlet

Existing Revetment

Existing Revetment

Existing Revetment

Lower Point

James River

Slight Transport of Sediment
in the Downdrift Direction
3-Foot Nearshore Wave

0 1000 feet

James River

Lower Point

2

25

2

10

42-20

4

1

100

Revetment

Existing Revetment

Existing

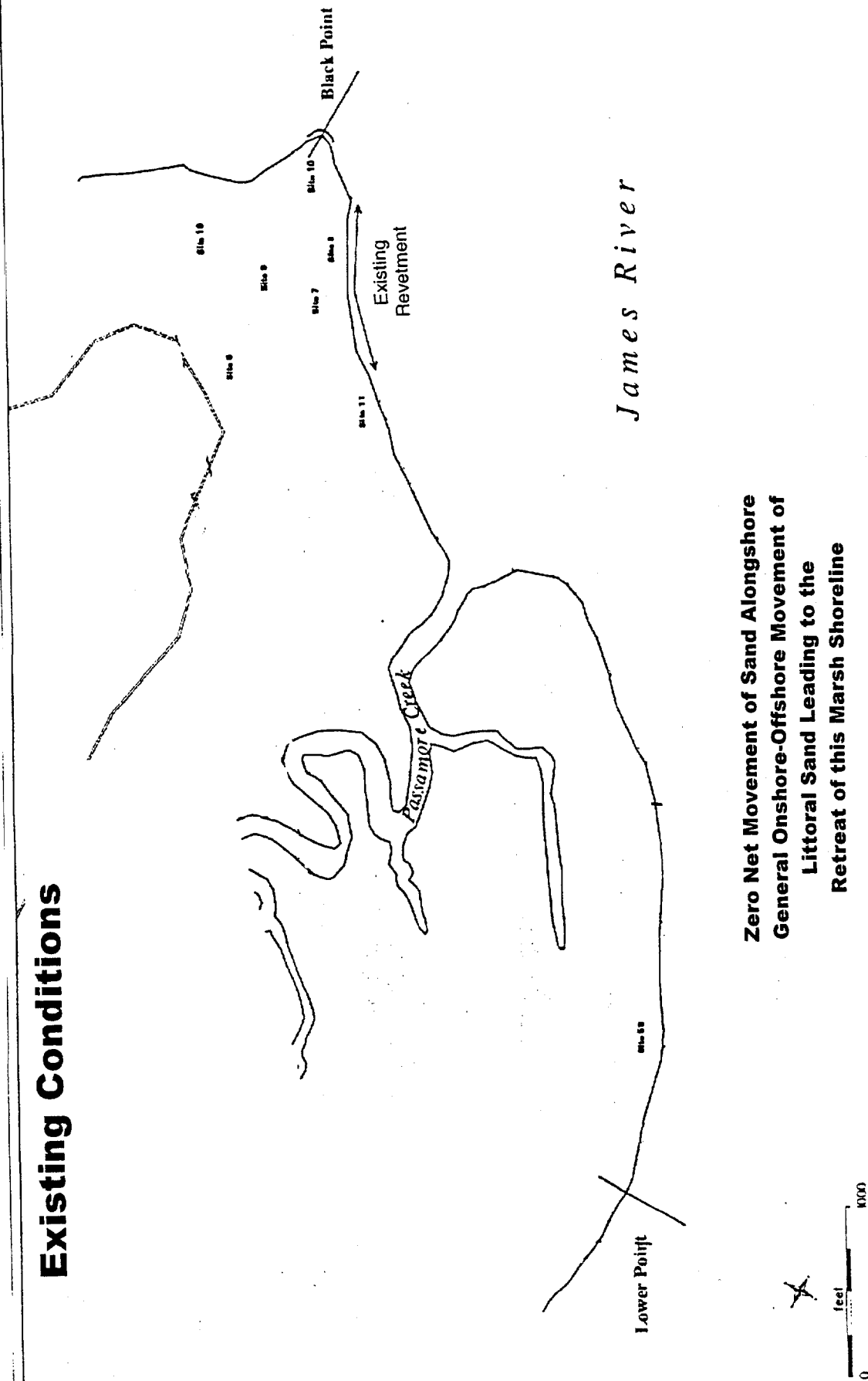
New

ATP

Church Point

Plate 2—Study Area Shoreline #2

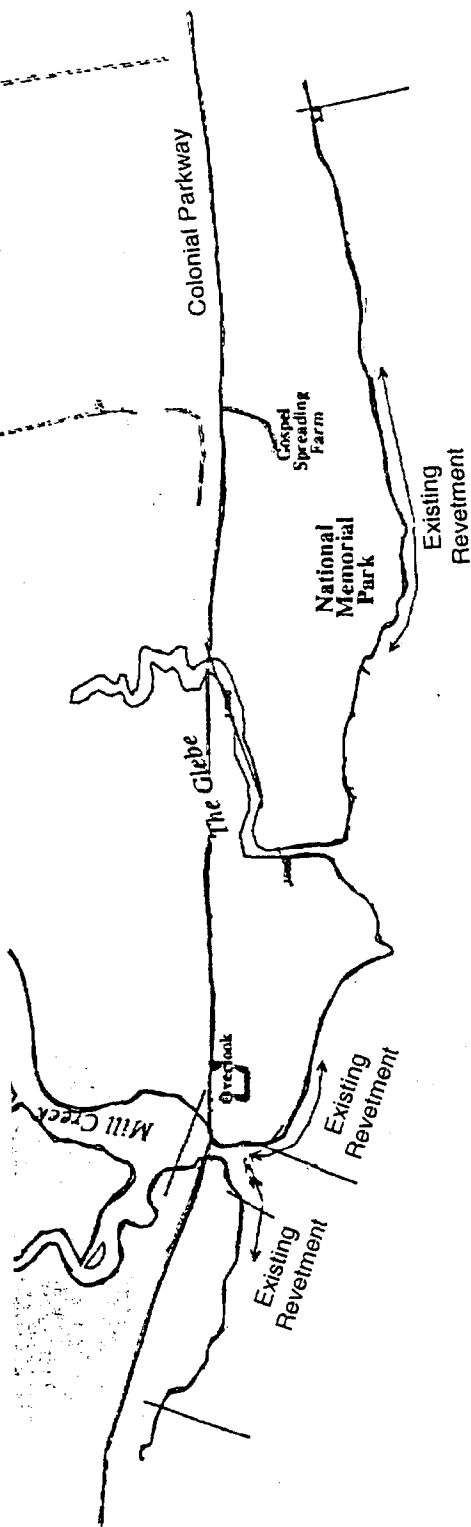
Existing Conditions



Zero Net Movement of Sand Alongshore
General Onshore-Offshore Movement of
Littoral Sand Leading to the
Retreat of this Marsh Shoreline

Plate 3—Study Area Shoreline #3

Existing Conditions



Transport of Sediment
in the Downriver Direction
2- to 3-Foot Wave



James River

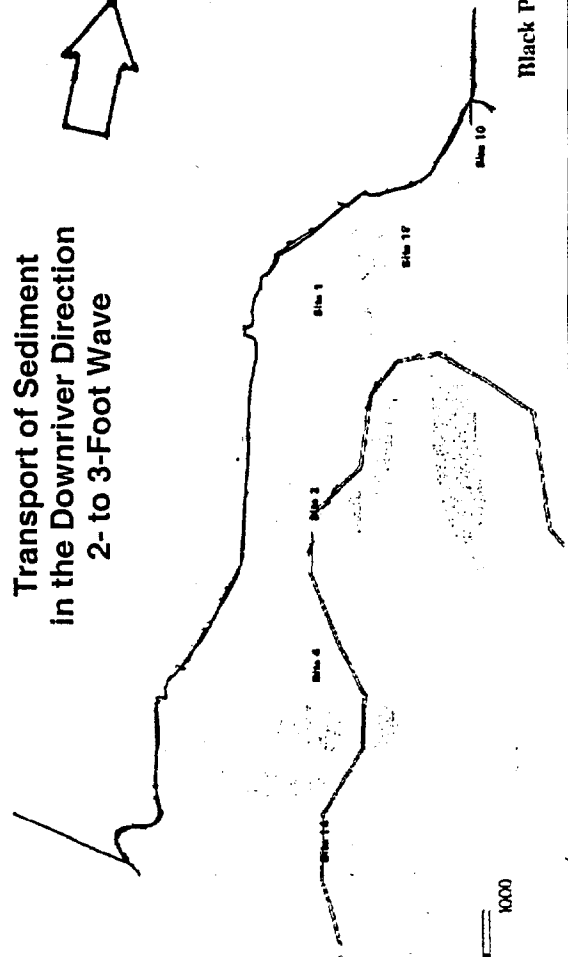


Plate 4—Study Area Shoreline #4

Existing Conditions

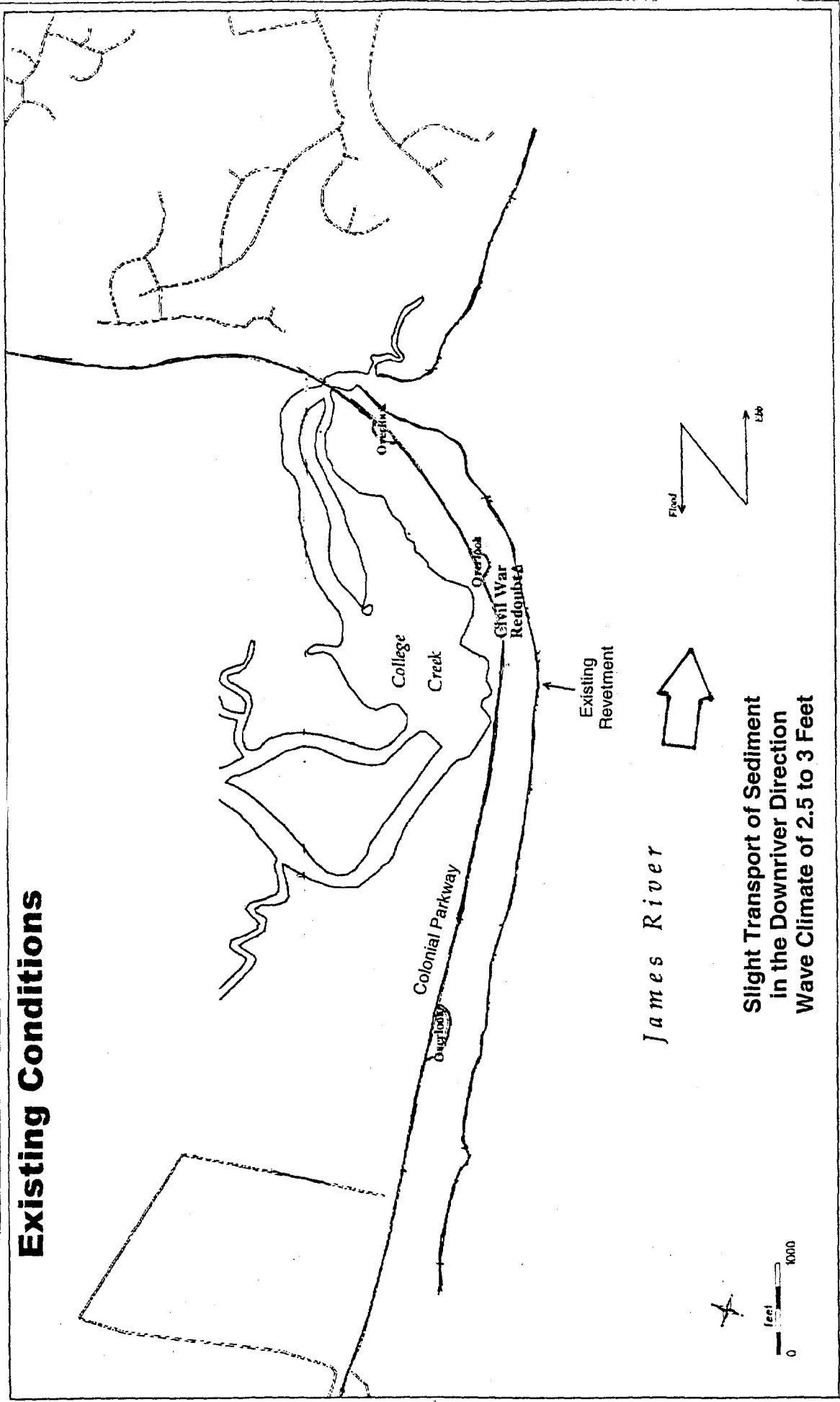


Plate 5—Study Area Shoreline #5

Locations of Alternative 1 (A1) Structures

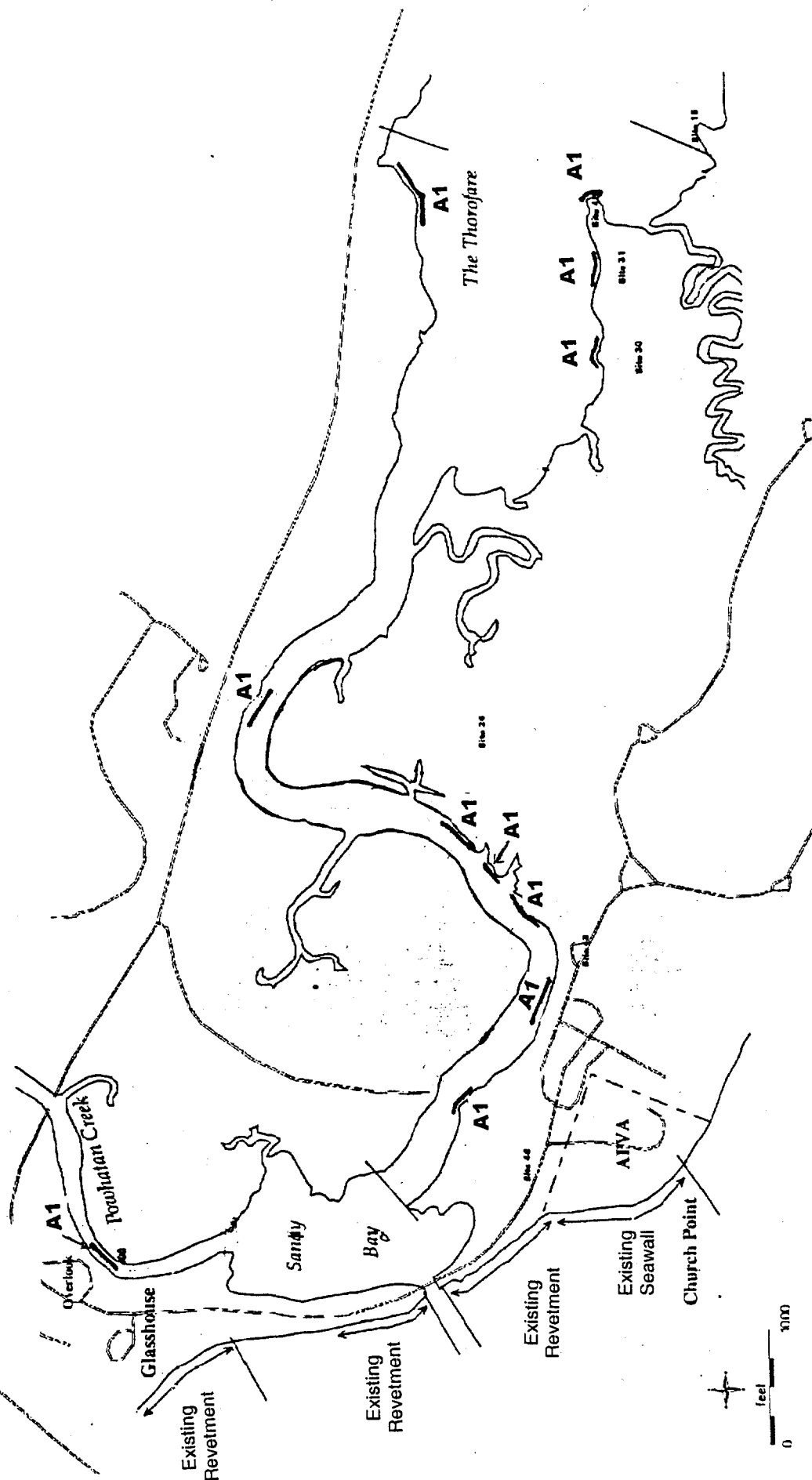
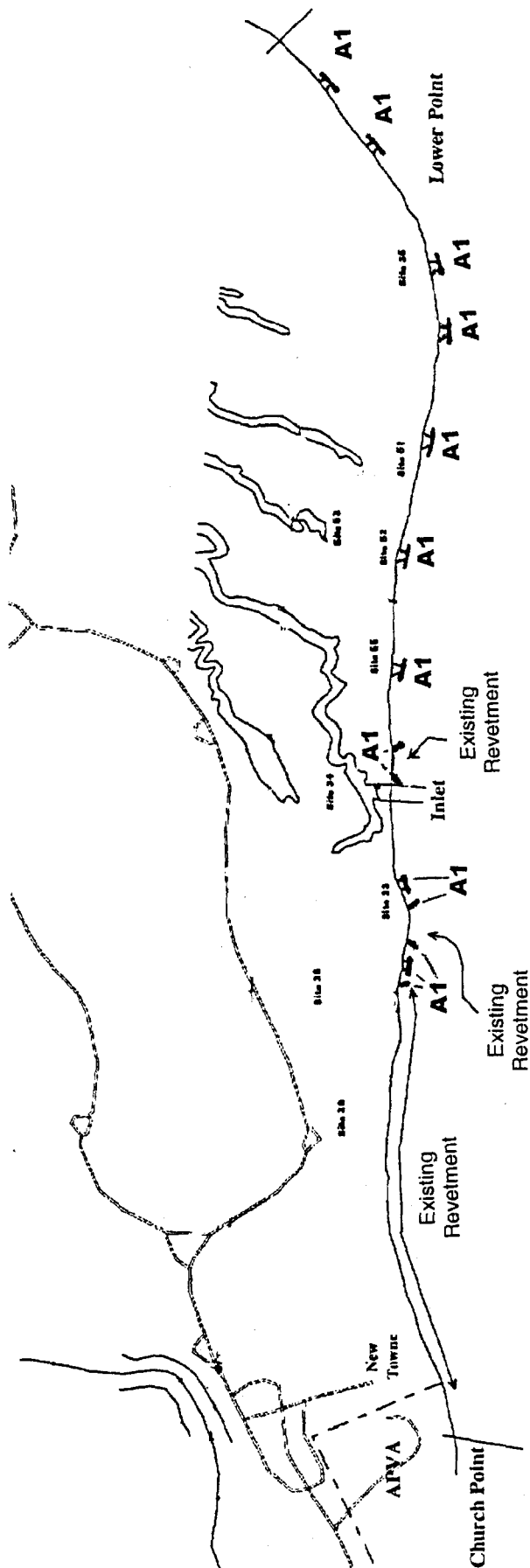


Plate 6—Location of Alternative 1 Structures along the Study Area Shoreline #1

Locations of Alternative 1 (A1) Structures



James River

Plate 7—Location of Alternative 1 Structures along the Study Area Shoreline #2

Locations of Alternative 1 (A1) Structures

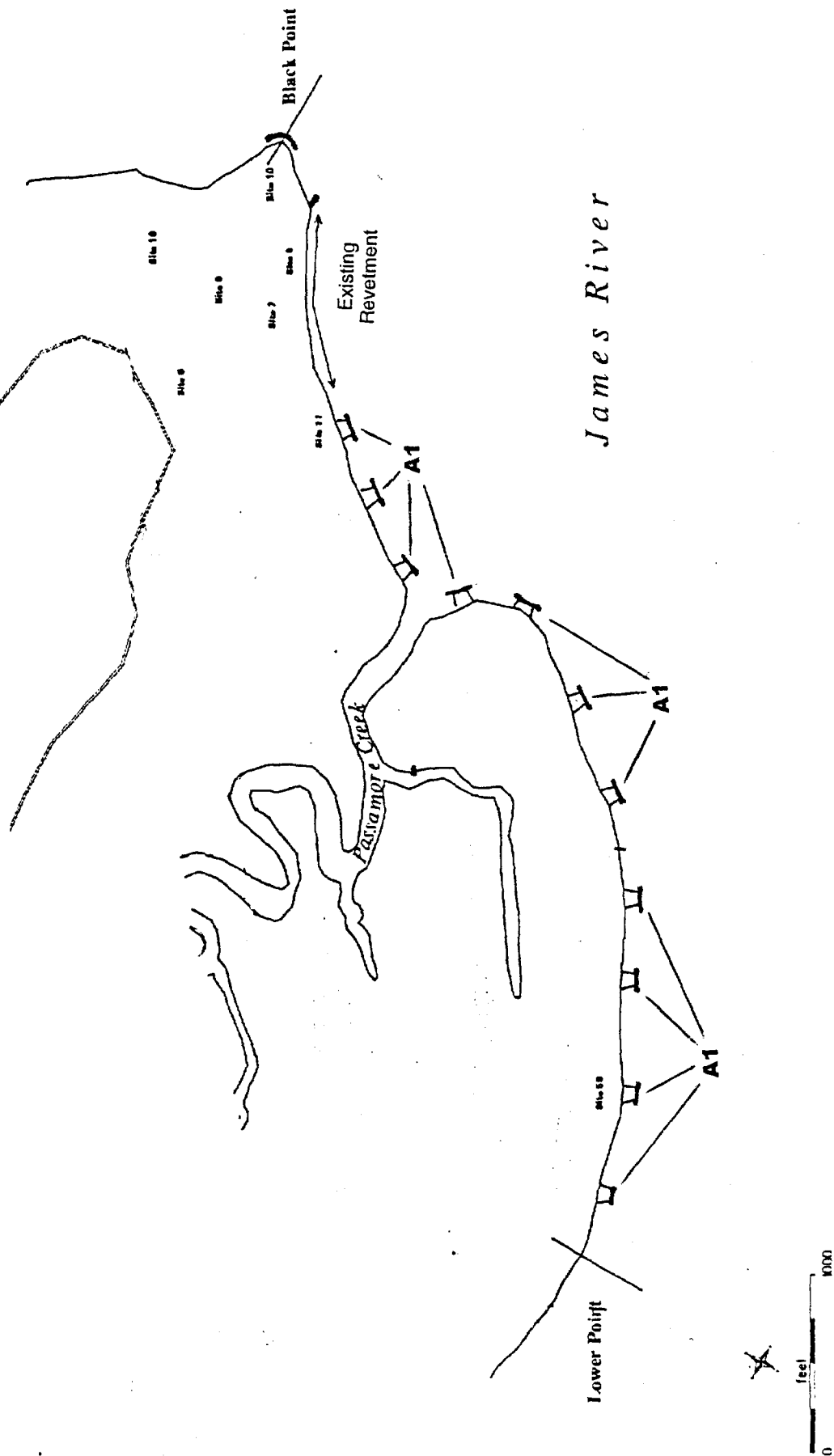


Plate 8—Location of Alternative 1 Structures along the Study Area Shoreline #3

Locations of Alternative 1 (A1) Structures

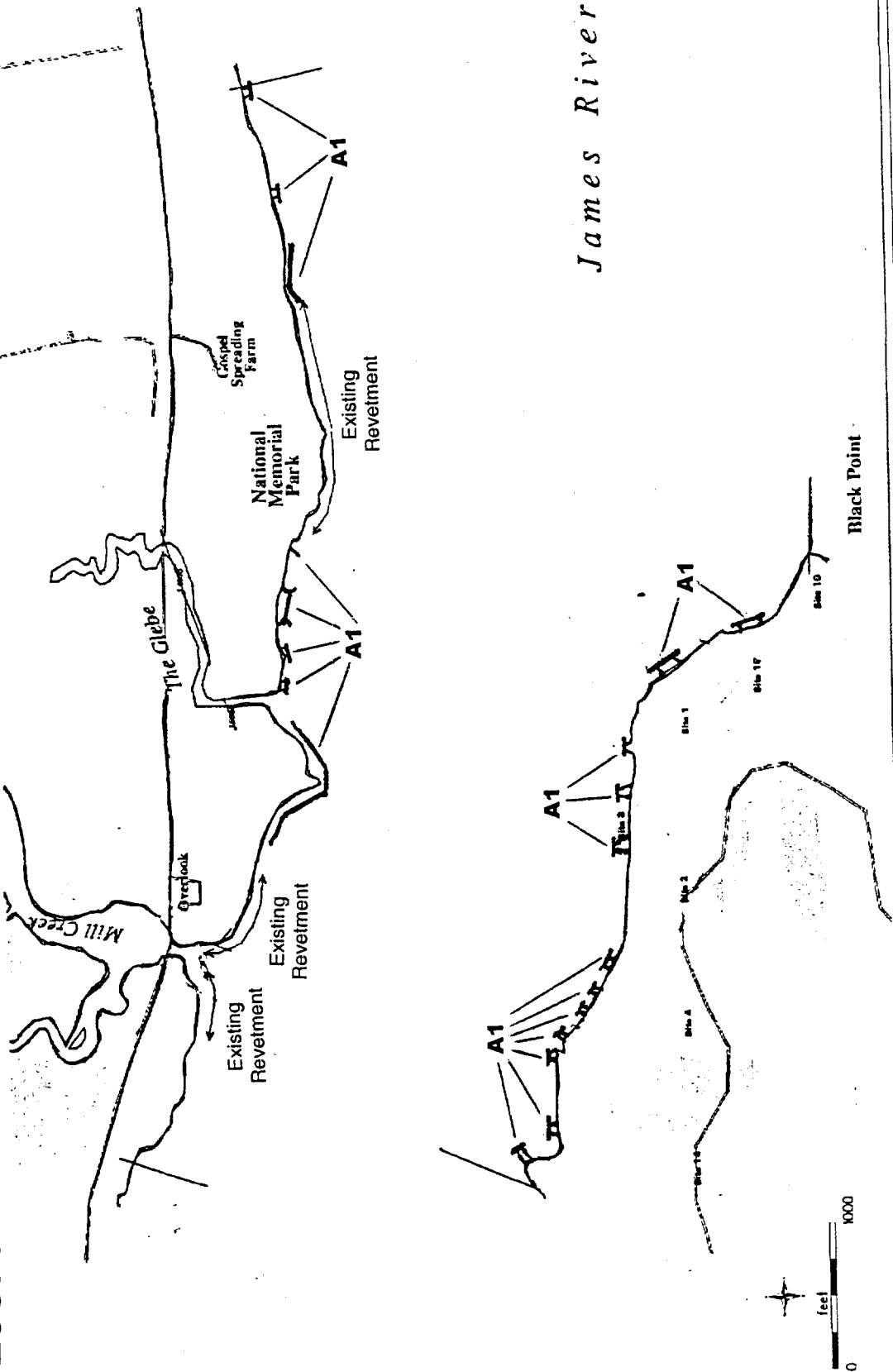


Plate 9—Location of Alternative 1 Structures along the Study Area Shoreline #4

Locations of Alternative 1 (A1) Structures

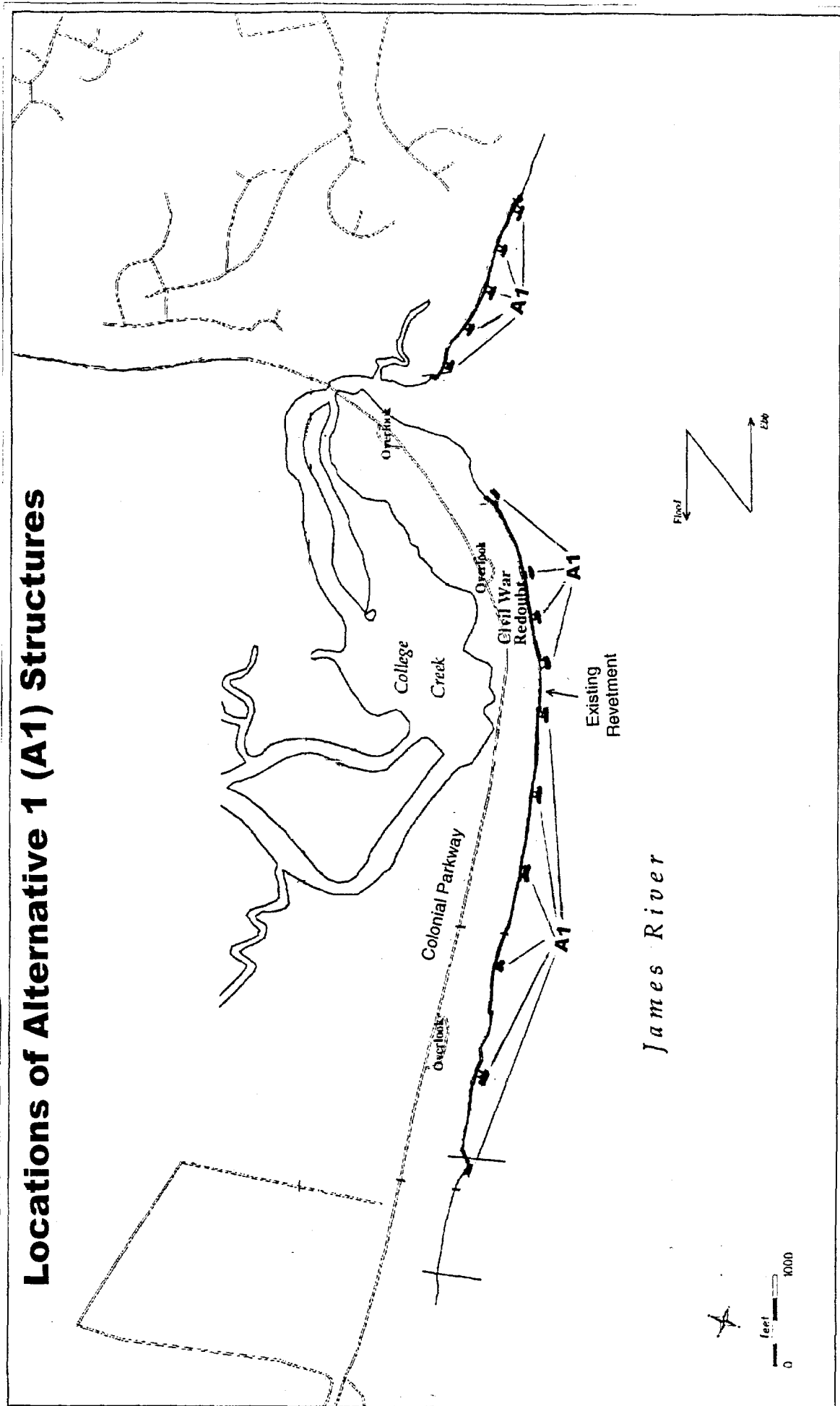
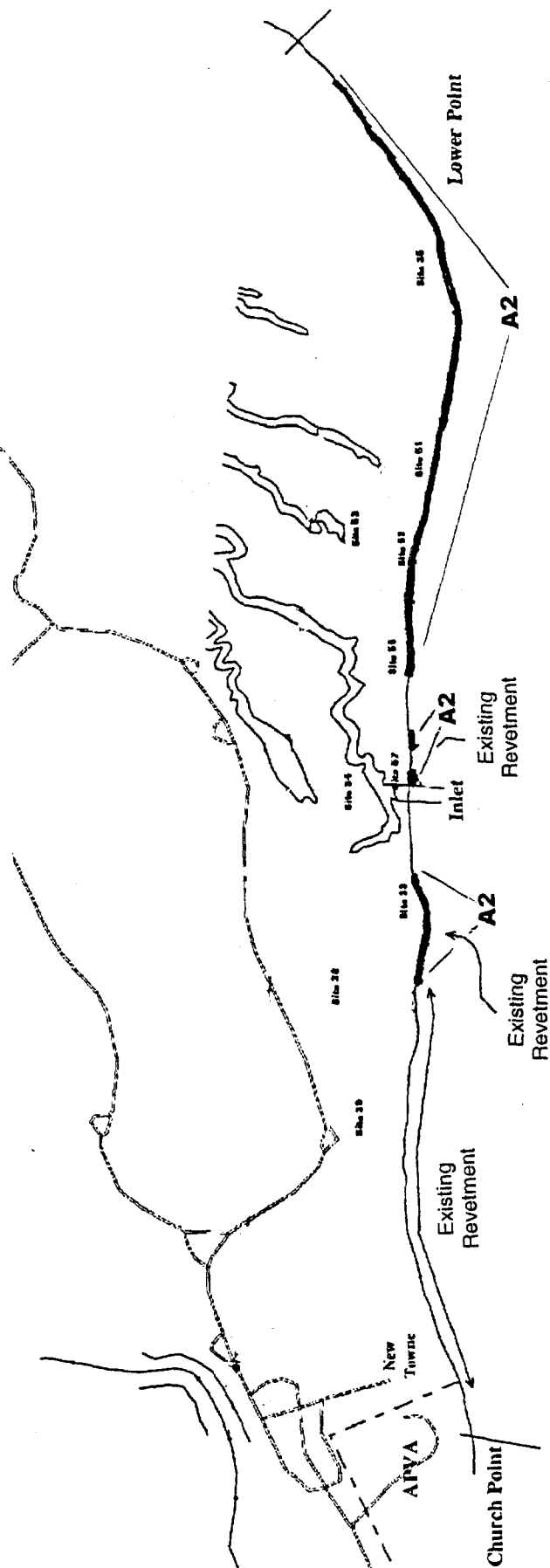


Plate 10—Location of Alternative 1 Structures along the Study Area Shoreline #5

This map illustrates the proposed A2 road alignment around Sandy Bay. The road is shown as a solid line, with sections labeled 'A2' and 'Site 26' through 'Site 31'. The map also shows the 'Existing Revetment' as a dashed line. Key locations include 'Poultatun Creek', 'Glasshouse', 'Church Point', and 'AITVA'. A scale bar indicates distances in feet (0 to 1000), and a north arrow is present.

Plate 11—Location of Alternative 1 Structures along the Study Area Shoreline #1

Locations of Alternative 2 (A2) Structures



James River

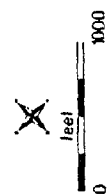


Plate 12—Location of Alternative 1 Structures along the Study Area Shoreline #2

Locations of Alternative 2 (A2) Structures

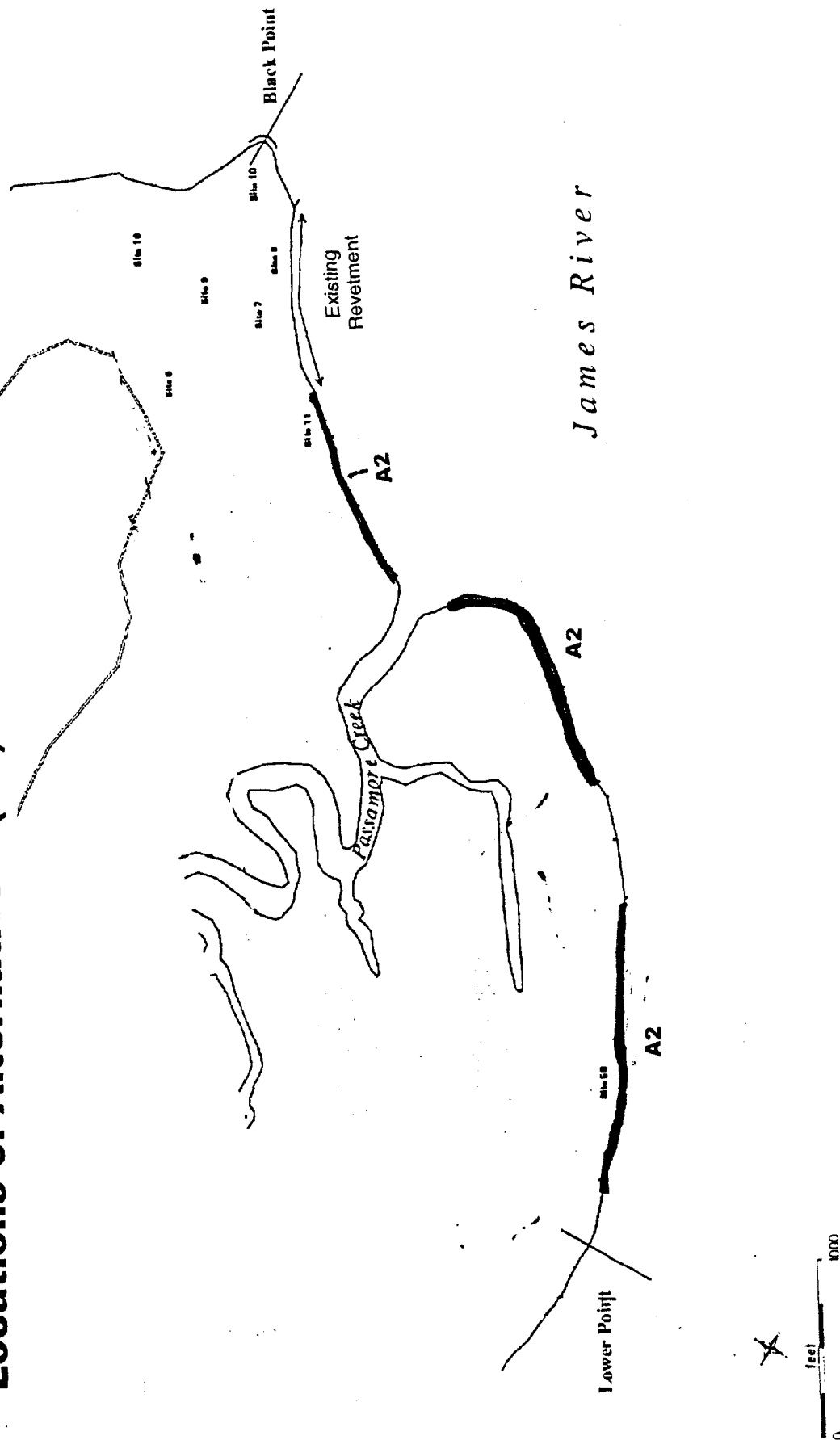


Plate 13—Location of Alternative 1 Structures along the Study Area Shoreline #3

Locations of Alternative 2 (A2) Structures

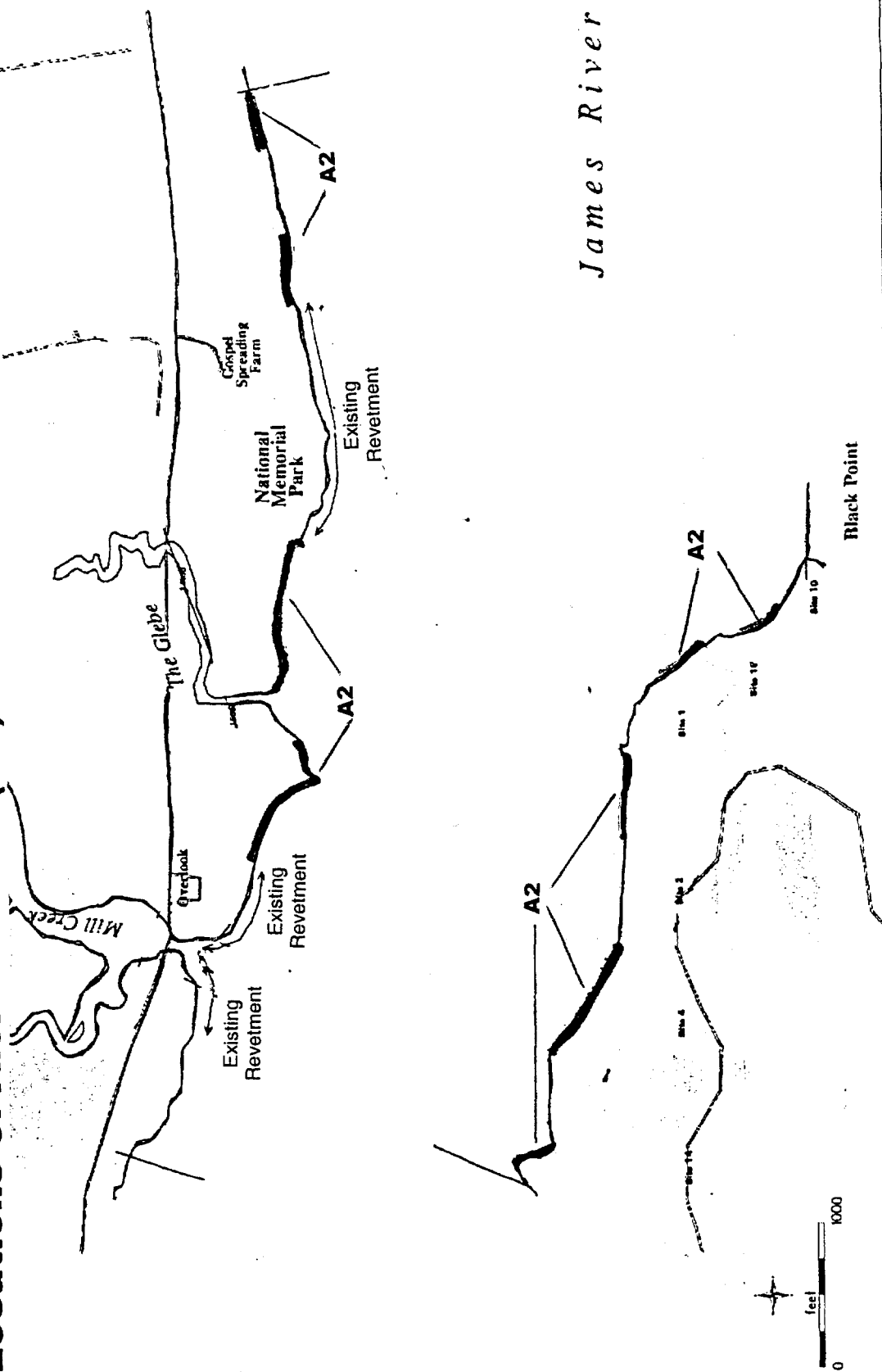


Plate 14—Location of Alternative 1 Structures along the Study Area Shoreline #4

Locations of Alternative 2 (A2) Structures

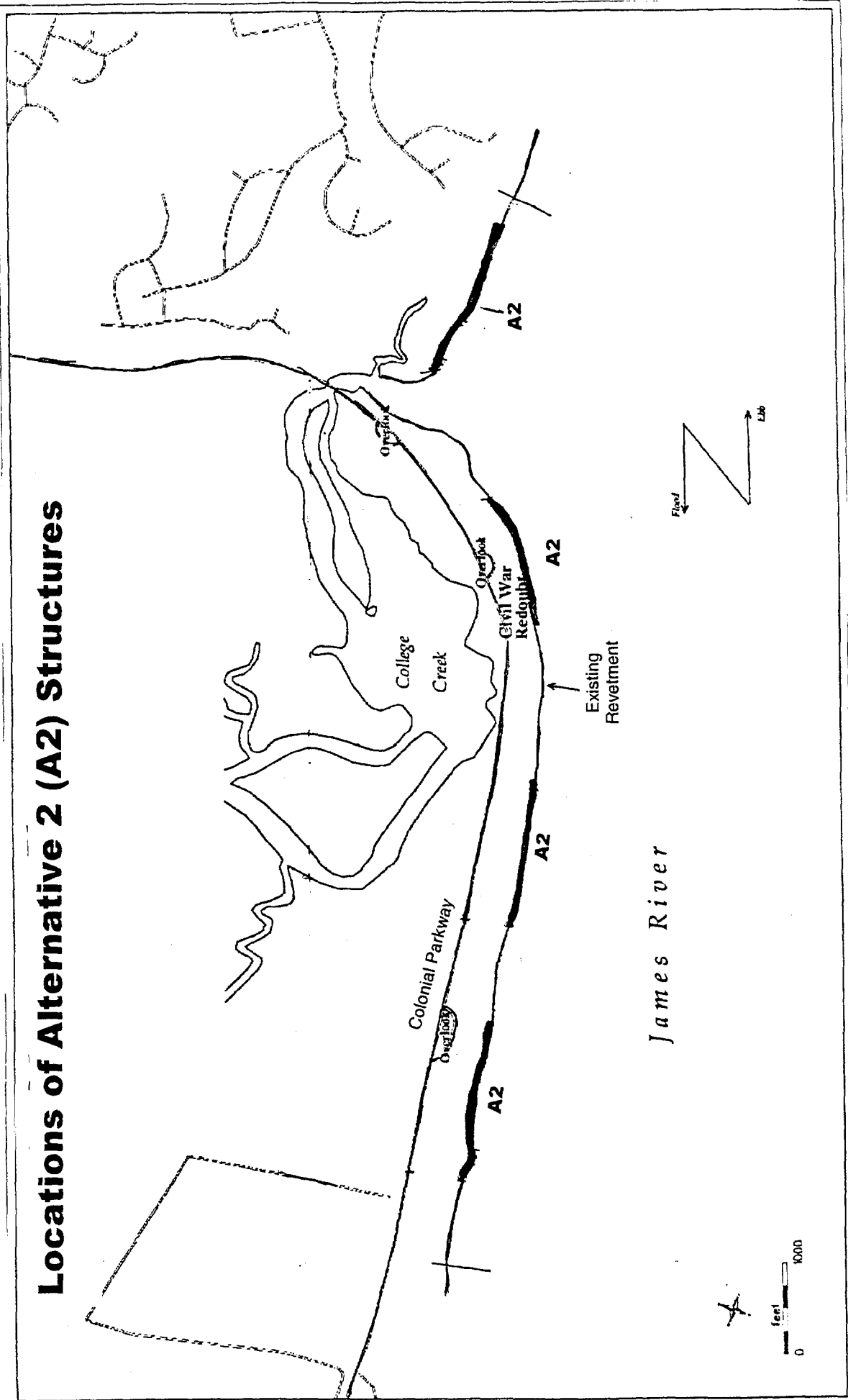


Plate 15—Location of Alternative 1 Structures along the Study Area Shoreline #5

APPENDIX E
STATEMENT OF FINDING

WETLAND STATEMENT OF FINDINGS

SHORELINE MANAGEMENT COLONIAL NATIONAL HISTORICAL PARK JAMESTOWN ISLAND, VIRGINIA

November 2001

RECOMMENDED: _____
SUPERINTENDENT, DATE

CERTIFIED FOR TECHNICAL ADEQUACY AND SERVICEWIDE CONSISTENCY:

CHIEF, WATER RESOURCES DIVISION, NPS DATE

APPROVED: _____
REGIONAL DIRECTOR, REGION DATE

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

INTRODUCTION

The National Park Service (NPS) has prepared an environmental assessment (EA) to evaluate a proposed shoreline management project at Colonial Historical Park, Jamestown Island, Virginia. Because the shoreline project is expected to affect wetlands, the resource must be analyzed in an environmental document, and a federal permit must be acquired for construction in and placement of fill on the wetlands. Executive Order 11990 requires the NPS to evaluate project impacts to wetlands. The goals presented in the Executive Order are to avoid, to the extent possible, the short- and long-term adverse impacts associated with destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

The NPS has chosen a proposed action for this EA. Both the proposed action and its compared alternative involve impact to wetlands. The purpose of this Statement of Findings is to provide rationale for locating the proposed actions in the wetlands and to document the expected effects on wetland functions and values.

The NPS has described agency policies for compliance with Executive Order 11990 in Director's Order 77-1: Wetland Protection and Procedural Manual #77-1: Wetland Protection. These policies and procedures stress exploring all practicable alternatives to building on or working in wetlands. NPS policies define a wetland as any area classified as wetland habitat according to the U.S. Fish and Wildlife Service's "Classification of Wetlands and Deepwater Habitats of the U.S." (Cowardin et al. 1979). The NPS must follow the steps below during development of proposed actions that have the potential to have adverse impacts on wetlands:

- 1) avoid adverse wetland impacts to the extent practicable,
- 2) minimize impacts that could not be avoided, and
- 3) compensate for remaining unavoidable adverse wetland impacts via restoration of degraded wetlands.

This sequencing process ensures that the project also meets the requirements of Section 404 of the Clean Water Act. A project must meet these requirements before the U.S. Army Corps of Engineers can issue a Section 404 wetland fill permit. NPS guidelines require a "Statement of Findings" to be written justifying any unavoidable impacts to wetlands. In addition, National Park Service policy requires wetland impact compensation if the adverse impacts on wetlands from the entire project total 0.1 acre or more. Compensation in the form of restoration of degraded or former wetland habitat is preferred. NPS

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

guidance states that wetland compensation should, first, occur within the same wetland system or, second, occur within the same watershed or, third, occur within the same park unit.

Proposed Project Description

The National Park Service (NPS) proposes to develop and implement erosion control measures at the Colonial National Historical Park (COLO) that would stabilize eroding shorelines that are impacting or have the potential to impact significant archaeological sites. The measures would stop the progress of ongoing erosion generated by both anthropogenic and natural wave forces by establishing vegetative wetland fringes with the use of rock sills and breakwaters. The specific purposes of the actions described in this environmental assessment include the following:

- Protect historic and pre-historic archaeological sites
- Protection, maintenance, enhancement and/or creation of wetlands habitat both vegetated and non-vegetated.
- Management of upland runoff and groundwater flow through the maintenance of vegetated wetland fringes.
- Minimize potential secondary impacts to downdrift shores through a reduction in the sand supply or the encroachment of structures onto subaqueous land and wetlands.
- For Jamestown and environs, a proposed shoreline strategy should not interfere with historical interpretation.
- Minimize the impacts from the staging of equipment and materials during construction.

There is an immediate need to take action on the erosion problems at significant archeological sites on Jamestown Island and the Colonial Parkway. The continuing erosion of shoreline areas adjacent to (and in some cases in the middle of) significant archeological sites threatens the permanent loss of these resources. (Appendix A, Figures 1-2).

WETLAND TYPES AND THEIR FUNCTIONS AND VALUES

Mud flats are thick layers of fine-grained sediments that occur along the margins of relatively calm, highly saline waters. They are typically classified as non-vegetated wetlands, with a rich concentration of phytoplankton and other microscopic and submicroscopic life forms, as well as a large assortment of invertebrates. Mud flats are partially flooded on a daily basis. These mud flats are prevalent in the tidal creeks and guts that are prevalent in and around Jamestown Island.

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

Salt marshes are often found directly landward of mud flats, and also occur in low-lying areas that are close enough to saline water bodies to be flooded on a regular basis. Vegetation in Jamestown Island salt marshes consists primarily of various species of cordgrass, saltgrass, and saltbushes. Maps have been prepared by VIMS, which depict the distribution of tidal wetlands in the project area (figures 14 and 15). The following narrative is taken from the VIMS tidal marsh inventory for James City County (Moore 1980).

"Historic Jamestown Island, which contains over 706 acres of tidal wetlands, is located in a zone of the James River which marks the upper limits of saltwater. As such, one generally finds the waters surrounding the island to be quite fresh during the spring but somewhat brackish during the fall. This upper limit of saltwater intrusion is evident within the vegetative patterns of the various tidal creeks. In most of these areas freshwater species such as arrow arum dominate the upstream areas, while brackish water species such as big cordgrass and saltmarsh cordgrass are found near the mouths.

Back River Marsh is one of the largest wetland areas on the island and it consists of extensive stands of wild rice and arrow arum as well as large areas of big cordgrass. Kingsmill Creek is dominated for most of its length by big cordgrass but grades to an upstream portion of reduced salinity known as Pitch and Tar Swamp, where such species as cattails and arrow arum are most abundant. At the most upstream section of this creek these marsh species are being replaced by pioneer swamp species including red maple and black gum.

Passmore Creek contains the most extensive wetlands acreage on Jamestown Island. The lower sections of the creek system are for the most part again dominated by big cordgrass. At the heads of the numerous branches, which are located between a series of ancient beach ridges, arrow arum and wild rice dominate. Active erosion along the western face of the island is slowly truncating these ridge and marsh areas. But because the waves also maintain a shallow sand beach along this retreating shoreline, drainage continues east to Passmore Creek rather than directly into the James River."

In addition to Jamestown Island proper, the College Creek shoreline on the James River to the east is also a proposed project site (see Appendix D, Plate 5). As depicted on figure 15 (VIMS tidal marsh inventory for College Creek), location number 75 (project site) is described by the VIMS inventory as predominantly a *Spartina cynosuroides*, big cordgrass (30%), *Spartina patens*, saltmeadow grass (25%), and remainder a mixture of marsh mallow (*Kosteletzkya virginica*), marsh hibiscus (*Hibiscus*

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

moscheutos), arrow arum (*Peltandra virginica*), and smartweed (*Polygonum spp.*). The high marsh fringe is mixed with myrtle and pine.

The salt marshes of Jamestown Island and vicinity are populated by a large variety of invertebrates, mammals, waterfowl and other birds.

All of the wetlands in the project area have special value because they are located within a national park, where citizens expect the landscape to remain undisturbed, and where people expect to be able to see and learn about unique natural features.

ALTERNATIVES AND IMPACTS

Three alternatives are described in detail in the project EA and are briefly described below:

- a) No Action Alternative
- b) Alternative 1 – Proposed Action – Shoreline erosion control by means of breakwaters, stone revetments, sills, and vegetated wetland creation.
- c) Alternative 2 –Shoreline erosion control by means of cantilevered vertical sheel sheet-pile bulkheads.

Other alternatives considered early in the project but dismissed.

Two other shoreline erosion control alternatives were evaluated, but dismissed after undergoing the National Park Service CBA process. These included sand nourishment (beach fill) and groins. Sand nourishment was eliminated because of high maintenance costs and the potential to encourage the use of the shoreline for recreational purposes. Groins were eliminated because of potential hazards to navigation and the potential to increase erosion along down drift shorelines.

No Action Alternative:

Under the no-action alternative, erosion of the Jamestown Island shoreline would continue indefinitely leading to the loss of valuable historic and cultural resources.

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

Alternative 1: Shoreline Management Plan (Proposed Action)

Under Alternative 1, a series of breakwaters, sills, and revetments would be constructed along erosional areas of the Jamestown Island shoreline that would control the erosion being experienced and prevent the loss of valuable historic and cultural resources.

Alternative 2: Bulkhead Plan (Proposed Action)

Under Alternative 2, a series of bulkheads would be constructed along erosional areas of the Jamestown Island shoreline that would control the erosion being experienced and prevent the further loss of valuable historic and cultural resources.

Impacts of No Action Alternative on Wetlands

Currently, wind-wave erosion (on the James River and the Thorofare) and boat wake (on Back River) results in the loss of vegetated wetlands along much of the Jamestown Island shoreline. The continued erosion of the Jamestown Island shoreline as is currently occurring under the no action alternative would continue to result in the loss of existing vegetated wetlands that are currently located along many stretches of shoreline.

Impacts of Alternative 1 on Wetlands.

Nonvegetated estuarine intertidal and subtidal habitats would be affected to varying degrees with the implementation of Alternative 1. These habitat zones will be adversely impacted as a result of the fill required for the vegetative fringe (in the intertidal zone) of approximately 2.66 acres and the placement of rock structures (in the subtidal zone) of approximately 3.06 acres. All of the structures will provide protection to existing vegetated wetland areas as well as increase the acreage of estuarine intertidal emergent wetland habitat (salt marsh). Currently, wind-wave erosion (on the James River and the Thorofare) and boat wake (on Back River) results in the loss of vegetated wetlands along much of the Jamestown Island shoreline. Construction of sills, breakwaters, and accompanying fill will not only protect existing vegetated wetlands but will also provide intertidal areas for establishment of saltmarsh wetland habitat along the water's edge. The following table presents a break down of wetland impacts as well as the proposed intertidal emergent wetland acreages.

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

moscheutos), arrow arum (*Peltandra virginica*), and smartweed (*Polygonum spp.*). The high marsh fringe is mixed with myrtle and pine.

The salt marshes of Jamestown Island and vicinity are populated by a large variety of invertebrates, mammals, waterfowl and other birds.

All of the wetlands in the project area have special value because they are located within a national park, where citizens expect the landscape to remain undisturbed, and where people expect to be able to see and learn about unique natural features.

ALTERNATIVES AND IMPACTS

Three alternatives are described in detail in the project EA and are briefly described below:

1. No Action Alternative
2. Alternative 2 – Proposed Action – Shoreline erosion control by means of breakwaters, stone revetments, sills, and vegetated wetland creation.
3. Alternative 3 –Shoreline erosion control by means of cantilevered vertical sheel sheet-pile bulkheads.

Other alternatives considered early in the project but dismissed.

Two other shoreline erosion control alternatives were evaluated, but dismissed after undergoing the National Park Service CBA process. These included sand nourishment (beach fill) and groins. Sand nourishment was eliminated because of high maintenance costs and the potential to encourage the use of the shoreline for recreational purposes. Groins were eliminated because of potential hazards to navigation and the potential to increase erosion along down drift shorelines.

No Action Alternative:

Under the no-action alternative, erosion of the Jamestown Island shoreline would continue indefinitely leading to the loss of valuable historic and cultural resources.

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

Alternative 1: Shoreline Management Plan (Proposed Action)

Under Alternative 1, a series of breakwaters, sills, and revetments would be constructed along erosional areas of the Jamestown Island shoreline that would control the erosion being experienced and prevent the loss of valuable historic and cultural resources.

Alternative 2: Bulkhead Plan (Proposed Action)

Under Alternative 2, a series of bulkheads would be constructed along erosional areas of the Jamestown Island shoreline that would control the erosion being experienced and prevent the further loss of valuable historic and cultural resources.

Impacts of No Action Alternative on Wetlands

Currently, wind-wave erosion (on the James River and the Thorofare) and boat wake (on Back River) results in the loss of vegetated wetlands along much of the Jamestown Island shoreline. The continued erosion of the Jamestown Island shoreline as is currently occurring under the no action alternative would continue to result in the loss of existing vegetated wetlands that are currently located along many stretches of shoreline.

Impacts of Alternative 1 on Wetlands.

Nonvegetated estuarine intertidal and subtidal habitats would be affected to varying degrees with the implementation of Alternative 1. These habitat zones will be adversely impacted as a result of the fill required for the vegetative fringe (in the intertidal zone) of approximately 2.66 acres and the placement of rock structures (in the subtidal zone) of approximately 3.06 acres. All of the structures will provide protection to existing vegetated wetland areas as well as increase the acreage of estuarine intertidal emergent wetland habitat (salt marsh). Currently, wind-wave erosion (on the James River and the Thorofare) and boat wake (on Back River) results in the loss of vegetated wetlands along much of the Jamestown Island shoreline. Construction of sills, breakwaters, and accompanying fill will not only protect existing vegetated wetlands but will also provide intertidal areas for establishment of saltmarsh wetland habitat along the water's edge. The following table presents a break down of wetland impacts as well as the proposed intertidal emergent wetland acreages.

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

Wetland and Deepwater Habitat Impacts Related to Alternative 1

Location Plate (Appendix D)				
	Impacted (ft ²)		Establish (ft ²) (proposed)	
	E2USN* (intertidal wetland)	E1UB2* (deepwater habitat)	E2RS2* (intertida l wetland)	E2EM1* (intertidal wetland)
I**	55,100	37,700	14,500	58,000
II	17,050	33,220	7,550	13,980
III	13,770	28,850	7,650	19,200
IV	23,990	27,060	7,275	20,850
V	6,000	6,600	1,500	4,575
Total	115,910	133,430	38,475	116,605
Total (acres)	2.66	3.06	0.88	2.68

*(Cowardin et al. 1979) Wetland Type or Deepwater Habitat Type:

E2USN = Estuarine, Intertidal, Unconsolidated Shore, Regularly Flooded Wetland

E1UB2 = Estuarine, Subtidal, Unconsolidated Bottom, Sand (deepwater habitat)

E2EM1 = Estuarine, Intertidal, Emergent Wetland, Persistent

E2RS2 = Estuarine, Intertidal, Rocky Shore, Rubble

** Erosion of the shoreline located on Plate I is primarily caused by boat wake.

Intertidal wetland areas (E2USN) impacted by the fill will be converted to emergent persistent intertidal wetlands (E2EM1). Compensation for these same intertidal habitat areas will be the structure rocks (E2RS2, 0.88 acres) that provide substrate and shelter for sessile species and the establishment of emergent persistent intertidal wetlands (E2EM1, 2.68 acres) landward of the structures. The compensation wetlands will be created from existing estuarine subtidal (i.e., nonwetland) habitat. They are therefore new wetland habitat above and beyond the intertidal wetland habitat (E2USN) that currently exists. Conversion of existing intertidal unconsolidated shore wetland (E2USN) to intertidal emergent wetland (E2EM1), as proposed in this project, is not counted as part of the compensation acreage.

There will be a net positive impact to vegetated wetlands with implementation of the proposed Shoreline Management Plan and a net adverse impact to unvegetated intertidal and subtidal habitats. A mitigation plan is presented that provides for establishment of 3.56 acres of new wetland habitat to compensate for the loss or alteration of 2.66 acres of wetlands (a compensation ratio of 1.34:1). While there may be some minor increases in erosion between the breakwater structures, where no sill is proposed, the long term benefits of erosion protection to existing wetlands and the creation of the

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

proposed wetlands far outweigh these effects. These impacts would not constitute an impairment of park resources and values. No cumulative impacts would be anticipated.

Impacts of Alternative 2 on Wetlands.

The implementation of Alternative 2 along the Jamestown Island shoreline would result in a net adverse impact to vegetated wetlands as the result of grading and filling associated with site preparation prior to the placement of the bulkhead. There would also be a net adverse (moderate), long-term impact to unvegetated intertidal and subtidal habitats as a result of the site preparation activities. Unprotected wetland areas located between sections of bulkheads could eventually be damaged or destroyed as continued erosion could flank the ends of the bulkheads. However, these impacts would not constitute an impairment of the park's resources and values. The loss of wetlands due to construction activities and placement of bulkheads would not (1) conflict with the purposes of the park, (2) damage or alter resources or values that are key to the natural or cultural integrity of the park or to opportunities for visitor enjoyment, or (3) conflict with a goal in the park's general management plan or other planning documents. No cumulative impacts would be anticipated.

WETLAND IMPACT MITIGATION MEASURES

The project (Alternative 1—proposed) was designed to avoid adverse environmental impacts to the greatest extent practicable. Several measures have been designed into the project to minimize impacts. These include implementation of best management practices such as temporary erosion control structures and adherence to management recommendations of DCR when working in areas adjacent to sensitive habitats, such as bald eagle nests and heron rookeries. This current shoreline is rapidly eroding, resulting in the loss of acres of shoreline wetland areas. While the project, as proposed, would directly and indirectly impact some wetlands, these losses would be exponentially compensated for via reduced erosion and wetland restoration related to shoreline protection features. Because of the protection of, and long-term net gains to, wetlands associated with the proposed project, no compensatory mitigation is recommended.

CONCLUSIONS

The National Park Service has identified Alternative 1 as the proposed action for providing protection to the eroding Jamestown Island shoreline. Wetland impact has been minimized to the practicable extent allowed by sound engineering and design and incorporating vegetated wetland creation

Wetland Statement of Findings— SHORELINE MANAGEMENT, COLONIAL NATIONAL HISTORICAL PARK, JAMESTOWN ISLAND, VIRGINIA

as a project feature. The proposed shoreline management project would adequately compensate for wetland loss caused by project implementation. Therefore, this project is consistent with Executive Order 11990 and Director's Order 77-1: Wetland Protection.

REFERENCES

Hardaway, C. S., Jr. and M. Hudgins. 1999. Colonial National Historical Park, Shoreline Management Plan for Jamestown Island, Powhatan Creek, Sandy Bay, Back River, The Thorofare, and James River Shorelines. Prepared by Virginia Institute of Marine Science and U.S. Army Corps of Engineers for National Park Service, Colonial National Historical Park.

National Park Service. 1998. Director's Order and Procedural Manual 77-1: Wetland Protection. U.S. Department of the Interior. Washington, D.C.

APPENDIX F
CORRESPONDENCE



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6669 Short Lane
Gloucester, Virginia 23061



August 23, 2000

Colonel Allan B. Carroll
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

→ Attn: Craig Seltzer
Environmental Analysis Team

Re: Shoreline Management Plan,
Jamestown Island, Virginia

Dear Colonel Carroll:

The U.S. Fish and Wildlife Service (Service) has reviewed the letter dated March 23, 2000 regarding the Shoreline Management Plan for Jamestown Island, Virginia. The Corps proposes to protect various shoreline locations surrounding Jamestown Island from continuing erosion. This letter constitutes the preliminary report of the Service and the Department of the Interior on the proposed project and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

The bald eagle (*Haliaeetus leucocephalus*) and sensitive joint vetch (*Aeschynomene virginica*), federally listed threatened species, are located within the project study area. Bald eagle nest (JC 87-01) is located less than one-quarter mile from locations currently under consideration for shoreline stabilization near the James River, south of Passmore Creek. A bald eagle summertime shoreline concentration area is located in the same vicinity. A population of sensitive joint vetch has been found on Back River, near the project study area. At least one wading bird nesting colony is located in the vicinity of the bald eagle nest, south of Passmore Creek (see enclosed map).

Section 7(a)(2) of the Endangered Species Act (Act) (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) requires a Federal agency to insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed threatened or endangered species, or result in the destruction or adverse modification of critical habitat. The regulations implementing this Act (50 CFR 402) require the Federal agency to review its actions at the earliest possible time to determine whether these actions may affect listed species. If the Federal action agency determines its actions may affect a listed species, formal consultation with the Fish and Wildlife

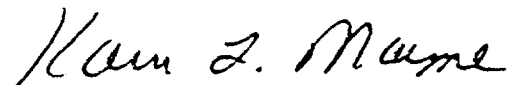
Service is required. If the Corps determines that the sensitive joint vetch or bald eagle may be affected by the proposed project, a request for formal consultation should be made to this office. In response to a request for formal consultation, the Service will submit a biological opinion to the Corps within 135 days after our receipt of your request.

For actions considered to be a major Federal construction activity significantly affecting the quality of the human environment (i.e. one requiring an EIS under the National Environmental Policy Act), Section 7(c) of the Act requires that the agency prepare a biological assessment to determine the effects of the project on any listed species or proposed species that may occur in the impact area. General recommendations for the preparation of a biological assessment are enclosed. We will be pleased to discuss the consultation process with you.

Depending on the scope of this project, formal Section 7 consultation for the bald eagle is likely. Regarding potential impacts to sensitive joint vetch, we may recommend surveys for this species if shoreline activities are proposed within Back River. Such surveys should be performed to allow time for the completion of Section 7 consultation, prior to final alternative selection and funding. Regarding potential impacts to the wading bird nesting colonies, depending on the timing and extent of proposed activities, the Service is likely to recommend time-of-year construction restrictions to protect wading birds during the nesting season.

The Service appreciates your coordination of this project with us. If you have questions, please contact William Hester at (804) 693-6694, ext. 134.

Sincerely,

A handwritten signature in cursive script that reads "Karen L. Mayne".

Karen L. Mayne
Supervisor
Virginia Field Office

Enclosure



United States Department of the Interior

FISH AND WILDLIFE SERVICE

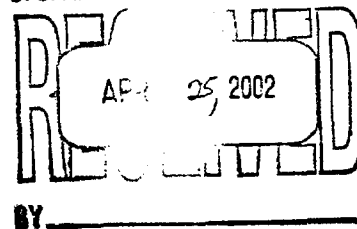
Ecological Services
6669 Short Lane
Gloucester, VA 23061



April 23, 2002

Colonel David L. Hansen
U.S. Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510-1096

U.S. ARMY CORPS OF ENGINEERS



Attn: Robert Pretlow
Regulatory Branch

Re: Shoreline Management at Colonial
National Historical Park, Jamestown
Island, Section 7-2446, James City
County, Virginia

Dear Colonel Hansen:

The U.S. Fish and Wildlife Service (FWS) has reviewed your March 29, 2002 Draft Environmental Assessment entitled "Shoreline Management, Colonial National Historical Park, Jamestown Island, Virginia." We have reviewed the document for potential impacts to federally listed and proposed endangered and threatened species and designated critical habitat for the above referenced project. The following comments are provided under provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

The National Park Service (NPS) proposes to protect the James River shoreline of Jamestown Island, Virginia by constructing breakwaters or bulkheads. NPS has incorporated the recommendations made by FWS, the Virginia Department of Game and Inland Fisheries, and the Virginia Department of Conservation and Recreation's Division of Natural Heritage to avoid and minimize potential impacts to the bald eagle (*Haliaeetus leucocephalus*), federally listed threatened. The distance and time of year restrictions proposed will adequately protect the eagle. FWS concludes that the proposed action is not likely to adversely affect the bald eagle or any other federally listed species.

If you have any questions, please contact Mr. Eric Davis at (804) 693-6694, extension 104.

Sincerely,


Karen L. Mayne
Supervisor
Virginia Field Office

cc: NPS, COLO, Yorktown, VA (Alec Gould)
VDGIF, Richmond, VA (Tom Wilcox)
VDGIF, Fredericksburg, VA (Jeff Cooper)
VDCR, DNH, Richmond, VA (Rene Hypes)

