National Park Service
U.S. Department of the Interior

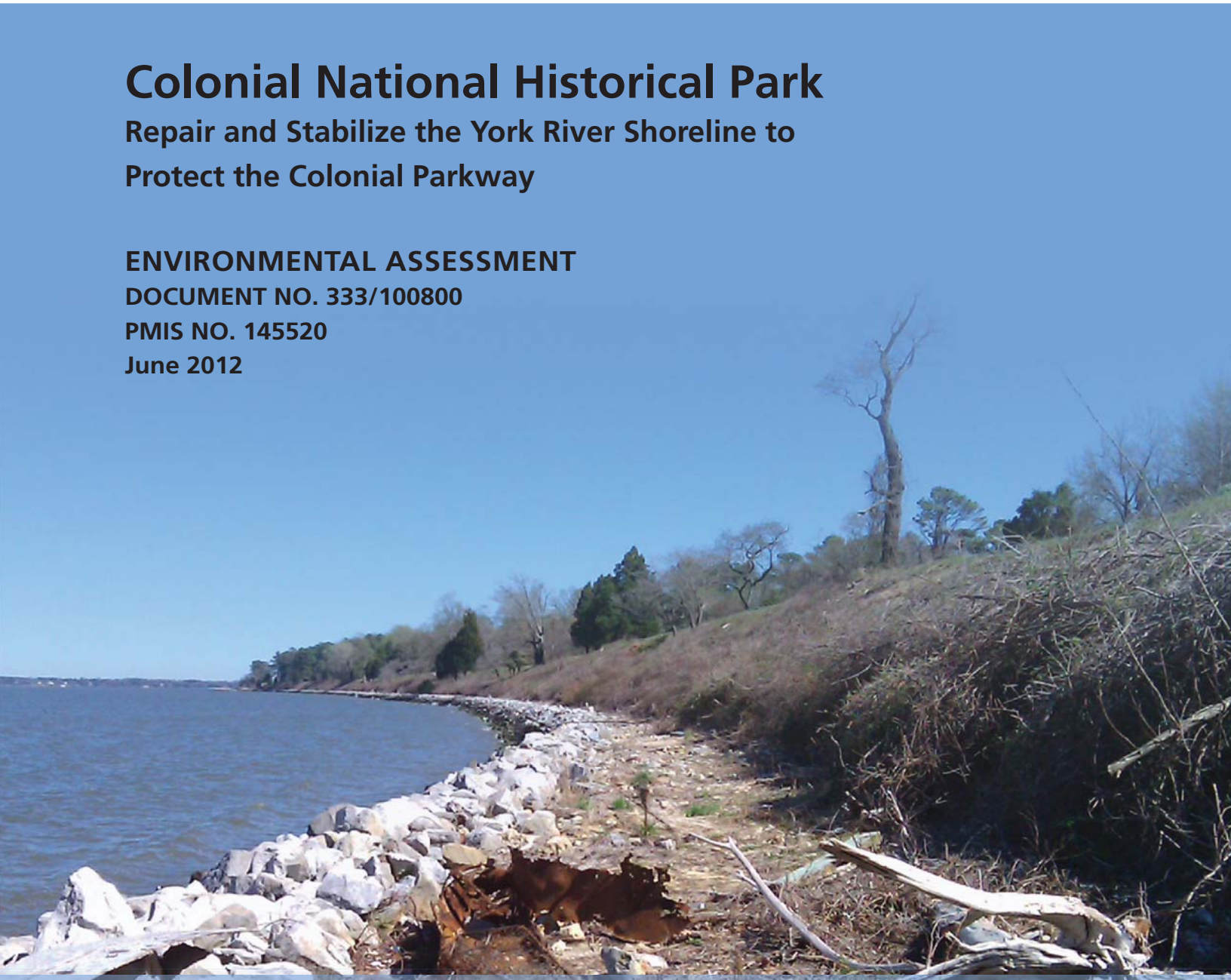
Colonial National Historical Park

Colonial National Historical Park

Repair and Stabilize the York River Shoreline to Protect the Colonial Parkway

ENVIRONMENTAL ASSESSMENT

DOCUMENT NO. 333/100800
PMIS NO. 145520
June 2012



U.S. Department of the Interior
National Park Service

Colonial National Historical Park
York County, Virginia

Repair and Stabilize the York River Shoreline to Protect the Colonial Parkway
Environmental Assessment

July 2012

Proposed Action: Colonial National Historical Park is located in York County, Virginia. Roughly 5.14 miles of the southern York River shoreline lie within the Yorktown Unit of the park. Artificial structures that defend the shoreline against wind-driven wave action are antiquated and are characterized by local failures, rendering them ineffective. Projected sea-level rise will exacerbate this problem. Repair and stabilization of the shoreline is needed to cease ongoing erosion and halt the landward migration of the shoreline. This erosion poses a direct threat to park resources, primarily the Colonial Parkway (the parkway). The parkway, a resource listed on the National Register of Historic Places, is the principal transportation link between the park's Yorktown and Jamestown Units. It lies just landward of the York River shoreline for a distance of 4.2 miles and is therefore particularly vulnerable. Archeological resources, estuarine wetlands, and public safety also are threatened by shoreline erosion.

The NPS proposes to repair the existing means of shoreline defense and install new structures within park property only, commencing near the confluence of Felgates Creek and the York River and continuing downstream to the boundary with the U.S. Coast Guard Training Center Yorktown. Actions needed to achieve these goals include the rehabilitation or installation of a combination of shoreline treatments, including rock revetments, rock spurs, continuous and gap sills, pocket beaches, and shore-attached breakwaters. Implementation of the NPS preferred alternative would result in long-term beneficial impacts to coastal resources and soils, wetlands, wildlife and wildlife habitat, vegetation, special status species, visitor use and experience, public safety, and infrastructure and park operations. Impacts to floodplains would be long-term, negligible and adverse. Construction of the NPS preferred alternative would result in short-term, negligible adverse impacts to wildlife and wildlife habitat, and short-term, minor adverse impacts on vegetated wetlands, vegetation, special status species, cultural landscapes, visitor use and experience, public safety, and both short and long-term minor adverse impacts on infrastructure and park operations. Impacts to cultural landscapes and historic resources would be long-term, negligible, and neither adverse nor beneficial (below the level of detection). The preliminary assessment of effect for archeological resources is that the project would have no effect. This finding is subject to further coordination with the State Historic Preservation Officer in accordance with a Programmatic Agreement made between the NPS and the Virginia State Historic Preservation Office per 36 CFR §800.14(b)(1)(ii).

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Note to Reviewers and Respondents:
This Environmental Assessment will be on public review for 30 days. If you wish to comment on this Environmental Assessment, you may mail comments to the name and address below or post them electronically at http://parkplanning.nps.gov/colo. Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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CONTENTS

Contents iii
List of Figures viii
List of Tables ix
Acronyms and Abbreviations x
Purpose and Need 1
Introduction 1
Purpose and Need for Action 5
Study Area Description 16
Project Background 16
Park Purpose and Significance 17
Relationship of Proposal to Other Planning Efforts 18
Scoping 20
Planning Issues and Concerns 21
Regulatory Issues and Management Concerns 22
Impact Topics Retained For Analysis 23
Impact Topics Dismissed from Further Analysis 26
Alternatives 31
Development of Alternatives 31
Guiding Principles 31
Shoreline Treatment Options 34
Study Reach Designations 37
Alternative 1: No Action 38
Reach IA 39
Reach I 39
Reach II 47
Reach III 47
Reach IV 48
Elements Common to All Action Alternatives 48
Alternative 2: NPS Preferred Alternative 51
Reach IA 51
Reach I 61
Reach II 65
Reach III 66
Reach IV 71
Alternative 3 71
Reach IA 71
Reach I 71
Reach II 79

Reach III 79
Reach IV 79
Value Analysis Study 79
Mitigation Measures 80
Coastal Resource and Soils / Wetland Resources / Wildlife and Wildlife Habitat 80
Vegetation 81
Special Status Species 82
Archeological Resources 82
Elements Considered but Dismissed 82
Summary Comparison of Alternatives 83
Summary Comparison of Impacts of the Alternatives 85
Environmentally Preferable Alternative 93

Affected Environment 95

Coastal Resources and Soils 95
Geology 95
Soils 96
Wave Climate 101
Nearshore Sediment Transport 101
Reach IA 102
Reach I 104
Reach II 105
Reach III 108
Reach IV 109
Wetland Resources 110
Regulatory Context 110
Wetland Delineation 110
Functions and Values Assessment 121
Floodplains 122
Wildlife and Wildlife Habitat 123
York River Estuary and Wildlife Habitat 123
Wildlife 123
Vegetation 135
Submerged Aquatic Vegetation (SAV) 135
Wetland Vegetation 136
Upland Vegetation 139
Invasive Species 140
Special Status Species 140
Federal And State Listed Species 140
Cultural Resources 144
Regulatory Framework 144
Cultural Landscapes 144
Historic Structures 145
Archeological Resources 146
Visitor Use and Experience 148
Public Safety 149
Infrastructure and Park Operations 151

Environmental Consequences 153

General Methodology for Assessing Impacts 153

Type of Impact 153
Context 154
Duration 154
Level of Intensity 154
Cumulative Impact Methodology 154
Coastal Resources and Soils 155
Methodology 155
Impacts of Alternative 1: No Action 156
Impacts of Alternative 2: NPS Preferred Alternative 157
Impacts of Alternative 3 159
Conclusion 160
Wetland Resources 161
Methodology 161
Impacts of Alternative 1: No Action 162
Impacts of Alternative 2: NPS Preferred Alternative 163
Impacts of Alternative 3 167
Conclusion 170
Floodplains 171
Methodology 171
Impacts of Alternative 1: No Action 172
Impacts of Alternative 2: NPS Preferred Alternative 172
Impacts of Alternative 3 173
Conclusion 174
Wildlife and Wildlife Habitat 174
Methodology 174
Impacts of Alternative 1: No Action 175
Impacts of Alternative 2: NPS Preferred Alternative 176
Impacts of Alternative 3 178
Conclusion 178
Vegetation 179
Methodology 179
Impacts of Alternative 1: No Action 180
Impacts of Alternative 2: NPS Preferred Alternative 180
Impacts of Alternative 3 181
Conclusion 182
Special Status Species 183
Methodology 183
Impacts of Alternative 1: No Action 184
Impacts of Alternative 2: NPS Preferred Alternative 184
Impacts of Alternative 3 185
Conclusion 185
Cultural Resources 186
Methodology 186
Impacts of Alternative 1: No Action 186
impacts of Alternative 2: NPS Preferred Alternative 187
Impacts of Alternative 3 188
Conclusion 189
Historic Structures 189
Methodology 189
Impacts of Alternative 1: No Action 190
impacts of Alternative 2: NPS Preferred Alternative 190

Impacts of Alternative 3 191
Conclusion 191
Archeological Resources 192
Visitor Use and Experience 193
Methodology 193
Impacts of Alternative 1: No Action 194
Impacts of Alternative 2: NPS Preferred Alternative 195
Impacts of Alternative 3 196
Conclusion 196
Public Safety 197
Methodology 197
Impacts of Alternative 1: No Action 198
Impacts of Alternative 2: NPS Preferred Alternative 198
Impacts of Alternative 3 199
Conclusion 200
Infrastructure and Park Operations 201
Methodology 201
Impacts of Alternative 1: No Action 201
Impacts of Alternative 2: NPS Preferred Alternative 202
Impacts of Alternative 3 203
Conclusion 204

Consultation and Coordination 205

The Scoping Process 205
Internal Scoping 205
Agency Consultation 205
Tribal Consultation 207
Required Permits and Approvals 210
Coastal Zone Management Consistency 211
List of Preparers and Contributors 212
Contributors and Reviewers 213
List of Recipients 213
Federal Agencies 213
Tribal Nations 213
State Agencies 214
Local Governments 214
Universities 214

References 215

Selected Bibliography 215

Appendix A: Relevant Correspondence

Appendix B: Federal Consistency Determination

Introduction B-1
Proposed Action B-1
Assessment of Effect B-1
Fisheries Management B-1
Subaqueous Lands Management B-2
Wetlands Management B-2
Dunes Management B-2
Non-Point Source Pollution Control B-2

Point Source Pollution Control B-2
Shoreline Sanitation B-3
Air Pollution Control..... B-3
Coastal Lands Management B-3

LIST OF FIGURES

Figure No.	Description	Page
1	Project Location Map	3
2a	Study Area Map – Reaches IA, I and II (USGS Quadrangle Map)	7
2b	Study Area Map – Reaches III and IV (USGS Quadrangle Map)	9
3a	Study Area Map – Reaches IA, I and II (Orthophotograph)	11
3b	Study Area Map – Reaches III and IV (Orthophotograph)	13
4	Alternative 1: No Action - Reaches IA, I, and II	41
5	Alternative 1: No Action - Reaches II and III	43
6	Alternative 1: No Action - Reach IV	45
7	Alternative 2: Shoreline Treatment - Reaches IA, I, and II (preferred)	53
8	Alternative 2: Shoreline Treatment - Reaches II and III (preferred)	55
9	Alternative 2: Shoreline Treatment - Reach IV (preferred)	57
10	Alternative 2: Representative Cross Section – Rock Sill	59
11	Alternative 2: Representative Cross Section – Revetment Rehab	63
12	Alternative 2: Representative Cross Section – Breakwater	69
13	Alternative 3: Shoreline Treatment - Reaches IA, I, and II	73
14	Alternative 3: Shoreline Treatment - Reaches II and III	75
15	Alternative 3: Shoreline Treatment - Reach IV	77
16a	Soil Survey Mapping: Reaches IA, I and II	97
16b	Soil Survey Mapping: Reaches III and IV	99
17	Field-Delineated Wetlands: Reaches IA, I, and II	113
18	Field-Delineated Wetlands: Reaches II and III	115
19	Field-Delineated Wetlands: Reach IV	117
20	Potential and Existing Shellfish Ground & Leases: Reaches IA, I, & II	127
21	Potential and Existing Shellfish Ground & Leases: Reaches II & III	129
22	Potential and Existing Shellfish Ground & Leases: Reach IV	131
23	Submerged Aquatic Vegetation Mapped in 2008	137

LIST OF TABLES

Table No.	Description	Page
1	Study Area Designation	38
2	Shoreline Treatment Approaches by Reach and Sub-Reach	50
3	Summary of Alternatives	83
4	Summary of Environmental Consequences	85
5	Key to Cowardin Classifications for Delineated Vegetated Wetlands	111
6	Amphibians and Reptiles Potentially Occurring in the Study Area	134
7	Summary of Essential Fish Habitat Species by Life Stage	135
8	Special Status Species Known to Occur Within the Project Vicinity	141
9	Summary of Vegetated and Unvegetated Impacts for Alternative 2	167
10	Summary of Vegetated and Unvegetated Impacts for Alternative 3	170
11	Consistency with Applicable Federal Laws, Regulations & Programs	207
12	Consistency with Applicable State Laws, Regulations & Programs	208

ACRONYMS AND ABBREVIATIONS

100MVMT – 100 million vehicle miles traveled
ADA – Americans with Disabilities Act
APE – Area of Potential Effect
CCC – Civilian Conservation Corps
CEQ – Council on Environmental Quality
CFR – Code of Federal Regulations
DCR – Virginia Department of Conservation and Recreation
DEQ – Virginia Department of Environmental Quality
DGIF – Virginia Department of Game and Inland Fisheries
DHR – Virginia Department of Historic Resources
DO – Director's Order
DSS – Data Sharing System
EA – environmental assessment
EPA – Environmental Protection Agency
FEMA – Federal Emergency Management Agency
ft – feet
ft/yr – feet per year
GMP – general management plan
IPaC – Information, Planning, and Conservation System
IPCC – Intergovernmental Panel on Climate Change
LOS – level of service
LUP – Land Use Permit
MHW – mean high water
mi – mile
MLLW – mean lower low water
MLW – mean low water
MSL – mean sea level
MUTCD – Manual on Uniform Traffic Control Devices
National Register – National Register of Historic Places
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NOAA - National Oceanic and Atmospheric Administration
NOI – Notice of Intent
NPS – National Park Service
NRCS – Natural Resources Conservation Service
NWS – Naval Weapons Station
PA – programmatic agreement

park – Colonial National Historical Park
parkway – Colonial Parkway
PEPC– Planning, Environment and Public Comment
SHPO – state historic preservation officer
SMP – Shoreline Management Plan
SWCB – State Water Control Board
SWPPP – Stormwater Pollution Prevention Plan
USACE – U.S. Army Corps of Engineers
USFWS – U.S. Fish and Wildlife Service
USCG – U.S. Coast Guard
USGS – United States Geological Survey
VA – value analysis
VAFWIS – Virginia Fish and Wildlife Information Service
VDNH – Division of Natural Heritage
VHB – Vanasse Hangen Brustlin, Inc.
VIMS – Virginia Institute of Marine Sciences
VMRC – Virginia Marine Resources Commission
VSMP – Virginia Stormwater Management Permit
WRMP – Water Resource Management Plan

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1
PURPOSE AND NEED

INTRODUCTION

Colonial National Historical Park (the park) is located in the southern tidewater region of the Commonwealth of Virginia, on the peninsula between the James and York Rivers (Figure 1). Measuring 10,221 acres in size, "it encompasses most of Jamestown Island, site of the first permanent English settlement in North America, and Yorktown, scene of the culminating battle of the American Revolution" (NPS 1993a). The Colonial Parkway (the parkway) links these two units of the park, providing a scenic 23-mile long drive and connectivity to other colonial sites, including Williamsburg. It is a resource listed in the National Register of Historic Places (National Register), in recognition of its association with the National Park Service's (NPS) legacy of designed parkways that were built for conservation and interpretive purposes, particularly with respect to historic resources. The parkway is also a designated "All-American Road." It is used by park visitors, local recreationists, and commuters.

For roughly 4.2 miles, the parkway lies in close proximity to the York River. While riverbank erosion has been a recognized issue for decades and has been combated via the placement of structural defenses or "armor" along the shoreline, strong storms in late 2009 markedly increased shoreline recession. Shoreline defenses were overtopped and wave energy impinged directly on undefended portions of the riverbank, resulting in erosion and sloughing. Though the NPS has performed "spot treatments" to address areas of particularly aggressive storm-related erosion, more comprehensive action is required to prevent further landward migration of the shoreline and subsequent undermining of the parkway at multiple locations.

The NPS owns and maintains the parkway surface, including a minimum 500-foot wide right-of-way outside the limits of the Jamestown and Yorktown units of the park. As such, the NPS is solely responsible for all maintenance of the roadway, vegetation and other natural and cultural resources within this right-of-way. In accordance with the park's General Management Plan (GMP), the NPS must "maintain the [parkway] for safety while retaining the integrity of its design as a scenic roadway."

This Environmental Assessment (EA) evaluates **three alternatives**: a no-action alternative and two action alternatives, including the NPS Preferred Alternative. The EA further analyzes the potential impacts these alternatives would have on the natural, cultural, and human environment.

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Shoreline Repair & Stabilization Project
Environmental Assessment

National Park Service
U.S. Department of the Interior

Colonial National Historical Park

Figure 1
Project Location Map

This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended; regulations of the Council on Environmental Quality (CEQ) (40 CFR 1508.9); and NPS Director's Order (DO) 12: Conservation Planning, Environmental Impact Analysis and Decision-Making. Per DO-77-1 (NPS 2002a) and DO-77-2 (NPS 2003), this document also includes a statement of findings (SOF) for wetlands and floodplains and a Federal Coastal Zone Consistency Determination (as appendixes). This EA also recognizes the Natural Resource Management Policies, as outlined in the NPS *Management Policies* (NPS 2006), specifically Watershed and Stream Processes (4.6.6), and Protection of Geological Resources (4.8.1), including Shorelines and Barrier Islands (4.8.1.1).

A Programmatic Agreement (PA) has been developed jointly by the NPS and the State Historic Preservation Officer (SHPO) at the Virginia Department of Historic Resources (DHR). Other signatories to the PA include the Federal Highway Administration (FHWA), U.S. Army Corps of Engineers (USACE), the Catawba Indian Nation, and the Virginia Council on Indians, and York County, Virginia. The PA implements procedures for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations outlined at 36 CFR Part 800." The fully executed PA is included in "Appendix A: Relevant Correspondence."

PURPOSE AND NEED FOR ACTION

The parkway is both a means of transportation and the primary means by which visitors to the park can interpret the landscape history of early colonial settlements and life between Jamestown and Yorktown. It offers a variety of viewsheds, pull-offs, and roadside markers for motorized and bicycle traffic. The purpose of the project is to protect the parkway from the imminent threat of shoreline erosion along the York River and associated landward migration of the shoreline, particularly in areas where it runs in close proximity to the parkway (e.g., Bellfield Straight, see Figures 2a and 3a). Action is needed at this time in order to mitigate and remediate the effects of historic and continuing storm damage to the parkway. Furthermore, the project would reduce the risk of erosion along areas of the shoreline that are not adjacent to the parkway but where recession is nevertheless occurring and where cultural resources have been identified. Action would be taken in these areas to ensure the integrity of the resources.

The project also acknowledges Secretary of the Interior Order No. 3289, Amendment No. 1, Section 3a (DOI 2010), which requires that each bureau and office of the Department of the Interior consider and analyze potential climate change impacts when undertaking long-range planning exercises and making major decisions regarding the use of Department resources. The planning of the shoreline stabilization project would consider rates of sea-level rise and make sure the resulting design is adaptable to future conditions.

Lastly, the shoreline stabilization project would provide opportunities (where appropriate) to enhance or restore tidal wetland features as part of the overall shoreline management strategy. This is consistent with Executive Order 11990, which in part directs the federal agencies "…to preserve and enhance the natural and beneficial values of wetlands…" and to "…strive to achieve a longer-term goal of net gain of wetlands Servicewide."

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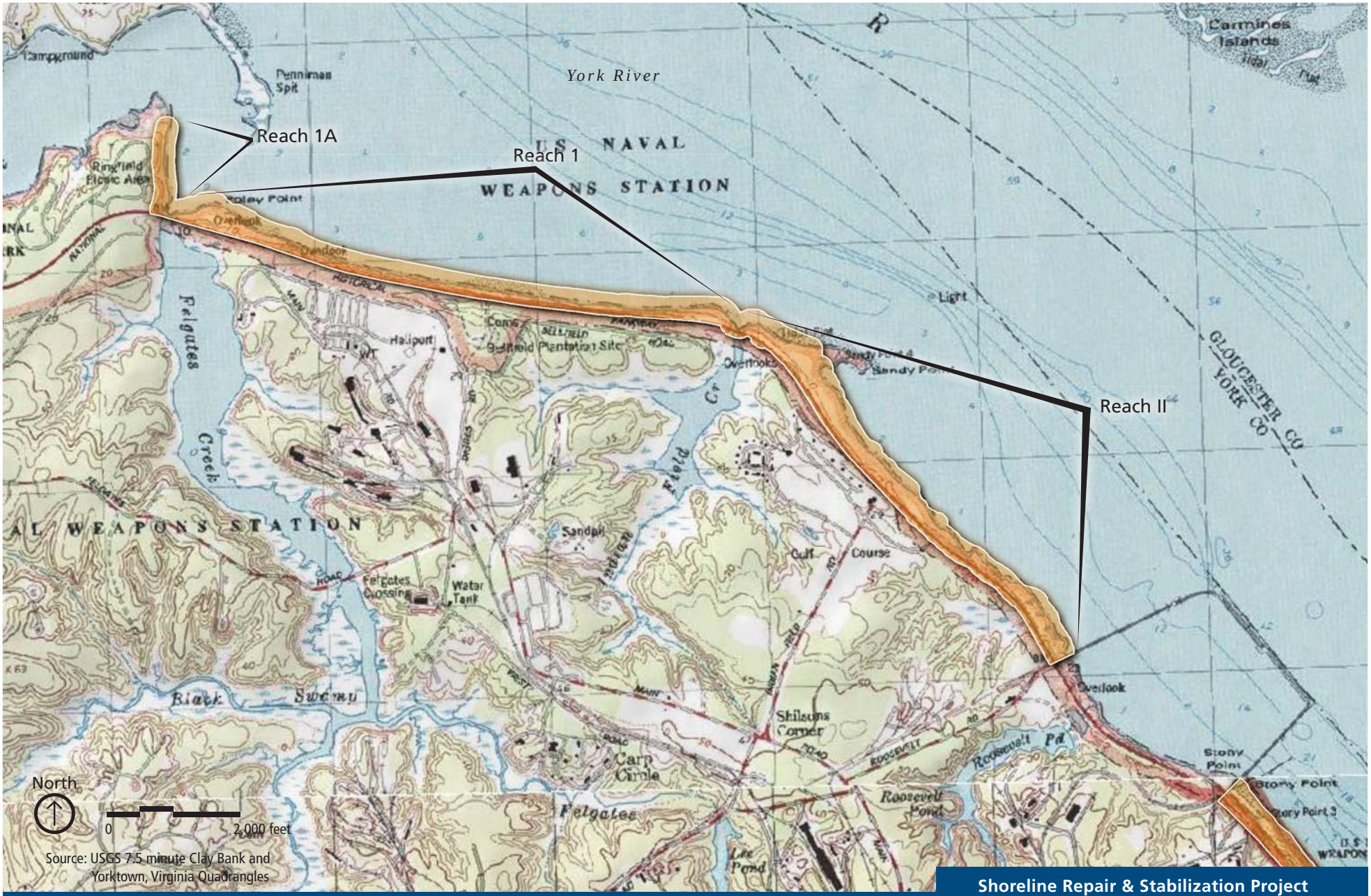

Source: USGS 7.5 minute Clay Bank and Yorktown, Virginia Quadrangles

Shoreline Repair & Stabilization Project Environmental Assessment

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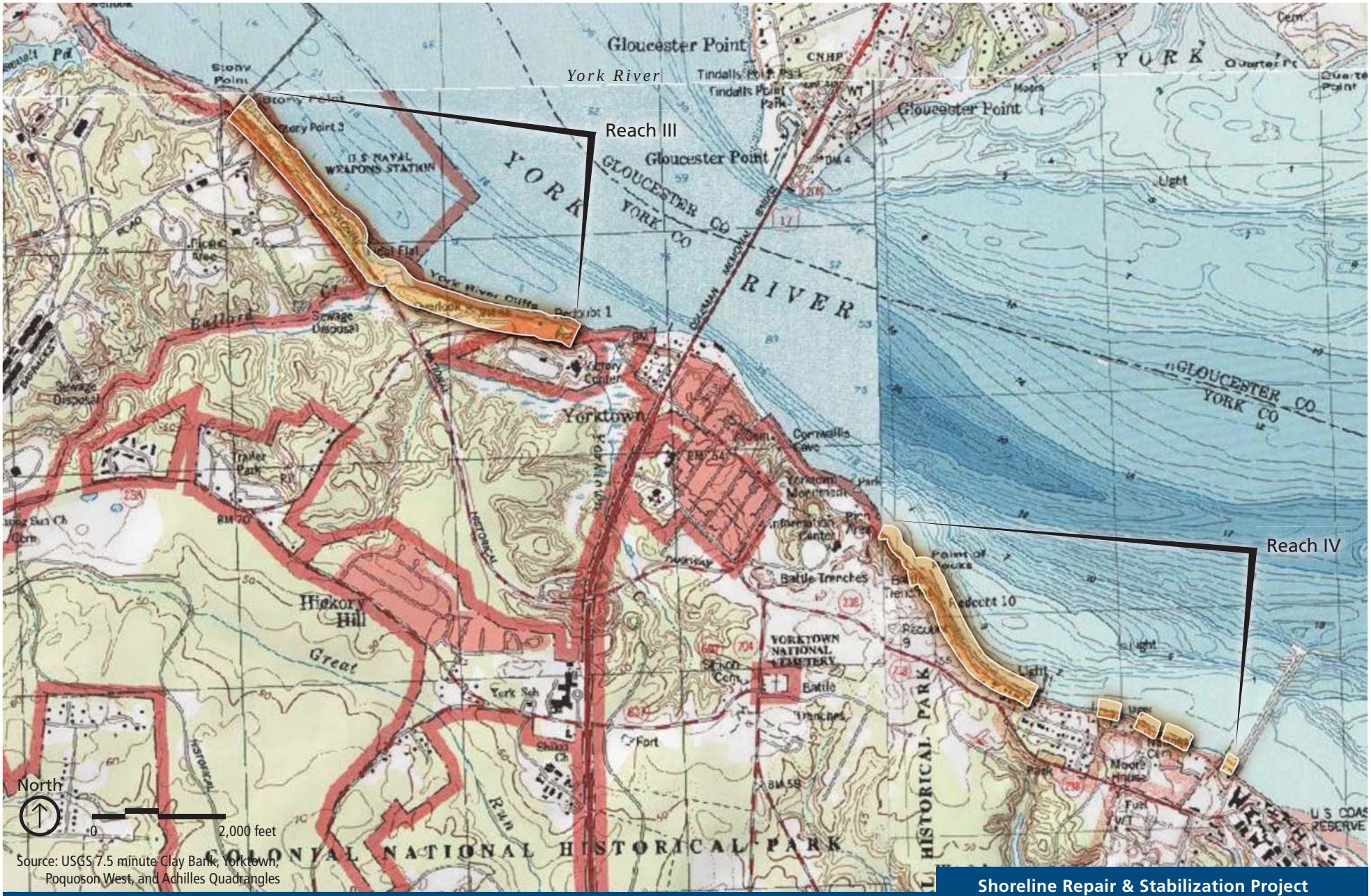
Figure 2a

Study Area Map: Reaches IA, I, and II (USGS Quadrangle Map)



Source: USGS 7.5 minute Clay Bank, Yorktown, Poquoson West, and Achilles Quadrangles

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Figure 2b

Study Area Map: Reaches III and IV (USGS Quadrangle Map)

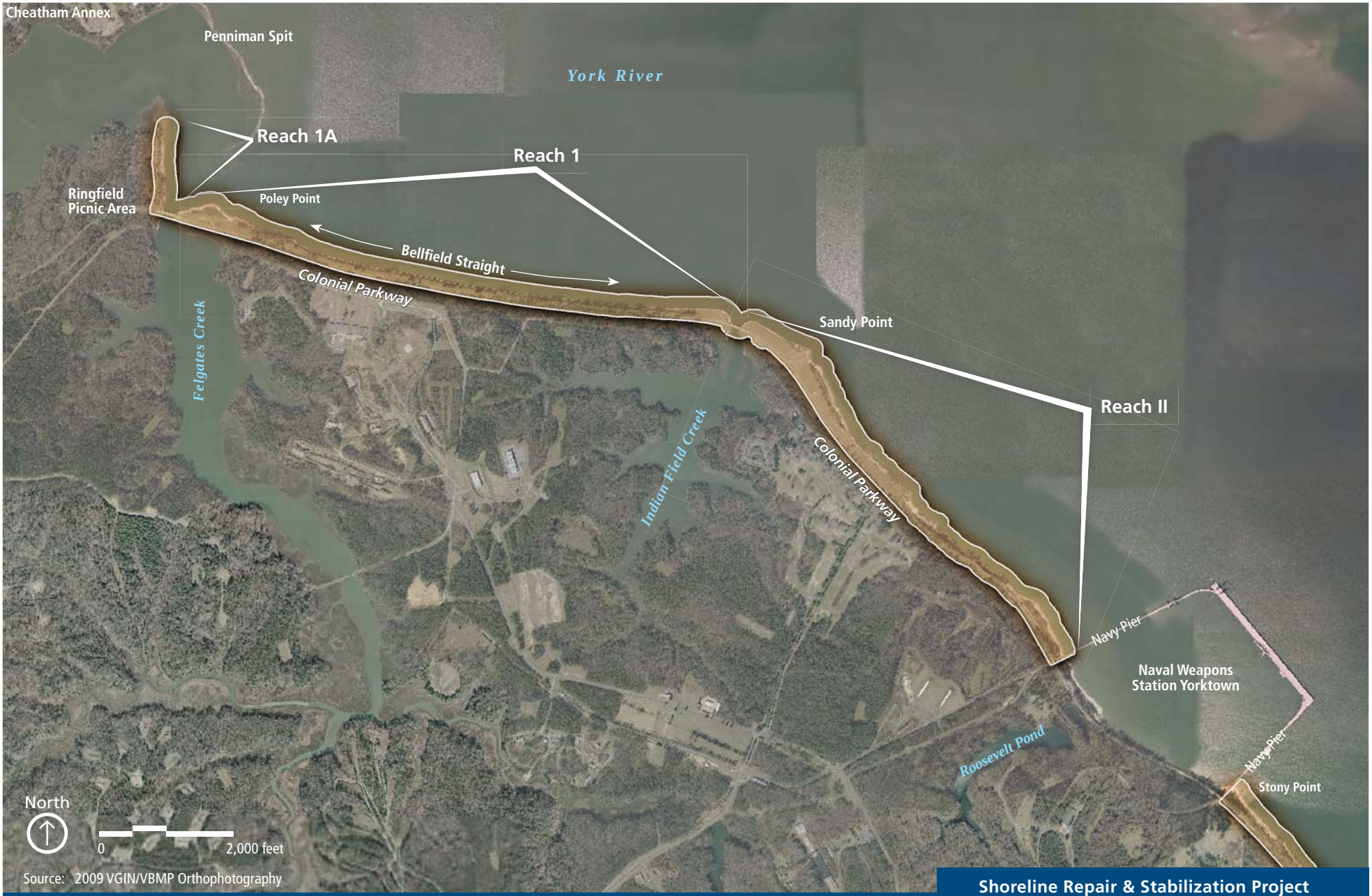

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Figure 3a

Study Area Map: Reaches IA, I, and II (Orthophotograph)

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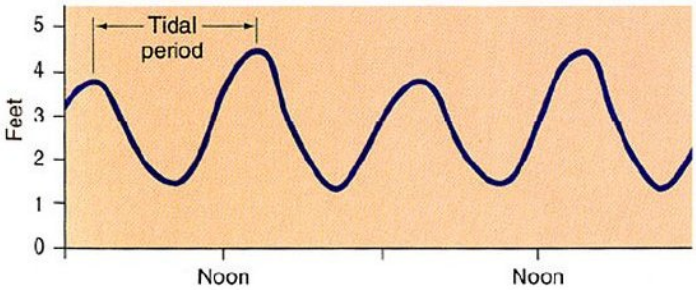
Figure 3b

Study Area Map: Reaches III and IV (Orthophotograph)

Photograph 1. View of erosion at location of Kilometer 5 (K5) on the Colonial Parkway before repair was carried out. (Source: NPS)

For roughly 4.2 miles of its 23-mile length, the parkway lies in close proximity to the York River shoreline (Figures 2a and 2b). This shoreline is subject to wind-driven wave action, particularly during storms that produce winds approaching from the northeast (i.e., nor'easters). Such wave action can cause bank erosion, which can subsequently threaten inland resources. For example, between Felgates Creek and Indian Field Creek (Figures 2a and 3a), the area known as Bellfield Straight, the road surface of the parkway is as little as 10 ft from the steep south bank of the York River.



The York River experiences "semidiurnal tides," meaning that the tide cycles through a high and low twice each day, with one of the two high tides being higher than the other and one of the two low tides being lower than the other. **Mean Lower Low Water (MLLW)** is the average of the lower of the two low tides over the National Tidal Datum Epoch (1983 – 2001).

Mean Low Water (MLW) is the average of all low tide readings over this time period. (Graphic Source: WHOI 2011)

Although most of the York River shoreline within the park is currently defended by a variety of structures primarily installed between 1930 and 1958 (e.g., revetments, sills, and breakwaters), recent storm activity has resulted in marked shoreline erosion. Erosion caused by Hurricane Isabel in September 2003 and exacerbated by Tropical Storm Ernesto in late August 2006 and an unnamed nor'easter in November 2006, prompted emergency reparations near kilometer 5 where the road prism of the parkway was particularly vulnerable (Photograph 1). The more recent November 2009 nor'easter has aggravated erosion at multiple shoreline locations within the boundaries of the park, most notable at Bellfield Straight. Along this stretch of shoreline, erosion has occurred behind the revetment, effectively separating it from the river bank and leaving a terrace between it and an actively eroding scarp that ranges from approximately 3 to 15 ft in width. The crest elevation of the revetment along Bellfield Straight is approximately 6 ft relative to mean lower low water (MLLW, see datum explanation this page). By comparison, the still water level associated with the Hurricane Isabel storm surge was estimated at 8.6 ft MLLW, while wave height extended to 12.5 ft MLLW.

In addition to shoreline erosion, stormwater-induced gullies have formed in the grassy areas immediately north of and adjacent to the parkway along Bellfield Straight. These gullies are

actively eroding and have been observed in seventeen discrete locations. If left unchecked, these features will migrate landward until they intersect and undermine the parkway surface, possibly requiring emergency repairs and necessitating road closures. Catastrophic erosion also could occur at these locations, posing a direct threat to the parkway's cultural landscape and historic structures, as well as affect public safety.

At locations where the parkway does not run in close proximity to the York River, continued shoreline erosion will affect other resources such as archeological resources and wetland resources. Areas include the east-facing shoreline at the Ringfield Picnic Area, at the confluence of Felgates Creek and the York River, downstream of Indian Field Creek, and along the York River Cliffs (Figures 2a and 3a). Due to its orientation, the shoreline along the Ringfield Picnic Area is particularly vulnerable to wind-driven waves during nor'easters. Penniman Spit, located approximately 1,200 ft offshore and parallel to the shoreline, provides some protection by dissipating wave energy before it reaches land. However, this spit has eroded appreciably in recent years and its efficacy in this regard has diminished accordingly. Consequently, the east face of the point at Ringfield Picnic Area has been actively eroding and is steeply sloped. Such river bank slumping and landward shoreline migration may result in the relocation and/or total loss of cultural resources here and at multiple other locations where they occur in close proximity to the river bank.

STUDY AREA DESCRIPTION

For the purpose of this EA, the study area is broken into five separate Reaches, each containing a terrestrial and aquatic component. These Reaches are consistent in name and extent with those used for the Shoreline Management Plan (SMP) developed for the York River shoreline by the Virginia Institute of Marine Sciences (VIMS 2006). These five Reaches are shown on Figures 2a, 2b, 3a, and 3b and are described in detail in "Chapter 2: Alternatives."

PROJECT BACKGROUND

The parkway is a 23-mile long road that connects the visitor center at Jamestown Island with Williamsburg and with the visitor center at Yorktown Battlefield, three sites that comprise the historic triangle (Figure 1). Constructed between 1930 and 1958, the parkway is listed on the National Register in recognition of its association with the NPS' legacy of designed parkways that were built for conservation and interpretive purposes, particularly with respect to historic resources.

The original idea to link the three sites that constitute the historic triangle dates back as far as 1909, when the City Council of Williamsburg passed a resolution to "secure an appropriation for the building of a macadamized road connecting the historic places of Jamestown on the James River and Yorktown on the York River" (NPS 1997). However, it was not until Congress authorized the establishment of Colonial National Monument in 1930 that planning for the parkway began in earnest. Though initial proposals called for an inland route, NPS landscape architect Charles E. Peterson was particularly taken with the idea of aligning the road along the York River (NPS 1997). To cross the mouths of Felgates Creek and Indian Field Creek, marshland was partially filled with dredge material while a relatively narrow opening was left to

ensure continued drainage. This material, or "hydraulic fill," consisted of a slurry of sand, gravel, and water excavated from the bottom of the York River and placed at the construction site using tubing. The fill material was kept in place by timber bulkheads, allowing for a final minimum elevation of 11 feet above the mean tide range (Davis et al. 2004).

The crossings at Felgates and Indian Field Creeks were completed in 1931. Soon afterwards, it was recognized that tides "which had once spread throughout the tidal marshes were now channeled into the narrow streams under the bridges, and the wave action carved away at the grading around the bridge abutments" (NPS 1997). Though riprap was placed in 1937 to help dissipate wave energy and reapplication has occurred since that time, erosion continues to be problematic to the current day.

Erosion along the shoreline at the Bellfield Straight was recognized as a serious issue by NPS engineers as early as 1933, shortly after the parkway grading was completed. A significant storm surge that year had high tides seven to nine feet above sea level. At the time, NPS engineers expressed similar concerns to those creating the need for the current action; that "the erosion was significant enough that… it might continue, undermining the stability of the earth beneath the parkway until it fell into the river some 50 feet below" (NPS 1997). This degree of erosion may have been exacerbated in part by clearing along the Bellfield Straight to open scenic vistas for motorists travelling along the parkway. To address the issue, a modified seawall was constructed by the Civilian Conservation Corps (CCC) before the parkway opened, consisting of a wood-reinforced earthen wall with riprap placed along the toe and honeysuckle "wattles" placed over the wall to help stabilize soil within the structure and provide an aesthetically appealing cover for the engineering structure. The ultimate fate of this seawall is unclear and maintenance records for the period following installation are not available. However, a review of aerial photographic records for the period 1937 through 2002 determined that shoreline position remained relatively static over Bellfield Straight, suggesting that the seawall / revetment treatment was largely successful.

Other means of shoreline defense have been installed along the York River shoreline since 1930, though a precise history of these efforts is not readily available. Naturally occurring headlands at Point of Rocks (Figures 2b and 3b) were hardened in the early 1960's and reinforced in 1979 (Hardaway et al., 1991). It is possible that the riprap revetment along Bellfield Straight was reinforced at one or both of these times. Five breakwaters constructed of broken concrete were installed in 1985 just upriver from the Yorktown Naval Weapons Station. Designed by the Virginia Institute of Marine Science (VIMS) and the Virginia Department of Conservation and Recreation (DCR), these so-called "NPS Breakwaters" represent offshore means of erosion control. The various types of shoreline treatments that exist within the project area are discussed in greater detail in the Coastal Resources and Soils section in Chapter 3: Affected Environment."

PARK PURPOSE AND SIGNIFICANCE

Congress authorized the establishment of the Colonial National Monument in 1930 and redesignated it as Colonial National Historical Park in 1936. It is a 8676.9-acre unit of the NPS located in the Coastal Plain of Virginia on the peninsula of land (aka the "Virginia Peninsula" or "Peninsula") between the York River and James River estuaries. The park represents one of the

first NPS ventures in the field of historic preservation, commemorating in particular the settlement of Jamestown in 1607 and the Battle of Yorktown in 1781 (Davis et al. 2004; NPS 1997). Initiated in 1931 and completed in 1957, the parkway was included in the original bill to link these three sites and provide a scenic corridor for motorists. The Colonial Parkway is "…the unifying component of the Park's road system that includes interpretive tour roads on Jamestown Island and the Yorktown Battlefield." (Davis et al. 2004)

RELATIONSHIP OF PROPOSAL TO OTHER PLANNING EFFORTS

Several plans and studies have informed and contributed to the development of alternatives for the proposed project. These include the following.

General Management Plan (GMP) (NPS 1993a) The GMP for the park, approved in 1993, identifies the parkway as one of three "principal management areas," the others being the Jamestown and Yorktown units. The GMP expressly states that "natural resource management will be consistent with NPS philosophy on management of natural zones while supporting cultural resource objectives." As a National Register listed resource found in close proximity to natural areas along the York River shoreline (including wetlands), the parkway represents a favorable convergence of natural systems and cultural wealth. The repair and restoration of the York River shoreline should therefore acknowledge this relationship throughout the planning and implementation phases. The GMP also explicitly mentions maintenance of the parkway for "safety while retaining the integrity of its design as a scenic roadway." Historic sites, landscapes, and undeveloped vistas along the parkway are also noted as worthy of protection.

The GMP did not expressly recognize the need for shoreline repair and rehabilitation. Much of the shoreline erosion currently manifested has occurred since the publication of the GMP in 1993, and thus was not recognized as a problem at the time. Nevertheless, the GMP does not preclude such work. It recognizes that maintenance and improvements within the boundaries of the park could result in adverse impacts to wetlands and floodplains, yet these could be minimized by adherence to executive orders and established guidelines.

Water Resource Management Plan (WRMP): Colonial National Historical Park (NPS 1994). The WRMP for the park was drafted to complement the GMP and to support the NPS decision making process relating to the protection, preservation, use, enhancement, and management of park water resources and associated environments. The WRMP identified three critical path items with respect to shorelines:

1. evaluate shoreline stability impacts to park cultural/natural resources;
2. monitor historic trends in shoreline movement along the York and James Rivers; and
3. undertake shoreline management strategies.

Documenting shoreline position and trends in movement over time were recognized as important for the protection of cultural resources and for the effective management of erosion and sediment control impacts both within and outside the park. The WRMP highlighted the need for the park to perform additional research with respect to shoreline processes in order to achieve the park's management objectives and acknowledged that "…historical, cultural, and natural resources are

potentially at risk due to their proximity to the shore zone." The WRMP recommended the development of a shoreline management plan that considers trends and rates in shoreline change, and assessment of man-made structures and perturbations and their effect on shoreline stability.

Shoreline Management Plan (SMP): Phase II, York River Shoreline and Swanns Point, James River Shoreline (VIMS 2006). The SMP, dated 2006, represents the type of research report recommended by the WRMP. The SMP presents a detailed mapping and analysis of shoreline position and rate of change over time, drawing on ortho-rectified aerial photographic records for the years 1937 1960, 1963, 1968, 1978, 1994, and 2002 to classify shoreline reaches as erosional (i.e., where sediment is being lost and the shoreline is moving landward), accretional (i.e., where sediment is accumulating and the shoreline is moving seaward), or transitional. Transitional reaches are those typically located between eroding and accreting reaches where an established trend is not obvious. More detailed land-based shoreline and nearshore bathymetric surveys were carried out at the NPS Breakwaters and at the Point of Rocks area and the associated Yorktown Bays.

The SMP also provides a synopsis of the various means of shore defense that currently exist along the York River shoreline as well as recommendations for potential future actions to address areas of concern. As such, the SMP is the principal document that was used to develop the alternatives for repair and stabilization of the York River shoreline as presented in "Chapter 2: Alternatives."

Traffic Safety Management Plan – Data Analysis and Recommended Countermeasures (CH2M Hill 2011). This report was drafted as part of the Northeast Region Long Range Transportation Plan Traffic Safety Study. It presents the recommended countermeasures that address traffic safety and operations issues at Colonial NHP; countermeasures that serve as the foundation for future safety projects. Traffic issues were identified by discussions with park staff and through field visits. Recommended countermeasures for the parkway within the project area include installing reflector tabs on guardrails and flexible guardrail delineators; installing approximately 400 ft of guardrail or flexible delineators with white retroflective tape at kilometer 3; installing flexible delineators with white retroflective tape and yellow-and-black "curve" diamond warning signs at Felgates Creek; and informing the public that the road surface may be slippery when wet and to decrease vehicle speed during inclement weather.

Value Analysis (VA) Report. The NPS conducted a value analysis in 2010 to compare the potential options for repairing and rehabilitating the York River shoreline (NPS 2011a). The VA looked at planning criteria and constraints as well as a variety of shoreline treatment options and their benefits, drawbacks, and costs to construct and maintain. The VA report documents the VA process that weighed the various treatment options. Those that scored the highest were carried forward and developed into two full action alternatives, both of which are presented in this EA along with the No-action Alternative.

Cultural Landscape Report for Colonial Parkway (CLR). The CLR (NPS 1997) includes abundant information on the history of the parkway development and construction as well as an assessment of the parkway's historic integrity and significance. Because the existing condition of the parkway is highly reflective of as-built conditions, its integrity was judged to be high. The

significance of the resource is associated with a variety of factors, including those associated with landscape architecture as a designed landscape and NPS design and the historic preservation movement.

SCOPING

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in a NEPA document. Scoping is used to identify which issues need to be analyzed in detail and which can be eliminated from in-depth analysis. It also allocates assignments among the NPS' interdisciplinary team members and/or other participating agencies; identifies related projects and associated documents; identifies permits, surveys, consultation, and other requirements; and creates a schedule that allows adequate time to prepare and distribute the environmental assessment for public review and comment before a final decision is made. Scoping efforts may include any public, staff, interested agency, or any agency with jurisdiction by law or expertise; for example, the SHPO; the U.S. Fish and Wildlife Service (USFWS); the Virginia Department of Environmental Quality (DEQ), etc. The planning process for the proposed action itself is rooted in NPS initiatives as mandated by the GMP and WRMP described in the preceding section. Scoping for the proposed repair and stabilization of the York River shoreline began in the spring of 2010, with scoping letters being sent to various local, state and federal agencies. These letters introduced the purpose and need for the project and included an invitation to attend an interagency meeting in March, 2010 or provide written input in lieu of attendance at the meeting. Agencies and organizations receiving a scoping letter included York County, the DEQ, the Virginia Department of Historic Resources (DHR), the Virginia Marine Resources Commission (VMRC), the DCR, the U.S. Navy (Naval Weapons Station Yorktown), the U.S. Coast Guard (USCG), the USFWS, and the USACE. Scoping letters and agency responses are included in "Appendix A: Relevant Correspondence."

In advance of the interagency meeting, staff from the park and the NPS Denver Service Center conducted a site visit and interdisciplinary meeting. The SMP and its constituent mapping of recommended shoreline treatments were used as a starting point for discussions between interdisciplinary team members. Planning issues and timeframes and protocols for the collection of required field data were discussed at this internal meeting. Recommendations on how to proceed with the determination of a preferred alternative for the project and to analyze components of the work for value effectiveness also were discussed. NPS consultants and VIMS were tasked with developing alternatives for the proposed shoreline treatments using the SMP as a reference and considering manifestations of shoreline change in the time since its publication. Two action alternatives were presented for NPS review and discussed via a second interdisciplinary team meeting/conference call in June 2010. Internal NPS scoping between interdisciplinary team members and their consultants were ongoing through to a Value Analysis meeting in July 2010. The resulting report outlined the NPS Preferred Alternative (NPS 2011a). For further scoping and public participation information, see "Chapter 5: Consultation and Coordination" and "Appendix A: Relevant Correspondence."

PLANNING ISSUES AND CONCERNS

During the scoping process, specific considerations and concerns were identified as critical to consider while planning how to best manage the park shoreline along the York River. The following were identified as most important to the planning and design process: provide continued safe public access along the parkway, consider the location of and protect natural and cultural resources, plan for anticipated sea-level rise, appreciate the regulatory implications of the potential approaches, consider site access restrictions from both land and water, and accommodate existing recreation. Along with the purpose and need for the proposed action, these topics guided the development of alternatives and contributed to the selection of impact topics, as identified in this section.

Plan for anticipated sea-level rise. The Intergovernmental Panel on Climate Change (IPCC) has determined that global average sea level has risen at an average rate of 1.8 mm per year (0.59 feet per century) from 1961 to 2003 (VIMS 2008). The nearest water level gauge on the York River is located immediately opposite the project location at Gloucester Point, Virginia. Over the period from 1950 to 2003, the mean sea-level trend at this gauge was 3.81 mm/year or 0.15 in/year (NOAA 2010). This rate is equivalent to 1.25 ft of rise in 100 years. Other gauges in the lower Chesapeake Bay have records which show rates or rise ranging from 1.14 to 1.98 ft in 100 years. The proposed methods of shoreline treatment and their eventual design specifications would need to strike a balance between reducing the risk of impacts associated with anticipated sea-level rise and protecting the integrity of archeological, cultural, and natural resources. In other words, while it is critical to increase the effective height of shore-protecting structures to account for sea-level rise and storm surges, such augmentations in shore defense must carefully consider potential impacts on these resources that would be caused by excavation, the placement of fill materials, and the removal of vegetation. The effective heights and of the proposed structures are also constrained by financial considerations.

Appreciate the regulatory implications of the potential approaches.
NPS Director's Order (DO) #77-1-1: *Wetland Protection* (NPS 2002a) mandates that NPS projects avoid to the extent possible long and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. It is likely that the proposed project would involve unavoidable temporary and possibly permanent impacts to jurisdictional waters of the United States and wetlands and streams regulated by the Commonwealth of Virginia. Code of Federal Regulations (CFR) 40 Part 230, entitled "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material" and Virginia Water Protection Permit Regulations require that practicable alternative courses of action be considered before projects can be authorized by the USACE and Virginia Department of Environmental Quality (DEQ). As both agencies require compensatory mitigation for impacts to jurisdictional resources, minimizing such impacts and finding means of incorporating wetland restoration, enhancement, or creation into the project design should be guiding principles during plan development.

Consider site access restrictions from both land and water.
Weight limit specifications for the parkway prohibit its use as an access road for construction equipment or the delivery of construction materials. Bathymetric conditions and potential

underwater archeological resources may dictate the locations and numbers of possible approaches to the shoreline from the water using barges. The location of terrestrial archeological and cultural resources may preclude the use of upland areas for barge landings and material staging.

Accommodate existing recreational uses.
Existing recreational uses within the project area include fishing, picnicking, and sightseeing at the open grassy areas at the mouths of Felgates Creek and Indian Field Creek. Proposed shoreline improvements and the construction approach necessary for their execution should be designed to minimize interference with these ongoing uses. Conversely, proposed shoreline treatments should not introduce new recreational opportunities, either directly or indirectly. For example, the installation of offshore breakwaters with shore-attached beaches may inadvertently attract the recreating public from both land and water, introducing the potential for human caused disturbance in areas that were previously inaccessible or rarely accessed. Such unplanned recreational use also may present liability and safety concerns for the park with respect to parking (including illegal parking on the parkway shoulder), pedestrian traffic in areas where such use is unplanned (including the parkway shoulder and parkway crossings). These unplanned uses can also increase expenditures on park operations and maintenance. Potential means of restricting access and providing proper signage and other means of access control and visitor information should be considered.

REGULATORY ISSUES AND MANAGEMENT CONCERNS

Based on discussions with NPS staff and planning team members, implementation of the shoreline treatments described in this EA would not require any changes to existing legislation or management policies in order to be implemented. Certain approvals and permits would be required prior to construction. These include the following:

- A USACE Individual Permit for impacts to navigable waters and wetlands of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.
- A permit for encroachment on subaqueous lands and sandy beaches administered by the Virginia Marine Resources Commission (VMRC) pursuant to Virginia Code sections 28.2-1200 et seq. and 28.2-1300 et seq.
- A tidal wetlands permit from the York County Wetlands Board in accordance with Section 23.1 (Wetlands) of the County Code.
- A permit from York County for land disturbance activities within areas designated as Chesapeake Bay Preservation Areas, pursuant to Section 23.2 (Chesapeake Bay Preservation Areas) and Section 10.1-2100 of the Code of Virginia.
- A Virginia Stormwater Management Program (VSMP) Permit to authorize land disturbance and construction of the project.
- A waiver would likely be issued by the Virginia Department of Environmental Quality (DEQ), exempting the project from obtaining a Virginia Water Protection Permit, pursuant to Section 401 of the Clean Water Act, as long as other federal, state, and local permits are issued.

- Coordination with the Virginia Department of Game and Inland Fisheries (DGIF) and the U.S. Fish and Wildlife Service (USFWS) would be required regarding the possible presence of state and federally listed rare, threatened or endangered species within the project area.
- Coordination with the U.S. Navy would be required to insure that barge traffic does not present any interference with operational activities at Naval Weapons Station (NWS) Yorktown.
- Coordination and consultation with the SHPO regarding the assessment of possible effects to both terrestrial and underwater cultural resources as outlined in the 2010 PA developed by the NPS and DHR (see Appendix A).
- Consultation is ongoing between the PA signatories and the consulting Native American tribes including the Catawba Indian Nation and the representative body of the Virginia Council on Indians.

A more detailed discussion of the regulatory issues is contained within "Chapter 5: Consultation and Coordination."

IMPACT TOPICS RETAINED FOR ANALYSIS

Impact topics are resources of concern within the project area that could be affected, either beneficially or adversely, by the range of alternatives presented in this EA. They were identified based on the issues raised during scoping; site conditions; federal laws, regulations, Executive Orders, NPS *Management Policies 2006* (NPS 2006), and Director's Orders; and staff knowledge of the park's resources.

Impact topics identified and analyzed in this EA are listed below along with a brief rationale for the selection of each impact topic. They include coastal resources, wetland resources, floodplains, wildlife and wildlife habitat, vegetation, special status species, cultural landscapes, historic structures, archeological resources, visitor use and experience, public safety, and infrastructure and park operations. Each impact topic is further discussed in detail in "Chapter 3: Affected Environment" and "Chapter 4: Environmental Consequences" of this document.

Coastal Resources and Soils

NPS *Management Policies 2006* (NPS 2006) states that the NPS is charged with protecting watershed and stream features primarily by avoiding impacts on watershed and riparian vegetation and by allowing natural fluvial processes to proceed unimpeded to the greatest extent possible. Similarly, coastal geologic resources (both features and processes) are integral components of park natural systems. NPS *Management Policies* (NPS 2006) require that natural geologic and shoreline processes (e.g., shoreline erosion and sediment transport) be allowed to proceed unimpeded except under certain circumstances. Because the proposed action seeks to repair and rehabilitate the shoreline of the York River within the park and includes the installation of shoreline defense structures in previously untreated areas that may impact natural processes, the impact topic of coastal resources and soils is addressed. A Federal Coastal Consistency Determination is included in Appendix B.

Wetland Resources

Executive Order 11990, *Protection of Wetlands* and NPS DO-77-1: *Wetland Protection* (NPS 2002a) require an examination of impacts on wetland resources. NPS *Procedural Manual #77-1* (NPS 2012) describes wetlands subject to Executive Order 11990, procedures for delineating wetland features, excepted actions in wetlands, guidelines for avoidance, minimization, and compensation for wetland impacts, and how to maintain compliance with Executive Order 11990.

The proposed action could result in permanent impacts to wetland resources. Therefore, the impact topic of wetland resources is addressed. According to NPS DO-77-1: *Wetland Protection*, a Statement of Findings (SOF) is required when an action is to occur within a wetland. Wetland SOFs document compliance with NPS wetland protection policies and procedures, including the NPS no-net-loss of wetlands policy. These procedures include requirements to avoid and minimize wetland impacts and to compensate for unavoidable wetland impacts through wetlands restoration. Due to the proposed phased approach to performing shoreline improvements, SOF's would be prepared on a phase-by-phase basis as preliminary design plans are advanced to construction-ready documents. This allows for potential wetland impacts to be assessed and compensated for, as necessary, based on more informed plans.

Floodplains

Executive Order 11988, "Floodplain Management," NPS DO-77-2: *Floodplain Management*, and Section 4.6.6 of NPS *Management Policies* (NPS 2006) require an examination of impacts on floodplains and potential risk involved in placing facilities within floodplains. The Federal Emergency Management Agency (FEMA) has determined that the proposed shoreline improvements lie within the 100-year flood zone. As such, the proposed action would be classified as Class I according to DO-77-2 guidelines. Class I actions include the location or construction of administrative, residential, warehouse, and maintenance buildings; non-excepted parking lots; or other man-made features which by their nature entice or require individuals to occupy the site, are prone to flood damage, or result in impacts to natural floodplain values. Any proposed Class I action requires that an SOF must be prepared. Due to the proposed phased approach to performing shoreline improvements, SOF's would be prepared on a phase-by-phase basis as preliminary design plans are advanced to construction-ready documents. This allows for potential floodplain impacts to be assessed based on more informed plans.

Wildlife & Wildlife Habitat

NPS policy is to protect the natural abundance and diversity of all naturally occurring communities. The NPS *Management Policies 2006* (NPS 2006), NPS DO 77: *Natural Resources Management*, and other NPS policies provide general direction for the protection of wildlife and wildlife habitat. The study area contains a variety of upland and aquatic species, though the nature of the project may affect the latter to a greater degree. While many of the wildlife species found in the region have ample habitat throughout the park and in the waters that continue beyond its boundaries, certain aquatic species such as oysters and crabs may be preferentially located within the study area due to site-specific conditions. This includes both natural occurrences and those incited by the construction of artificial oyster reefs. Proposed construction

activities could result in temporary impacts to these species and their habitat, as well as other free-swimming species of fish. Additionally, the construction of certain shoreline treatments may have impacts on species that are dependent upon connectivity between uplands and aquatic habitats. Therefore, the impact topic of wildlife and wildlife habitat is addressed.

Vegetation

NPS policy is to protect the natural abundance and diversity of all naturally occurring communities. NPS *Management Policies 2006* (NPS 2006), and other NPS and the park policies provide general direction for the protection of vegetation. Vegetation in the study area includes upland vegetation and wetland species that exist along the banks of the York River and in intertidal areas, especially the mouths of tributary streams. The proposed action would include development in both uplands and wetlands. Therefore, the impact topic of vegetation is considered.

Special Status Species

In a letter dated March 17, 2010, the DCR noted that the state listed threatened bald eagle (*Haliaeetus leucocephalus*) may be found in or around the study area. Park staff has noted the presence of an active bald eagle nest in the Ringfield Picnic Area at the far western end of the study area. The proposed action could therefore impact special status species. Thus, the impact topic of special status species is addressed.

Cultural Landscapes

A cultural landscape is a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person exhibiting other cultural or aesthetic values. There are four kinds of cultural landscapes, which are not mutually exclusive: historic site, historic designed landscape, historic vernacular landscape, and ethnographic landscape (NPS DO 28: Cultural Resources Management Guidelines, NPS 2002b). The cultural landscape of the parkway was described in the CLR (NPS 1997). The proposed action could modify aesthetic elements of the cultural landscape of the parkway. Therefore, the impact topic of cultural landscapes is addressed.

Historic Structures

A historic structure is defined by the NPS as “a constructed work, usually immovable by nature or design, consciously created to serve some human act” (DO 28). In order for a structure or building to be listed on or eligible for listing on the National Register, it must possess historic integrity of those features necessary to convey its significance, particularly with respect to location, setting, design, feeling, association, workmanship, and materials. The National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation (NPS 1990) provides a comprehensive discussion of these characteristics. The park’s historic structures, buildings, and objects have been assessed in several NPS documents including the 1997 CLR for the parkway. The proposed action does not propose to modify any historic structures within the park. However, the no action alternative may leave historic structures vulnerable to damage by landward migration of the York River shoreline. Therefore, the impact topic of historic structures is addressed.

Archeological Resources

Archeological resources are the material remains of past human activity (National Register Bulletin 36, Guidelines for Evaluating and Registering Archaeological Properties). These material remains are analyzed using several methods including, but not limited to, scientific tests, oral interviews, and ethnographic data. An archeological survey of the parkway was completed in 2009 by the College of William and Mary Center for Archaeological Research (Monroe 2009). This survey included areas within the study area for the proposed action and identified a variety of resources that are eligible or potentially eligible for inclusion on the National Register of Historic Places. These resources are predominantly Middle to Late Woodland camps, including the Native American village of Kiskiak. Therefore, the impact topic of archeological resources is addressed.

Visitor Use and Experience

Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks (NPS 2006). The NPS strives to provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the natural and cultural resources found in parks. The visitor experience encompasses interpretation, understanding, enjoyment, safety, circulation, and accessibility of the study area. While the proposed action may result in temporary changes to these elements during the construction phase, the no action alternative may result in longer term and more adverse impacts to visitor use and experience. Therefore, this impact topic is addressed.

Public Safety

NPS *Management Policies 2006* (NPS 2006) instructs NPS staff to consider public safety in all proposed actions. The parkway is used heavily by both commuters and park visitors. Shoreline erosion in close proximity to the road continues to pose safety concerns. Because a primary objective of this project is the improvement of safety, the impact topic of public safety is addressed.

Infrastructure and Park Operations

The proposed action would result in changes to infrastructure and park operations. These changes include the augmentation of existing shore defense structures and the installation of additional structures, which the park will then maintain for the foreseeable future. The no action alternative also could have consequences for infrastructure and park operation. Therefore, this impact topic is addressed.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

The following impact topics were initially considered but dismissed from further analysis because the resource is not present in the project area or because any potential impacts would be no more than negligible to minor. They include water quality, museum collections, ethnographic resources, Indian Trust resources and sacred sites, prime farmland, climate change, energy requirements and conservation potential, socioeconomic resources and adjacent land, and environmental justice.

Water Quality

NPS *Management Policies 2006* (NPS 2006) states that the NPS will "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations." This impact topic was dismissed due to the unlikelihood of water quality impacts incited by either the proposed action or the no action alternative. IDT members discussed whether or not turbidity in the water column caused by the erosion of undefended reaches of shoreline could be considered a water quality impact. It was subsequently dismissed because shoreline erosion and the resulting sediment transport is a natural process that can sustain downstream beaches or assist in their formation, effectively reducing the risk of shoreline erosion. Such sediment deposition could actually be characterized as a beneficial impact in an environment that is characterized by artificially created shorelines. Potential water quality impacts during construction would be mitigated by conditions contained within state and federal permits such as Virginia Stormwater Management Program permits.

Museum Collections

A museum collection is an assemblage of objects, works of art, historic documents, and/or natural history specimens collected according to a rational scheme and maintained so that they can be preserved, studied, and interpreted for public benefit (NPS 2002b). There are no museum collections within the study area nor would any of the park's existing museum collections be notably impacted by the proposed action. Therefore, the impact topic of museum collections is dismissed from further analysis.

Ethnographic Resources

An ethnographic resource is defined as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 2002b). These include sacred sites. There are no known ethnographic resources within the study area. Therefore, the impact topic of ethnographic resources is dismissed from further analysis. In the unlikely event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) would be followed.

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts on Indian Trust resources from a proposed project or action by U.S. Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian Trust responsibility is a legally enforceable obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal laws with respect to Native American tribes. There are no known Indian Trust resources in the study area, and the lands comprising the park are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Therefore, the impact topic of Indian Trust resources is dismissed from further analysis.

Prime or Unique Farmland

In 1980 the CEQ directed federal agencies to assess the effects of their action on farmland soils classified as prime or unique by the United States Department of Agriculture, Natural Resources Conservation Service. Prime or unique farmland is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; and unique farmland produces specialty crops such as fruits, vegetables, and nuts. There are no prime or unique farmlands associated with the project area; therefore, prime or unique farmland was dismissed as an impact topic in this EA.

Climate Change

Climate change refers to any significant changes in average climatic conditions (such as mean temperature, precipitation, or wind) or variability (such as seasonality, storm frequency, etc.) lasting for an extended period (decades or longer). Recent reports by the U.S. Climate Change Science Program, the National Academy of Sciences, and the United Nations Intergovernmental Panel on Climate Change (IPCC) provide clear evidence that climate change is occurring and will accelerate in the coming decades. There is strong evidence that global climate change is being driven by human activities worldwide, primarily the burning of fossil fuels and tropical deforestation. These activities release carbon dioxide and other heat-trapping gases, commonly called “greenhouse gases,” into the atmosphere (IPCC 2007).

There are two aspects of climate change that must be considered in an environmental impact analysis:

- our impact on climate change: i.e., through our actions, the potential to increase or decrease emissions of greenhouse gases that contribute to climate change
- the impact of climate change on us: i.e., how are the resources that we manage likely to change in response to changing climate conditions, and how does that change or otherwise affect our management actions and the impacts of those actions on the resource

The proposed action would not result in the construction of any carbon-emitting infrastructure nor would it result in any enhancement of vehicular use of the parkway or create any new recreational attraction that would increase vehicular carbon emissions. During the construction process, the proposed action could result in a temporary increase in emissions of greenhouse gases from the operation of construction vehicles. Because the project would have no measurable impacts on climate change, it is dismissed as an impact topic for further analysis.

Impacts of climate change on the project are likely to be of a subtle, gradual nature. A rise in sea level would alter the hydrology of the wetlands in or near the study area and may cause wave attack to occur at higher elevations and/or be translated farther inland. Changes in climate such as general warming, changes in water availability, and storm frequency, intensity, or duration could cause changes in composition and location of vegetated communities within the park over the decades. While most people visiting or passing through the park would be unaware of the changes, changes in shoreline position and vegetation communities may occur as a result of sea level rise. For this reason, climate change is referenced as appropriate in “Chapter 4: Environmental Consequences.”

Energy Requirements and Conservation Potential

The CEQ guidelines for implementing NEPA require an examination of energy requirements and conservation potential as a possible impact topic in environmental documents [40 CFR 1502.16(e)]. The park strives to incorporate the principles of sustainable design and development into all facilities and operations. The objectives of sustainability are to design structures to minimize adverse impacts on natural and cultural values; to reflect their environmental setting; to maintain and encourage biodiversity; to construct and retrofit facilities using energy efficient materials and building techniques; to operate and maintain facilities to promote their sustainability; and to illustrate and promote conservation principles and practices through sustainable design and ecologically sensitive use. Essentially, sustainability is living within the environment with the least impact on the environment.

The proposed action is not expected to result in noticeable changes to energy requirements or the ability to conserve energy resources. In fact, because the proposed action would address shoreline erosion in a comprehensive manner energy that would otherwise be spent by mobilizing construction equipment for iterative and localized reparations under the no action alternative would be conserved. Consequently, any adverse impacts caused by the proposed action relating to energy use, availability, or conservation would be negligible. Therefore, the impact topic of energy requirements and conservation potential is dismissed from further analysis.

Socioeconomic Resources and Adjacent Land

Colonial National Historical Park is an important resource contributing to regional economics, including local communities, which provide visitor services for those entering the park. The preferred alternative would result in construction-related spending of about $1,200 per linear foot, which would provide a short-term benefit to the local and regional economy from employment opportunities and spending on goods, services, and materials. However, as the project would be phased over a number of years, the proposed action would not noticeably alter socioeconomic resources.

The proposed action would be restricted to lands owned by the NPS, which is comingled with private property in the far eastern portion of the study area between Point of Rocks and the Coast Guard Training Station Yorktown. Some private landowners in this area have already engaged in shoreline stabilization measures similar to those proposed with negligible impact on adjoining properties. As such, the proposed action is not expected to adversely affect adjacent landowners. Therefore, the impact topic of socioeconomic resources and adjacent lands is dismissed from further analysis.

Environmental Justice

Executive Order 12898, “General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low income populations and communities. According to the EPA, environmental

justice is the "…fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies."

The goal of "fair treatment" is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects and identify alternatives that may mitigate these impacts. Environmental justice is dismissed from further analysis for the following reasons:

- Implementation of the proposed action would not result in any identifiable adverse human health effects. Therefore, there would be no direct or indirect adverse impacts on any minority or low-income population.
- The impacts associated with implementation of the proposed action would not disproportionately affect any minority or low-income population or community.
- Implementation of the proposed action would not result in any identified effects that would be specific to any minority or low-income community.

2
ALTERNATIVES

Chapter 2 describes various alternatives for the stabilization of the shoreline at the park. The alternatives for the proposed action were designed to control landward migration of the York River shoreline to preserve the integrity of the parkway and cultural and archeological resources and, where possible, to preserve and enhance wetland environments along the shoreline. CEQ regulations for implementation of NEPA call for the alternatives considered in a document to include a no-action alternative. The description and evaluation of the no-action alternative provides a baseline to which the action alternatives can be compared. The EA examines three alternatives: Alternative 1 (the No-action Alternative) and two action alternatives: Alternative 2 (the NPS Preferred Alternative) and Alternative 3.

DEVELOPMENT OF ALTERNATIVES

GUIDING PRINCIPLES

Alternatives 2 and 3 were developed based on the recommendations of the SMP. However, because shoreline conditions have changed markedly since the time the document was published, areas for which no treatment was prescribed have recently become unstable to the degree that action is now recommended. To augment the recommendations of the SMP and thus the action alternatives for consideration in this EA, staff from Vanasse Hangen Brustlin, Inc. (VHB) and VIMS conducted a work session to explore possible treatment options. Options discussed during this workshop were subjected to the following governing principles so that only reasonable options for shoreline treatment were carried forward:

- options should be in keeping with the project's purpose and need statement
- options should be acceptable within the current regulatory climate and make sense from a permitting standpoint
- options should be largely in keeping with shoreline treatments that are proven and typical of the setting and not experimental or untested
- options should recognize the considerable degree of shoreline manipulation that has already occurred within the project area and strive to refurbish existing structures and/or develop structures that complement existing structures from a hydrodynamic standpoint

such that post-construction impacts on local bathymetry (i.e., scour) and local / regional depositional patterns are unaffected to the greatest extent possible

- options should be suitable for the given hydrogeomorphic setting and/or degree of anthropogenic change
- options should be designed to account for sea-level rise and be consistent with the guidelines of the NPS *Climate Change Response Strategy* (NPS 2010a)
- construction materials and methods should be readily available and feasible to employ
- options should represent a long-term but reasonable solution and be of a nature that reflects the level of observed threat to the adjacent park resources

It was also recognized during the development of the alternatives that no approach would be able to provide absolute protection for park resources. Rather, by considering the guidelines presented above along with financial constraints, the NPS developed alternatives that would result in a high level of protection. Additional information is provided below under "Elements Common to All Action Alternatives."

In addition to these governing principles, a NPS *Management Policies* (NPS 2006) were also considered. Specific and applicable policies are described below.

Watershed and Stream Processes

The NPS is charged with protecting watershed and stream features primarily by avoiding impacts on watershed and riparian vegetation and by allowing natural fluvial processes to proceed unimpeded. When conflicts between park infrastructure and stream processes are unavoidable, NPS managers must first consider relocating or redesigning facilities rather than manipulating streams. Where such manipulation is unavoidable, managers will use techniques that are visually nonobtrusive and that protect natural processes to the greatest extent practicable.

In developing the suite of shoreline treatments, the NPS in conjunction with VIMS and VHB, carefully weighed the introduction of new shoreline treatment methods against the potential impacts to nearshore sediment transport. Methods of shoreline treatment and their interaction with these processes are described in the following section, "*Shoreline Treatment Options*."

Protection of Geologic Processes

Geologic resources (both features and processes) are integral components of park natural systems. The NPS will allow natural geologic processes to proceed unimpeded except under certain circumstances. With respect to this project, two such exceptions are applicable:

- necessary in emergencies that threaten human life and property;
- there is no other feasible way to protect natural resources, park facilities, or historic properties.

Shorelines and Barrier Islands

Similarly, natural shoreline processes will be allowed to continue without interference. Any manipulation of the shoreline proposed to protect cultural resources may be approved only after an analysis of the degree to which such measures would impact natural resources and processes, so that an informed decision can be made through an assessment of alternatives. This EA represents such an assessment. NPS guidelines also require minimization of impacts outside the target areas (i.e., upstream and downstream areas).

In addition to these policies, the CLR for the parkway (NPS 1997) provided cautionary language regarding the indiscriminate use of riprap in future approaches to shoreline management as this may lead to an entirely armored coast, compromising the character of the parkway and surrounding natural areas.

The CLR noted that comprehensive application of such means of edge protection may lower the "integrity of the parkway's overall shoreline character" and recognized that shoreline management is a "complex task, requiring the integration of risk assessment, natural resource, cultural resource, and engineering approaches."

Lastly, the development of alternatives took into account the fact that relocation of the parkway, parkway infrastructure, and cultural and archeological resources is not possible for a number of reasons, most importantly:

- Retaining the resources in situ is particularly important given the rich history of the Historic Triangle.
- The parkway courses through an area with abundant natural resources located immediately adjacent to both sides of the alignment, meaning that opportunities for realignment are constrained by the likelihood of impacts to these resources.
- As a resource listed on the National Register, realignment of the parkway would result in an impact to the cultural landscape. Additionally, archeological resources are so disseminated that removal and cataloging necessary as a result of ground disturbance would be both cost-prohibitive and would likely have to be carried out at a level that would permanently alter the physical appearance of the area further potentially affect the cultural landscape.

The NPS Management Policies recognize instances where resource management practices may influence alternatives available for decision. In developing potential treatments for shoreline and coastal areas the Management Policies provide:

> Where human activities or structures have altered the nature or rate of natural shoreline processes, the Service will, in consultation with appropriate state and federal agencies, investigate alternatives for mitigating the effects of such activities or structures and for restoring natural conditions. The Service will comply with the provisions of Executive Order 11988 (Floodplain Management) and state coastal zone management plans prepared under the Coastal Zone Management Act of 1972. Any shoreline manipulation measures proposed to protect cultural resources may be approved only after an analysis

> of the degree to which such measures would impact natural resources and processes, so that an informed decision can be made through an assessment of alternatives. Where erosion control is required by law, or where present developments must be protected in the short run to achieve park management objectives, including high-density visitor use, the Service will use the most effective method feasible to achieve the natural resource management objectives while minimizing impacts outside the target area. (4.8.1.1)

The action alternatives developed that have effects on existing coastal processes have been developed in light of these provisions.

SHORELINE TREATMENT OPTIONS

Options to reduce the risk of shoreline erosion and to stabilize disturbed shorelines within the Chesapeake Bay consist of a suite of well established and proven approaches. The selection of a specific approach must consider a variety of local conditions. One such factor is the hydrodynamic setting, which includes the wave climate. The wave climate is the overall wave energy that is imparted on a stretch of shoreline averaged through time. It is a function of both fetch, defined as the distance over water which wind can blow to generate waves, as well as nearshore bathymetry and shoreline orientation. High energy environments may thus require a more robust means of defense than would low energy settings. Another factor influencing the selection of an approach is the presence or absence of existing means of shoreline treatment. For instance, should an existing structure consist of rock boulders or riprap, environmental impacts may be lessened or avoided by reincorporating these materials within the new approach rather than removing them from the site and installing an entirely new means of shoreline treatment.

The installation of shoreline treatments can affect natural shoreline processes of erosion and sediment transport. While shoreline armoring can effectively reduce the risk of erosion, it can accordingly staunch the supply of sediment that would otherwise be liberated from the riverbank and transported downstream. This nearshore transport of sediment, also known as littoral drift, can be important in sustaining the shape and extent of downstream depositional features such as beaches and spits. Structures that extend seaward from the shoreline (e.g., groins) can trap sediment in transport from upstream areas, resulting in similar impacts. Lastly, the presence of wetland features, cultural or archeological resources, or infrastructure along or in close proximity to the shoreline may dictate the most suitable approach.

Because of the considerable size of the project area and the variety of nearshore conditions present, both action alternatives include a variety of different possible approaches. However, many are common to both alternatives. Each of these approaches is described in general below as described in the SMP (VIMS 2006), followed by a discussion of their placement with Alternatives 2 and 3.

Defensive Approaches

Defensive shore protection approaches are those that are commonly placed at or along the base of an eroding bank as a last line of defense. For the purposes of this EA, stone revetments and sheet piling are the defensive approaches that have been considered.

Revetments

Photograph 2. Example of stone revetment installed as a shoreline defense structure. (Source: VHB)

Revetments are shoreline armoring systems that protect the base of eroding upland. They are by far the most common means of shoreline defense currently in use within the study area. Revetments are typically placed atop a graded slope. This slope may be achieved by excavating eroding banks in a landward direction (commonly referred to as bank "layback") or via the placement of fill materials in a seaward direction or by a combination of both cut and fill. The dimensions of the revetment are dependent on existing bank conditions and design parameters such as storm surge and wave height. These parameters also determine the size of the stone required for long-term structural integrity. Generally, two interlocking faces of armor stone are laid over a bedding stone layer with filter cloth between the earth subgrade and the bedding layer. The size of materials used within the revetment depends on the typical storm surge and wave height experienced at the location.

Sheet Piling

Photograph 3. Example of steel sheet piling installed as shoreline defensive structure. (Source: Atlantic Civil Products)

Sheet piling consists of interlocking sheets of steel that are driven into the earth using heavy equipment such as a pile driver or vibrating hammer. The resulting continuous wall is typically corrugated in cross-section. For the purposes of this EA, sheet piling would be of a cantilevered design as opposed to anchored into the bank using tiebacks. In cantilevered design, sheet piling is driven a sufficient depth into the ground to become fixed as a vertical cantilever in resisting the lateral active earth pressure (USS 1984).

Offensive Approaches

Offensive approaches to shoreline protection include structures that are built at some distance into shallow nearshore waters to dissipate the incoming wave energy before it reaches upland areas. These structures traditionally have been groins, structures extending in perpendicular fashion from the shoreline into the water and designed to capture sediment as it moves downstream. However, over the past decades, the use of breakwaters and sills has become an important element for shoreline protection. The use of offensive structures requires a thorough understanding of nearshore sand transport processes acting within a given shore reach. For this EA, sills and breakwaters are the approaches employed.

Sills and Breakwaters

Sills and breakwaters are free-standing structures designed to reduce wave action by energy attenuation (such as by surface friction or by the wave breaking), refraction (changing the wave direction as it moves into shallower water), and diffraction (waves "bending" around the sill or breakwater). A sill has a lower crest, is closer to the shore and usually is more continuous than larger breakwater units which the sills can be used in combination with. Sills are installed with beach fill behind (landward) to create a substrate for establishing a vegetated marsh fringe. They can be constructed of either stone or wood. Both sills and breakwaters may have spurs attached to them. Spurs typically project seaward away from the shoreline to move the point of wave diffraction farther offshore. Spurs or purposeful gaps created in otherwise continuous sills (gapped sill) allow for the creation of relatively small "pocket beaches," which offer habitat diversity along long stretches of artificially protected shoreline. These approaches are commonly referred to as "living shorelines," as they can provide habitat for marine plants and animals, improved water quality, and reduced sedimentation (Hardaway and Duhring 2010).

Photograph 4. Example of continuous sill with vegetated area between the structure and the bluff line. (Source: VIMS)

Living shoreline treatments do not sever the natural processes and connections between uplands and aquatic areas. Rather, living shoreline treatments are generally designed to compliment and accentuate geomorphic features of the shoreline that have developed due to natural processes over time. Further, this approach involves the placement of sandy fill material to act as a dissipative land-water interface and planting medium for the establishment of marsh and dune grasses. The potential for these types of structures to adversely impact nearshore processes is

particularly minimal in areas of previously armored shoreline, as the volume of sediment being contributed to the littoral system is limited.

Headland Control

This approach controls existing points of land (i.e., headlands) or strategically creates new points of land with stone breakwaters. The means of headland control employed for this EA is referred to as shore-attached or headland breakwaters. Headland breakwaters usually require beach fill in order to acquire long-term shoreline erosion control since they are constructed in areas that are subject to more energetic wind and wave conditions. The beach fill between the stone breakwater and the original shoreline is called a tombolo. The dimensions of the breakwater system and their positioning relative to the shoreline are dependent on the desired degree of protection, nearshore bathymetry, and potential impacts on littoral sediment transport (i.e., potential for the headland breakwaters to trap sediment that would otherwise be delivered downstream). Entrapment of sediment in transport can be reduced considerably by purposefully creating the tombolo as part of the installation process, also known as beach nourishment. Establishing this connection and an equilibrium plan form between the structure and the riverbank will limit both the loss of the nourishment material and increase the likelihood that sediment in transport from upstream areas will bypasses the structure(s) and continue downstream.

Photograph 5. View of shore-attached breakwaters at the Yorktown waterfront, an example of headland control structures. NWS-Yorktown is visible at the top of the frame. (Source: VHB)

Headland breakwaters were installed at the Yorktown Waterfront (which lies between components of the project boundary) in 2000 and successfully protected landward infrastructure from the storm surge associated with Hurricane Isabel.

STUDY REACH DESIGNATIONS

Because of the considerable length of York River shoreline within the park, the SMP divided the study area into five discrete Reaches (Figures 2a, 2b, 3a, and 3b).

- Reach IA: extends from the northern tip of the point at the Ringfield Picnic Area south to the mouth of Felgates Creek
- Reach I: extends from the mouth of Felgates Creek eastward along Bellfield Straight to the mouth of Indian Field Creek
- Reach II: extends from the mouth of Indian Field Creek to the western pier of the NWS Yorktown
- Reach III: extends from the eastern pier of NWS Yorktown to a point just beyond the location of Redoubt 1 / Fusilier's Redoubt at the Yorktown Victory Center
- Reach IV: extends from a location at the Point of Rocks due east of the Yorktown Battlefield visitor center through to the property line with the USCG Training Station Yorktown, not including those private properties intermingled in this reach.

These same reach designations are used for the purposes of this EA, each of which is further divided into "Sub-Reaches" that are distinguished by an additional alpha designation (e.g., Reach I, Sub-Reach b). These Sub-Reaches represent the smallest unit of classification (Figures 4 through 6). Within each Sub-Reach, the shoreline treatment approach is uniform. Each action alternative uses the same Sub-Reach designations.

The study area for this EA is the compilation of these study reaches. The landward and seaward extent of the study area is defined by reach in Table 1.

Table 1: Study Area Designation

Reach	Sub-Reaches	Landward Limit of Study Area	Approximate Seaward Limit of Study Area Measured from Shoreline (ft)
IA	all	approximately 50 ft from top of bluff	200
I	all	approximately 20 ft south of parkway edge of pavement	200
II	all		200
III	a		300
	b		200
	c	approximately 150 ft from top of bluff (cleared area at Yorktown Victory Center)	200
IV	all	shoreline and bluff face only	200

ALTERNATIVE 1: NO ACTION

Under the No Action alternative, no comprehensive or planned and designed shoreline improvements would be carried out. Rather, reparations to existing shoreline defenses would be carried out on an as needed basis in response to an observed and imminent threat to the parkway

caused by continued landward migration of the shoreline, storm related or otherwise. Such reparations would likely be carried out in localized fashion in a manner similar to repairs at parkway kilometers 3 and 5. Other maintenance activities would include occasional removal of excess vegetation from riverbank slopes (particularly along Bellfield Straight) where such vegetation may pose a threat to bank stability and/or block the viewshed of the York River.

Reach designations are mapped on Figures 4 through 6. Specific conditions at and potential actions for each of the study Reaches are discussed below. Resources in uplands along the river bank in the study area include prehistoric, Native American and historic, Colonial and Post-Colonial era sites. The prehistoric components date to the Middle and Late Woodland periods and most of the historic components date to the 18th and 19th centuries, with one plantation site dating to the 17th century. Some of these resources are deemed eligible for inclusion on the National Register of Historic Places (WMCAR 2009, 2011a).

REACH IA

There is currently no means of shoreline defense for this Reach. Park infrastructure at the Ringfield Picnic Area is limited to the access road and restroom, which have been closed since 1994. Vehicular access from the parkway is restricted. No routine maintenance activities are currently carried out in this portion of the park.

REACH I

The dominant feature in Reach I is the riprap revetment along Bellefield Straight. Under the No-action alternative, this revetment would remain in place, sections of which have greatly diminished capacity to prevent shoreline erosion during storm events because areas of the riprap revetment have detached from the shoreline. Under the No-action Alternative, gullies at Bellfield Straight would be repaired by targeted maintenance on an ongoing basis. Areas of imminent shoreline encroachment would be addressed in similar fashion to work completed at parkway markers kilometer 3 and kilometer 5; as emergency measures carried out in ad hoc fashion.

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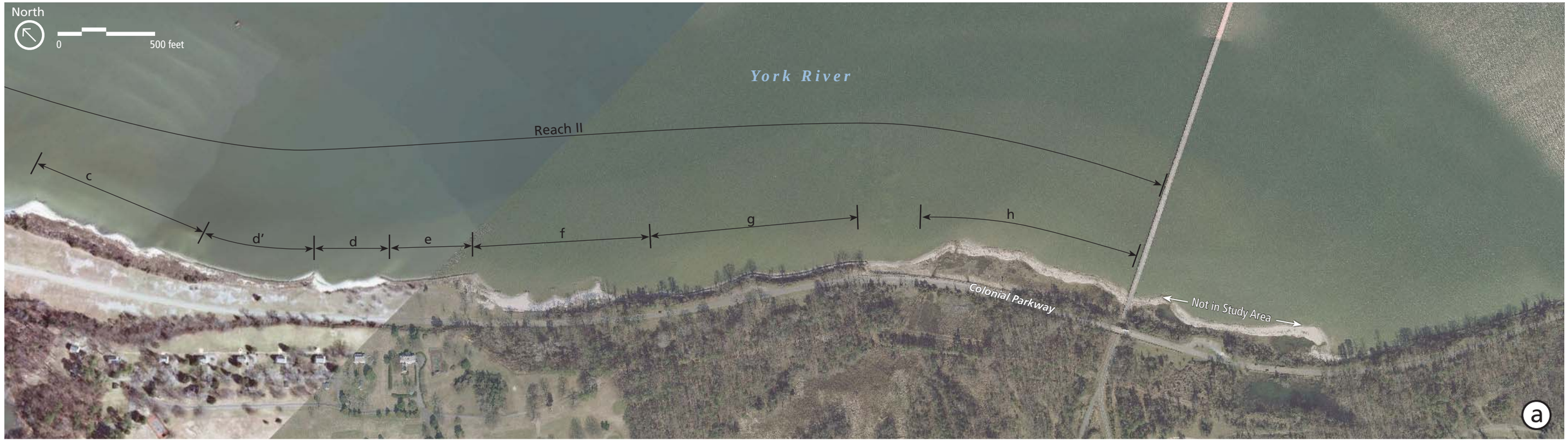
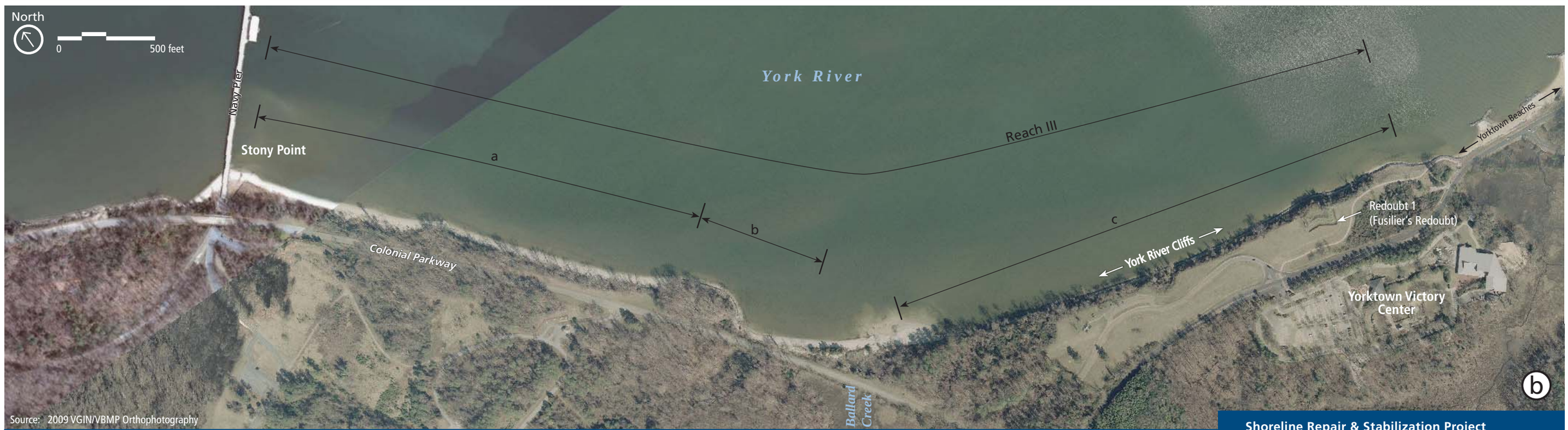
Figure 4
Alternative 1: No Action - Reaches IA, I, and II





Source: 2009 VGIN/VBMP Orthophotography

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Figure 5
Alternative 1: No Action - Reaches II and III

Source: 2009 VGIN/VBMP Orthophotography

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Environmental Assessment

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Figure 6
Alternative 1: No Action - Reach IV

REACH II

Indian Field Creek marks the transition from Reach I and Reach II. Under the No-action Alternative, targeted maintenance would be carried out on an as needed basis at locations of imminent shoreline encroachment. One such location may include the area around the bridge abutments that was eroded during Hurricane Isabel.

Photograph 6. View of the undermined road surface at the northwest abutment at Indian Field Creek after Hurricane Isabel. (Source: NPS)

REACH III

Reach III is dominated by two Sub-Reaches, “a” and “c.” At Sub-Reach “a,” a narrow and sandy beach is present, fronting a steep and wooded river bluff at the backshore. Though such beaches are rare along the southern shore of the York River, the beach is too narrow and the low backshore does not provide sufficient wave energy dissipation for the toe of the bluff during storm events. In Sub-Reach “c,” Fusilier’s Redoubt, a pedestrian pathway, and road surface are located immediately landward of the bluff. Repairs to existing shoreline treatment approaches would be carried out on an as needed basis and in localized fashion in response to imminent shoreline encroachment or after such encroachment has occurred.

Photograph 7. View of shoreline at Reach II, Sub-Reach "b," showing revetment separation from bank and associated slumping of bank materials. Stormwater-enhanced gullies can be seen as notches in the ground surface at the top of the bank. (Source: VHB)

REACH IV

Reach IV is characterized by a single shoreline treatment approach: riprap revetment. Sections of Reach IV have poorly vegetated riverbanks above the revetment and localized revetment failures. Like Reach I, and Reach III at the York River Cliffs, such erosion would continue under the No-action Alternative. Though the parkway is not located in close proximity to Reach IV, other cultural resources associated with the Yorktown Battlefield do lie just beyond the top of the river bluff. As per the other Reaches, repairs to existing shoreline treatment approaches under the No-action Alternative would be carried out on an ad hoc and localized fashion in response to imminent shoreline encroachment on resources or after such encroachment has occurred.

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

The proposed shoreline treatments for both Alternative 2 and Alternative 3 are graphically depicted in Figures 7 through 9 and 13 through 15, respectively, and described in Table 2. Table 2 also includes the resource at risk by reach, which may include historic structures (parkway and others), the cultural landscape of the parkway, archeological resources, and/or wetland resources. Application of the governing principles discussed in the previous section and a consideration of local site conditions and pre-existing means of shoreline treatment dictated that the proposed

action for both alternatives remain the same for some locations within the study area. For example, rehabilitating the existing revetments under the bridges at Felgates Creek and Indian Field Creek is the only practicable option. Also, existing wetlands and the possibility of enhancing such features led to the recommendation to use a gap rock sill immediately downstream of the mouth of Felgates Creek at Reach I, Sub-Reach “a” and at multiple locations in Reach II, including Sub-Reaches “c,” “d,” and “e.” Due to the deeper water in the nearshore in Reach IV and the degree of rock material already invested as a revetment along the toe of the slope, the treatment options for Alternatives 2 and 3 are identical (revetment rehabilitation).

The effective heights of structures for both Alternative 2 and 3 are conceptual and subject to change based on future detailed design work. They were developed collaboratively between VIMS and VHB to provide reasonable design parameters from which a robust impacts analysis could be completed. The design concepts provided in this document do not provide absolute protection against any storm event. This would not be financially feasible and may be impossible to accomplish without contravening the guiding principle discussed earlier in this chapter. Rather, the design concepts provide a high level of protection; effectively reducing the risk of shoreline erosion that would result from a storm surge elevation equivalent to that experienced during Hurricane Isabel. The most appreciable vertical augmentation of shoreline defense would occur along areas of existing revetment (defensive structures), where crest elevation may increase by up to 4 ft to +9 ft MLW. This elevation is just above the Hurricane Isabel still water surge elevation, which means that should an equivalent event happen in the future, wave run up would occur above the level of protection. While this may result in some erosion above that elevation, the stone augmentation along the toe and flank of the embankment would reduce the risk of bank failure considerably from current conditions.

Potential barge approaches from the York River towards temporary “port” locations are shown in Figures 7 through 9 for Alternative 2 and Figures 13 through 15 for Alternative 3. These would be the principal avenues for material delivery to complete temporary haul/construction roads along the shoreline and allow access for the equipment required to install the structures. These approaches are identical for both Alternatives 2 and 3. Though the exact method of equipment and material delivery is pending final design plans, it is probable that multiple barges would be strung together in series to create a temporary and floating road. These would be temporarily anchored to remain stationary when equipment and material are offloaded. The most landward barge would be purposefully run aground to allow equipment to disembark. The most seaward barge would be positioned at a location that allows free moving tugboats and supply barges to offload materials, equipment, and equipment operators throughout the construction phase.

Table 2: Summary of Shoreline Treatment Approaches by Reach and Sub-Reach

Reach	Sub-Reach	Resource at Risk	Shoreline Treatment Alternative 2	Shoreline Treatment Alternative 3
IA	a	AR, WR	Rock Sill	Wood Sill
	b	AR, WR	Pocket Beach	Wood Sill
	c	AR, WR	Rock Sill and Pocket Beach	Wood Sill and Pocket Beach
	d	HS(P), CL	Revetment Rehabilitation	
I	a'	HS(P), CL	Revetment Rehabilitation	
	a	HS(P), CL, WR	Gap Sill (Rock)	
	b	HS(P), CL, AR	Revetment Rehabilitation	Steel Sheet Piling
	c	HS(P), CL	Revetment Rehabilitation	
II	a'	HS(P), CL, AR	Revetment Rehabilitation	
	a	HS(P), CL, AR	Revetment Rehabilitation	Steel Sheet Piling
	ab	HS(P), CL, AR	Rock Sill	Steel Sheet Piling
	b'	HS(P), CL, WR, AR	Rock Sill Rehabilitation	
	b	HS(P), CL, WR, AR	Rock Spur and Pocket Beach	Revetment
	c	HS(P), CL, WR, AR	Rock Sill and Pocket Beach	
	d'	HS(P), CL, WR, AR	Rock Sill Rehabilitation	Gap Sill (Rock)
	d	HS(P), CL, WR, AR	Gap Sill (Rock)	
	e	HS(P), CL, WR	Rock Sill Rehabilitation	Gap Sill (Rock)
	f	HS(P), CL, WR, AR	Breakwater Rehabilitation	Revetment
	g	HS(P), CL	Revetment Rehabilitation	
	h		No Action (area of natural beach development)	
III	a	HS(P), CL, WR	Breakwater System	Revetment
	b	HS(P), CL	Revetment Rehabilitation and Spur	Revetment Rehabilitation
	c	HS(O), AR	Revetment Rehabilitation	Steel Sheet Piling
IV	a	HS(O)	Revetment Rehabilitation	
	b	HS(O)	Revetment Rehabilitation	

KEY: AR: archeological resources
CL: cultural landscape of the parkway
HS: historic structures, (P): parkway, (O): other
WR: wetland resources

ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

The proposed shoreline treatments for Alternative 2 are graphically depicted in Figures 7 through 9 and described in Table 2.

REACH IA

There is currently no means of shoreline defense at Reach IA. Wave attack on the bluffs of the Ringfield Picnic Area has resulted in the displacement of cultural artifacts from the soil column and onto the back beach. Rather than place armoring at the base of the bluff in the form of a revetment, the principal treatment approach is the use of a rock sill with pocket beaches occurring at purposeful breaks in the sill. This approach works in complementary fashion with the existing beach. A relatively large (~200 ft long) pocket beach would be created in the center of the Reach between two seaward-pointing spurs. The revetments protecting the pilings supporting the bridge over Felgates Creek would be rehabilitated, which may include repositioning and/or reapplication of rock material to increase the effective height.

Construction access to Reach IA would be provided by a single barge port located near the center of the Reach. The exact location of the barge port, material staging area(s), and the configuration and location of the construction haul road are subject to detailed design as well as the results of underwater archeological investigations. The road would be approximately 15 ft wide and constructed of sand. The haul road would incorporate vehicle “turnouts” located at the north and south termini of the proposed sill. These turnouts would allow room for construction equipment to turn around and return to the barge port. These turnouts would be roughly 40 ft wide by 80 ft long.

Construction of the sill would occur on the seaward side of the haul road. A track hoe equipped with a long boom and hydraulic thumb bucket or rock grapple would most likely be the heavy equipment deployed to carefully place the rock material to construct the sill. The sill itself would have a crest elevation of approximately 3.0 ft mean low water (MLW, see page 7 for definition) and be 4 ft wide with sideslopes at a ratio of 1.5:1 (horizontal:vertical) (Figure 10). Subsequent to sill installation, the sandy roadbed material would be left in place and augmented behind the sill as necessary to act as a planting medium for the establishment of tidal marsh vegetation. A zone of saltmarsh cordgrass (*Spartina alterniflora*) would be established immediately behind the sill, transitioning to saltmeadow cordgrass (*Spartina patens*) landward as elevation increases and as space permits.

While the installation of the haul road required to construct this sill and the subsequent placement of the sandy planting substrate may overlap with and impact the seaward fringe of existing estuarine wetlands, the area of post-construction planting would result in an overall increase in wetland area. This is because the sill will be positioned some distance seaward of the existing wetland fringe and planting would proceed out to the flank of the sill.

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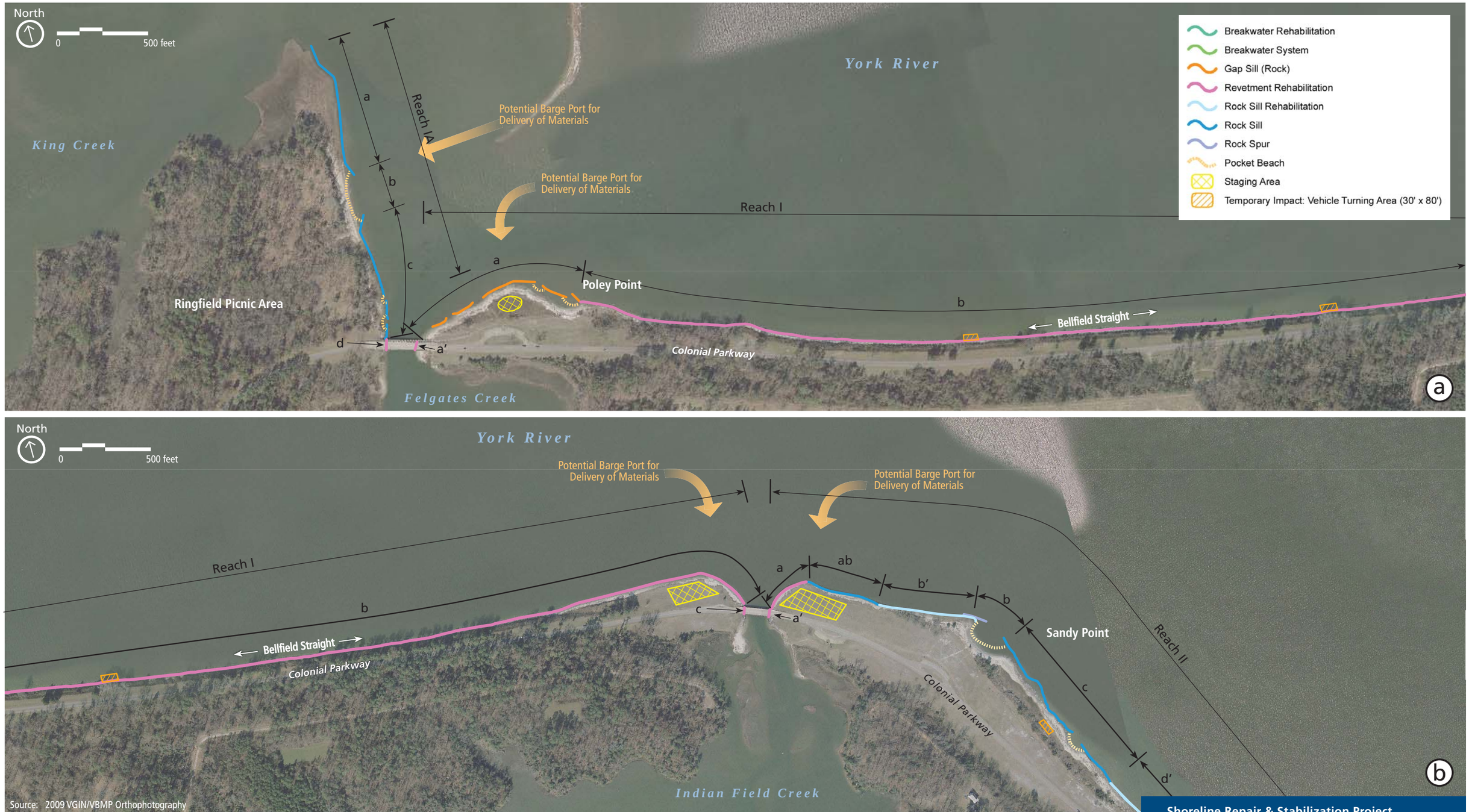

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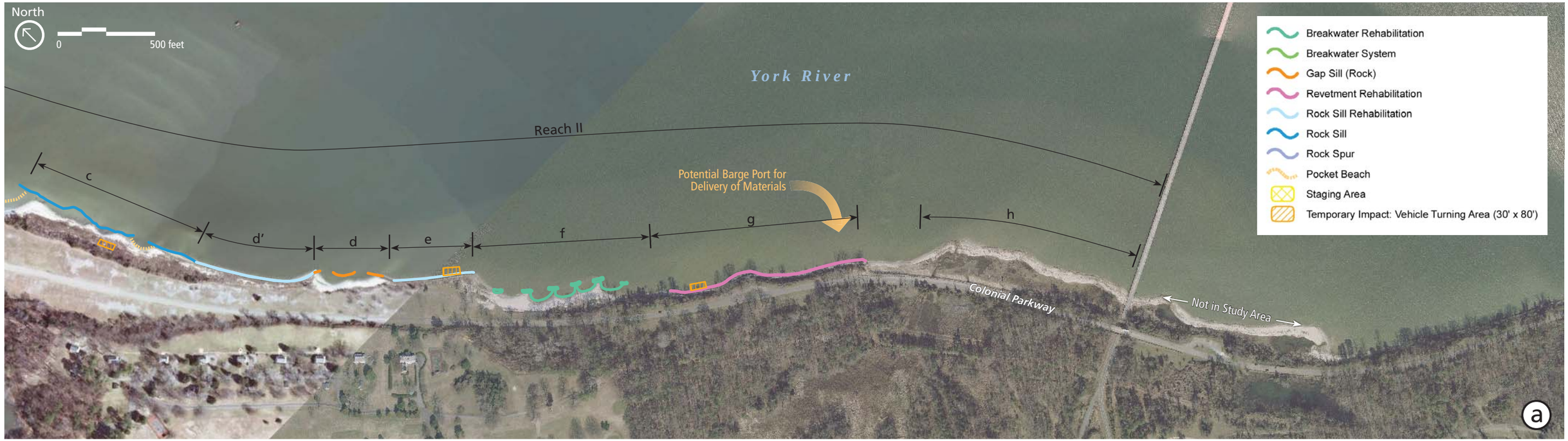
Figure 7
Alternative 2: Shoreline Treatment - Reaches IA, I, and II (NPS Preferred Alternative)



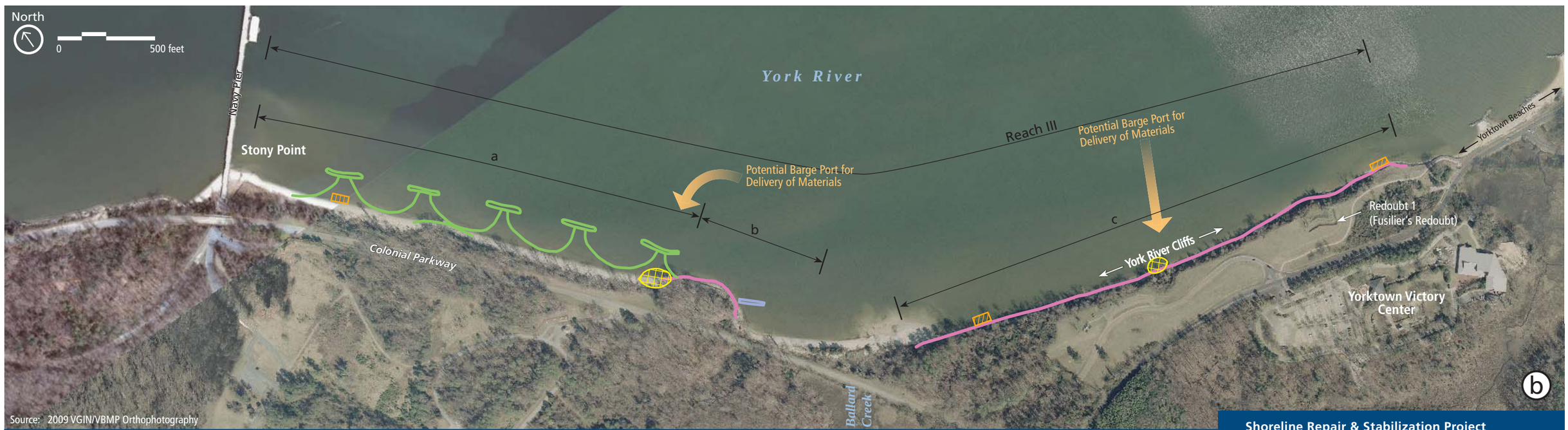


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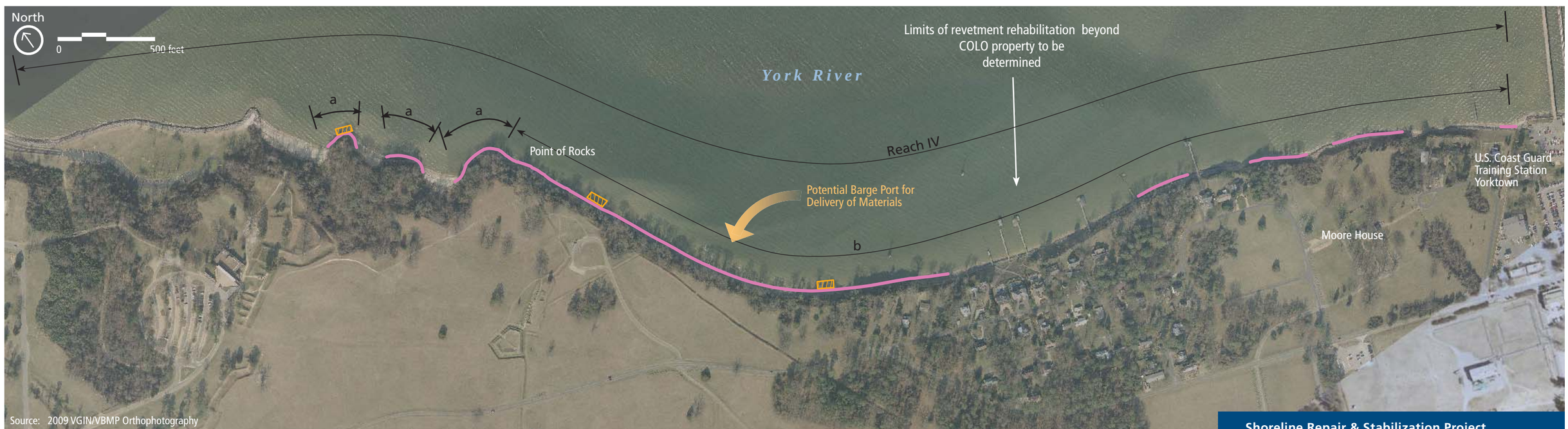
Figure 8

Alternative 2: Shoreline Treatment - Reaches II and III (NPS Preferred Alternative)

- Breakwater Rehabilitation
- Breakwater System
- Gap Sill (Rock)
- Revetment Rehabilitation
- Rock Sill Rehabilitation
- Rock Sill
- Rock Spur
- Pocket Beach
- Staging Area
- Temporary Impact: Vehicle Turning Area (30' x 80')



Source: 2009 VGIN/VBMP Orthophotography

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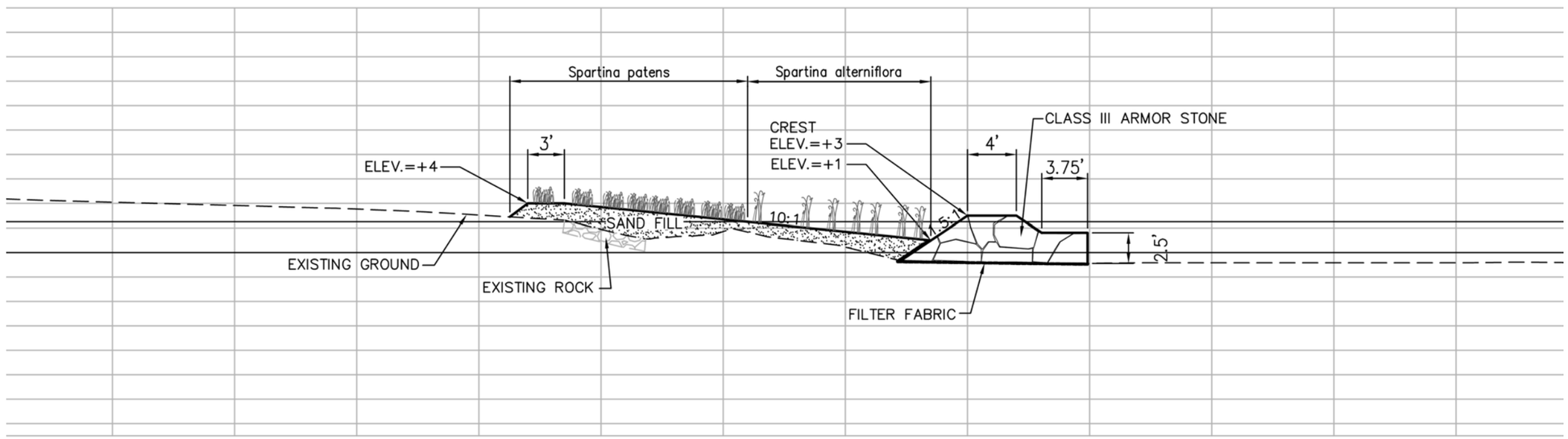
Figure 9

Alternative 2: Shoreline Treatment - Reach IV (NPS Preferred Alternative)



Horizontal Scale: 1" = 10'
Vertical Scale: 1" = 10'

Figure 10
Alternative 2: Representative Cross Section - Rock Sill

REACH I

Reach I consists of two shoreline treatments. At Sub-Reach "a" immediately downstream of Felgates Creek (also known as Poley Point), a gap sill would be constructed in the manner and per the dimensions described for Reach IA. Zones of saltmarsh cordgrass and saltmeadow cordgrass also would be established. Like Reach IA, this approach to offensive, living shoreline treatment would reduce the risk of shoreline recession and subsequent parkway damage by enhancing the wetland interface between MLW and the parkway. The only other option to reduce the risk of shoreline encroachment towards the parkway at this location is to install a revetment along the north flank of the parkway. This treatment approach would be inconsistent with the guiding principles described under the *Development of Alternatives* in Chapter 2, as it would fail to protect the wetland resources identified at Poley Point as well as park infrastructure (the wayside) and would result in an increase in riprap revetment (which is discouraged by the parkway CLR).

For the remainder of Reach I, the proposed shoreline treatment is rehabilitation of the existing revetment. The design of the rehabilitated revetment would seek to augment the structure in a vertical and seaward direction. The height of the revetment would be increased from the present elevation of roughly 5.5 ft MLW to 9.0 ft MLW (Figure 11). The rehabilitation would involve a minor degree of bank cutting (on the order of 5 to 10 ft) to facilitate construction access and to achieve the appropriate grade to "attach" the revetment to the bank. The conceptual design minimizes bank cutback by putting the seaward position of the haul road as far out as possible (i.e., at the seaward break in slope of the existing revetment).

The rehabilitated revetment would consist of three principal components:

1. Armor Stone: Armor stone is the seaward component of the revetment consisting of Virginia Class III[1] armor stone placed at a 2:1 slope placed on top of the existing revetment. The horizontal width of the armor stone would be approximately 20 to 25 ft, though because it would be placed in large part atop the existing revetment, the seaward expansion of new stone would generally be limited to 5 to 10 ft but would be dependent on local conditions.

2. Splash Apron: The splash apron is a ±10-ft wide horizontal swath of gravel directly behind the armor stone, vegetated with saltmeadow cordgrass.

3. Bluff Stone: The bluff stone is material placed at the interface of the revetment with the existing bank. It would consist of Virginia Class II[2] stone. This is an atypical revetment features that has been added to the conceptual design to minimize bank grading and allow for construction access from the erosional terrace that has developed landward of the existing revetment.

[1] 500 to 1,500 lbs with at least 50 percent weighing more than 900 lbs except that approximately 10 percent may weigh less than 500 lbs
[2] 150 to 500 lbs with at least 50 percent weighing more than 300 lbs except that approximately 10 percent may weigh 150 lbs or less

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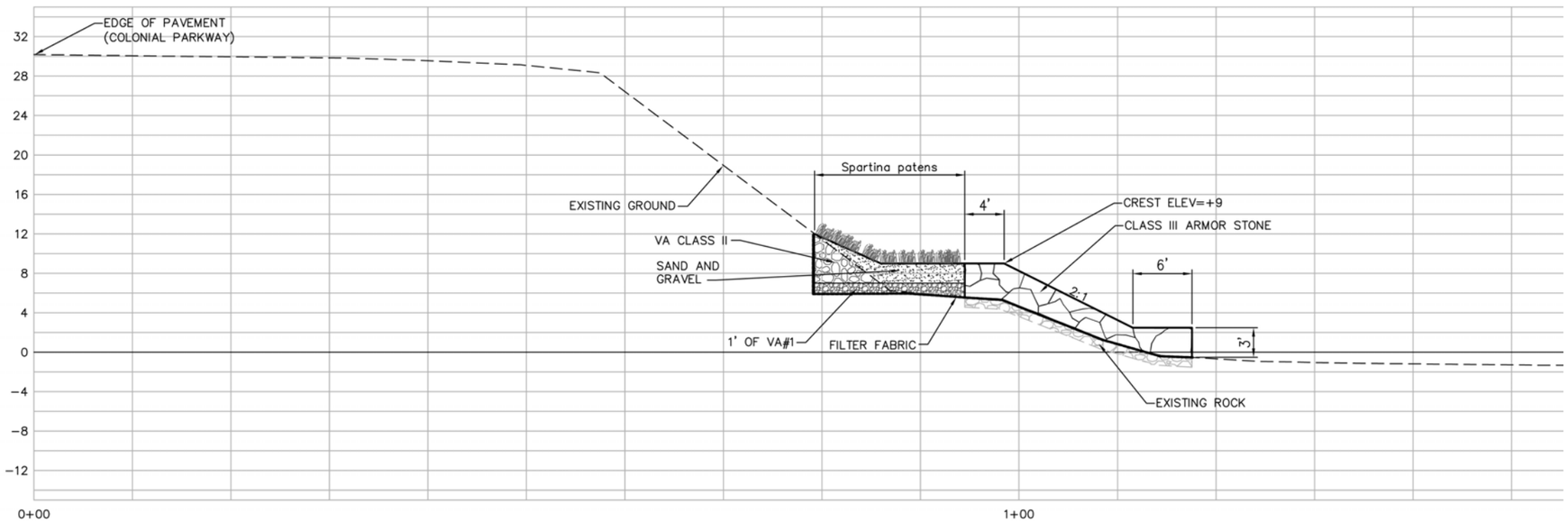

Figure 11
Alternative 2: Representative Cross Section - Revetment Rehabilitation

Two barge ports would be used for Reach I, one located at either end. Two vehicle turnouts would be provided at regular spacing. Due to the length of this Reach, on-land material staging may be required. This would occur in the grassy areas near the barge port (i.e., areas around the mouth of Felgates and Indian Field Creek between the parkway and the York River). The rock materials that comprise the current revetment would be reused as part of both the construction process and as the foundation for the new armor stone. Much of the current revetment has separated from the river bank. The haul road, measuring approximately 20 ft in width, would be constructed in part atop this rock course using a bulldozer. Turn out areas would be a maximum of 40 ft wide at the passing zone (center) and be 80 feet long. The turn outs would taper from this central zone down to the 20-ft haul road width. The materials would be flattened and augmented with additional rock as necessary to allow construction equipment to run along it.

Revetment rehabilitation would proceed from an interior location within the Reach and retreating to each barge port. This process of backing out allows for the roadbed and former revetment materials to be reincorporated into the structure of the new revetment. However, to facilitate the construction process, the areas of the turn outs would remain as localized protuberances along the revetment. This approach would depend on final design and regulatory approval.

Alternative 2 also would involve the reparation of gully erosion between the bluff line and the parkway road surface. This work may be possible to accomplish from the haul road, but it is likely that some work would need to be performed via access from the parkway and using moderate duty equipment. Any large pieces of organic debris within the gully would be first removed to create a suitable substrate. No excavation would be carried out. The gully would then be backfilled with an appropriate material. The park has typically performed such repairs using fine-textured materials such as clay. The filled gully would then be top dressed with any available stockpiled native soil material and the area restored to preconstruction conditions, including recontouring and revegetation using an NPS approved seed mix and park native plants if available. Hydroseeding the mix with the use of a tackifier would be a suitable approach and would help prevent soil erosion and displacement of seed. All restoration would follow guidelines approved by park staff. Any fill material needed would be taken from approved sources outside the park and all reasonable measures would be taken to acquire the fill from a weed-free source. Any excess material generated from construction activities would be stockpiled in park storage areas for future use in approved projects or disposed of at approved sites outside the park.

REACH II

Reach II contains the largest variety of proposed shoreline treatments. Revetment rehabilitation would occur in three locations in a manner similar to that discussed above for Reach I: Sub-Reaches “a,” “d´,” and “g.” At Sub-Reaches “ab” and “c,” new rock sills would be created upstream and downstream of Sandy Point where bathymetric conditions are amenable to marsh wetland creation. These sills would be constructed in a manner similar to that for Reaches IA and I. The sill at Sub-Reach “ab” would be constructed in roughly the same location as the existing remnants of the revetment, using these materials to the maximum extent possible in the construction of the new sill. The upland area landward of the sill is currently a maintained grassy area which lies atop hydraulic fill placed during the construction of the Indian Field Creek

bridge. It would be excavated to create a planting terrace approximately 40 ft inland from the existing revetment. This approach would create a marsh fringe wetland system similar to what may have been present along the shoreline before the construction of the parkway. The ability to recreate pre-construction conditions is the primary reason for pursuing this approach.

The rock sill at Sub-Reach "c" would be located seaward of the current discontinuous sill by approximately 30 ft. However, the crest elevation of these sills would be slightly lower, at approximately 3.0 ft MLW. The width of the crest would be 4.0 ft and the sideslopes would have a gradient of 2.5:1. The reasoning for the proposed new sill at Sub-Reach "c" is the same as for Reach I, Sub-Reach "a;' to reduce the risk of shoreline recession and subsequent parkway damage by enhancing the wetland interface between MLW and the parkway. The only other option to reduce the risk of shoreline encroachment towards the parkway at this location is to install a revetment along the backshore. This treatment approach would be inconsistent with the guiding principles described under the *Development of Alternatives* in Chapter 2, as it would fail to protect the wetland resources seaward of the revetment and would result in an increase in the amount of shoreline armoring, which is discouraged by the parkway CLR.

An existing sill would be rehabilitated at Sub-Reach "e," just upstream of the NPS Breakwaters located in Sub-Reach "f." Each of these construction activities would be carried out using construction equipment and haul roads similar to those described in the preceding sections for Reaches IA and I. Proposed barge ports and vehicle turnout locations are provided in Figures 7 through 9.

The NPS Breakwaters would be rehabilitated under Alternative 2. This would include repositioning the existing concrete slabs only as needed to accommodated the placement of new rock required to augment structure height. The crest elevation of the new rock would be approximately 5.0 ft MLW, the crest would be approximately 6 ft wide, and 1.5:1 slopes would extend from the crest to the river bottom. Class III stone would be used as armor stone. Clean, sandy fill material may be placed landward of these features to create shore-attached breakwaters. In such an instance, the installation of plant materials also would be considered.

No action is proposed in Reach II downstream of Sub-Reach "g." This is because the reparations have already been conducted at parkway kilometer 5. Furthermore, Sub-Reach "h" represents an area of active beach formation where longshore transport of sediment is accumulating on the upstream side of the west pier at NWS Yorktown.

REACH III

Sub-Reach "a" represents the only location of proposed new breakwater construction within the project boundaries. Though this Sub-Reach already has a sandy beach present, the elevation of the beach and the backshore area is insufficient to dissipate wave energy during storm events. The rate of shoreline recession in this area ranged between 3 to7 ft for the period 1994 to 2002. The riverbank will continue to recede landward as sea level rise allows storm surges to impinge upon the bank at higher elevations.

In determining the approach to reduce the risk of shoreline recession at Sub-Reach "a," the existing sandy beach was taken into account. The shore-attached breakwaters provide the opportunity to protect and expand this sandy intertidal habitat, which is relatively sparse along this reach of the York River. Five separate breakwaters are proposed. Each breakwater would have a crest elevation of approximately 5.0 ft MLW and crest width and length of approximately 6 ft and 150 ft, respectively (Figure 12). The gradient of the sideslopes of the breakwater would be 1.5:1. The breakwaters would be spaced by a gap distance of roughly 200 ft and they would be located approximately 130 ft seaward of the current shoreline. The footprint of each breakwater would measure approximately 174 ft in length by 30 ft in width, resulting in an area of approximately 6,310 ft^2 (0.14 ac). The total footprint for all five breakwaters would be approximately 31,550 ft^2 (0.72 ac).

Each breakwater would be attached to the shore by a bar of sand (also known as a tombolo) that would be brought to the site from offshore sources, embellishing the existing beach face in this location, both in height and width. Construction would proceed in much the same manner as that described for the rock sill at Reach IA, with equipment working on sandy beach fill material landward of the proposed structures.

The lowermost segment of Sub-Reach "b" has been repaired in the recent past. This reparation was named for its location at parkway kilometer 3. This revetment would be rehabilitated as part of Alternative 2 and would include a new spur pointing downstream where the riverbank turns sharply south. This spur would act as an artificial headland, moving the point of wave diffraction farther offshore to assist in attaining local equilibrium of the shoreline plan form.

The gap between Sub-Reaches "b" and "c" corresponds to the mouth of Ballard Creek, where no erosion-related issues have been observed. Downstream of this point, the existing revetment running along the base of the York River Cliffs would be rehabilitated in similar fashion to the revetment at Bellfield Straight (Reach I, Sub-Reach "b"), though its crest elevation would be 10.0 ft MLW as opposed to 9.0 ft.

Because of the presence of the mouth of Ballard Creek between Sub-Reaches "b" and "c", two barge ports would be required to provide construction access for Reach III. The locations of these ports, turnouts, and stockpile areas are presented on Figures 5 through 7. In this instance, stockpile areas would be located in areas that would subsequently be permanently improved (e.g., behind breakwater beach at Sub-Reach "a") and thus limiting the amount of post-construction restoration.

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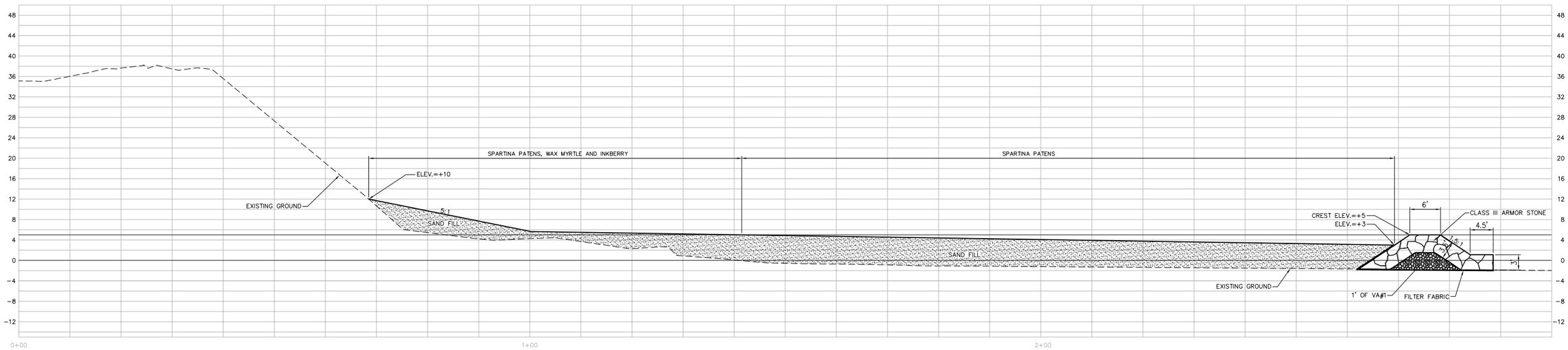

Horizontal Scale: 1" = 20'
Vertical Scale: 1" = 20'

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Figure 12

Alternative 2: Representative Cross Section - Shore-Attached Breakwater System

REACH IV

As previously mentioned under the section "Elements Common to All Action Alternatives," the proposed approach throughout Reach IV is revetment rehabilitation. Construction would be carried out in identical fashion to revetment rehabilitation in the Reaches described above. However, due to the intermingled nature of private and public properties in Reach IV, potential barge access locations have not been identified.

Photograph 8. Example of wood sill. (Source: NC Division of Coastal Management).

For the purpose of this EA, riverbank cut back is not considered an option at the two westernmost promontories in Sub-Reach "a," which are part of the Point of Rocks area. This is because these features are comprised of relatively resistant rock materials and represent naturally occurring headland control.

ALTERNATIVE 3

The proposed shoreline treatments for Alternative 3 are graphically depicted in Figures 13 through 15 and described in Table 2.

REACH IA

The shoreline treatment, means of access, and necessary equipment would be identical to Alternative 2, with a continuous wooden sill being used instead of a rock sill. The large pocket beach shown in a central location of Reach IA in Alternative 2 would not be created.

REACH I

The only difference between Alternatives 2 and 3 for Reach I is the use of steel sheet piling as opposed to revetment rehabilitation. The specifications of the haul road and required heavy equipment would remain the same, with the addition of a pile driver. The footprint of the pile driver may require a wider haul road and turn out width than that described for Alternative 2. This additional width would likely be made up by extending the road in a seaward direction (fill) as opposed to additional bank cut back. However, because stone material from the revetment may lie in close proximity to the toe of the slope (i.e., the ideal position for sheet pile installation), more extensive bank cut back may be required in order to expose a substrate that is relatively void of large stone material and thus amenable to pile driving.

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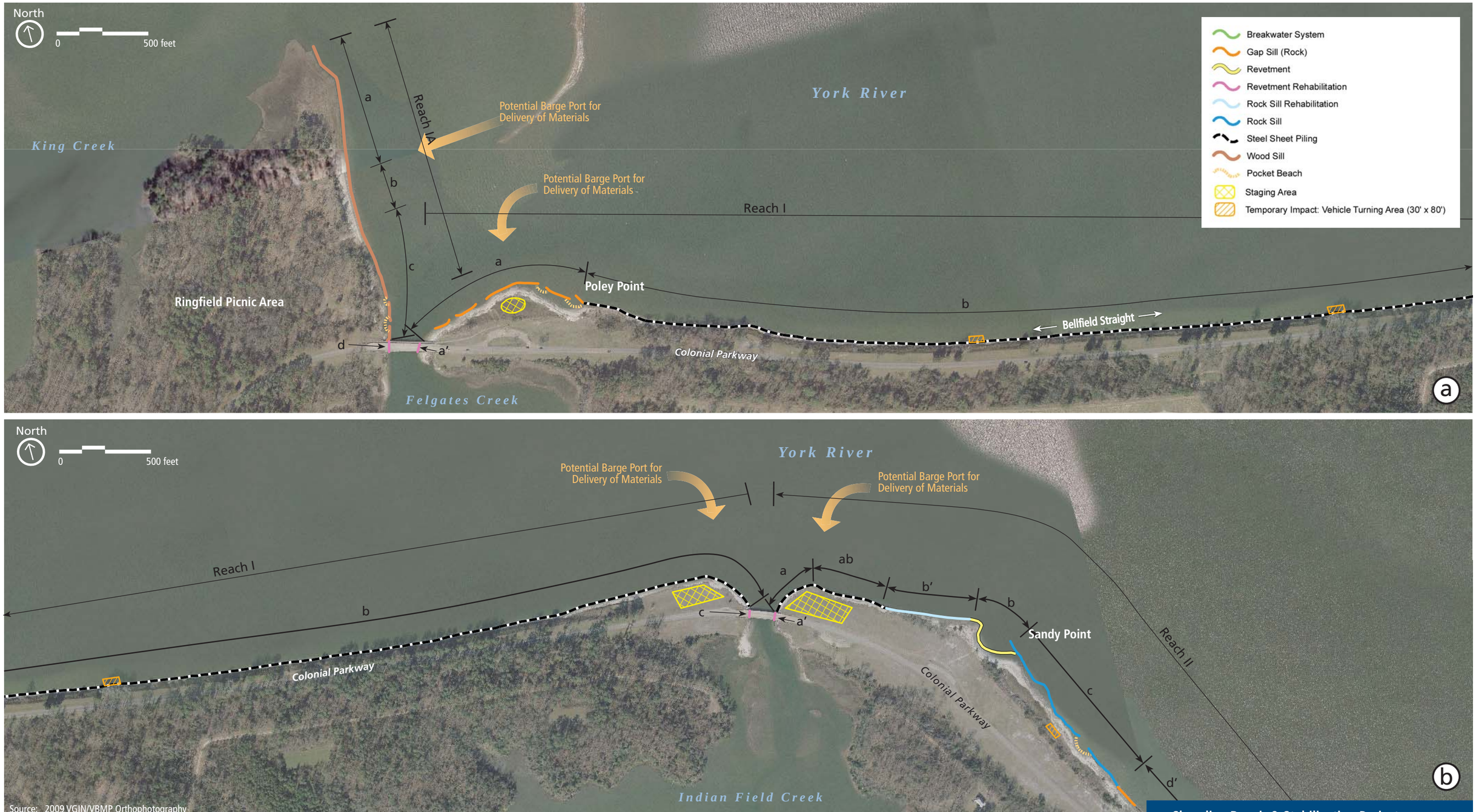

Source: 2009 VGIN/VBMP Orthophotography

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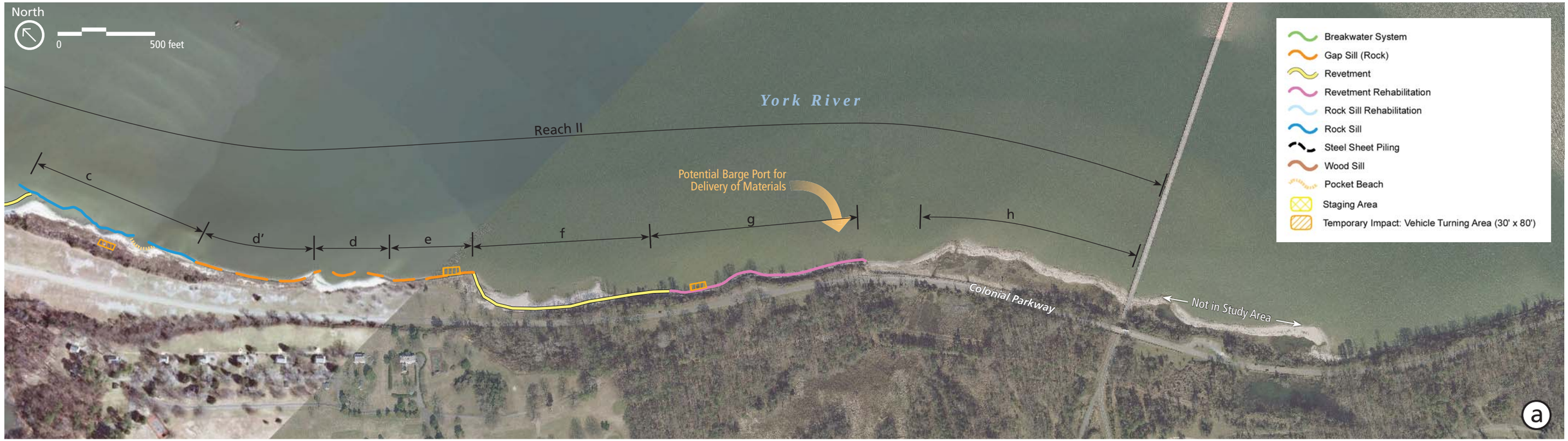
Figure 13
Alternative 3: Shoreline Treatment - Reaches IA, I, and II



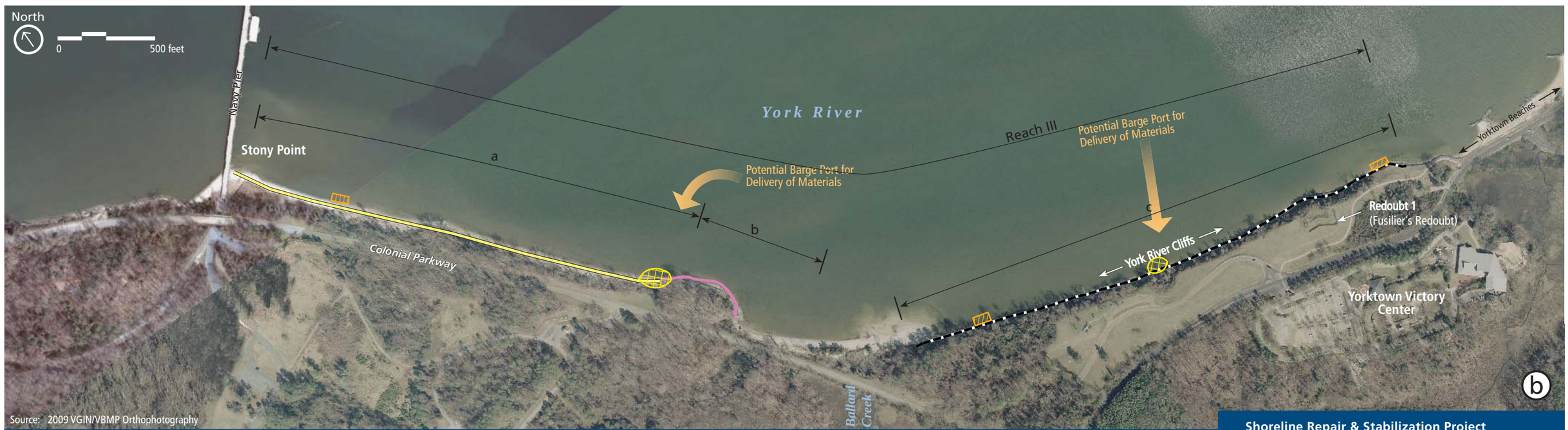


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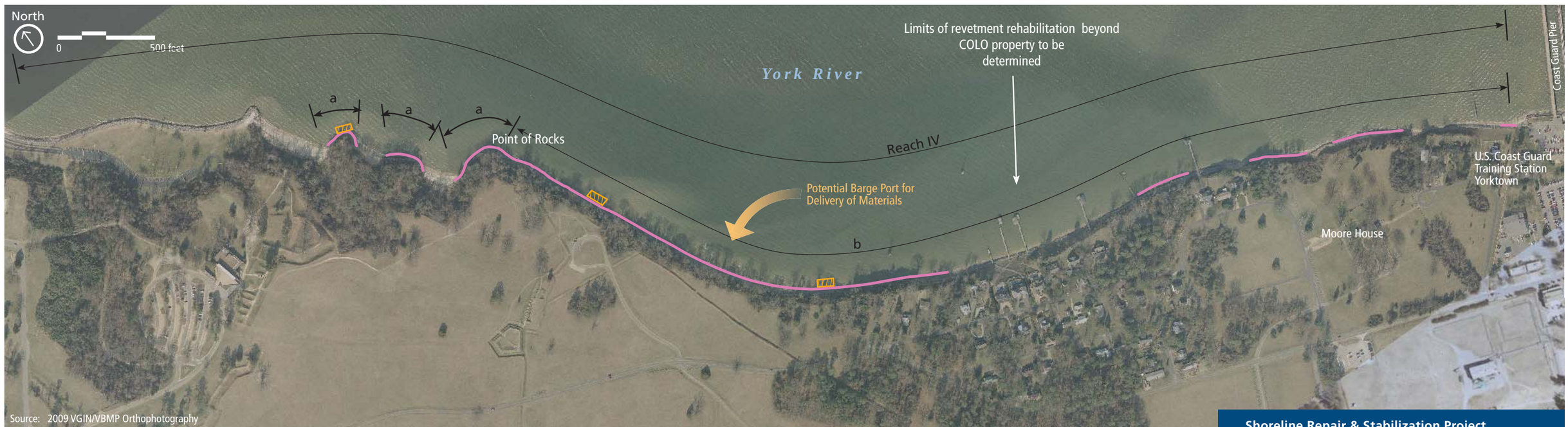
Figure 14
Alternative 3: Shoreline Treatment - Reaches II and III

- Breakwater System
- Gap Sill (Rock)
- Revetment
- Revetment Rehabilitation
- Rock Sill Rehabilitation
- Rock Sill
- Steel Sheet Piling
- Wood Sill
- Pocket Beach
- Staging Area
- Temporary Impact: Vehicle Turning Area (30' x 80')



Source: 2009 VGIN/VBMP Orthophotography

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Figure 15
Alternative 3: Shoreline Treatment - Reach IV

Like Alternative 2, the rock material constituting the current revetment would be modified for use during construction as roadbed and would be reincorporated into the eventual finished

product either as fill material behind the sheet pile wall and/or placed at a to-be-determined slope against the seaward side of the wall to act as a means of wave dissipation.

REACH II

The proposed treatments for Reach II in Alternative 3 vary somewhat from Alternative 2. These differences are summarized in Table 2 and on Figures 14 and 15. The most pronounced difference is the use of revetment along the back beach at Sub-Reach "f" as opposed to the rehabilitation of the NPS Breakwaters. Construction methods and means of access would remain similar to that for Alternative 3, Reach I.

REACH III

Under Alternative 3, Sub-Reach "a" would be treated in similar fashion to the area landward of the NPS Breakwaters; with a rock revetment installed at the back beach. Steel sheet piling would be employed along the base of the York River Cliffs at Sub-Reach "c," as opposed to revetment rehabilitation under Alternative 2. Construction methods and means of access would remain similar to that for Alternative 3, Reach I.

REACH IV

The approach carried out for Reach IV would be identical to Alternative 2 (i.e., revetment rehabilitation).

VALUE ANALYSIS STUDY

A Value Analysis (VA) Study was conducted on July 13 and 14, 2010, led by a NPS Technical Expert. In attendance were representatives from the park, the NPS Denver Service Center, VHB, and VIMS. The objectives of the VA Study were the following:

- minimize impacts to natural and cultural resources
- protect structural integrity and character of Colonial Parkway
- protect against long-term sea level rise
- reduce or eliminate long-term impacts from climate change
- minimize visual impact of stabilization measures
- increase wetland habitat

The three alternatives were subject to an assessment based on planning criteria and constraints such as designing at a minimum for the 100-year storm; recognizing adjacent cultural and natural resources; providing access to the project area for material delivery; and avoiding the inadvertent creation of attractive nuisances such as new beaches. After reviewing a functional analysis of the various shoreline treatment approaches discussed in the preceding section, "Choosing by

Advantages" matrix was completed to determine the score for each alternative taking into account seven key factors:

1. prevent loss of resources – parkway and battlefield landscapes
2. prevent loss of resources – archeological resources
3. protect or preserve wetlands
4. operations and maintenance
5. sustainability
6. constructability issues / construction impacts
7. create habitat and enhance wetlands

Alternative 2 provided the greatest advantage at the lowest cost outside of the No-action Alternative. On purely a benefit or importance basis, Alternative 2 provides the greatest advantage to the NPS. The VA Study and the resulting report (NPS 2011a) assisted in the selection of Alternative 2 as the NPS Preferred Alternative for the project.

Alternative 2 would not be constructed in its entirety at once, but rather constructed in phases as available funding provides. Those Reaches or Sub-Reaches where resources are seen to be most at risk (i.e., Reaches I and II) would likely be addressed first.

MITIGATION MEASURES

To prevent and minimize potential adverse impacts associated with the preferred alternative, best management practices (BMPs) and mitigation measures would be implemented during the construction and post construction phases of the project. General and resource specific BMPs and mitigation measures are listed below. This list is not all-inclusive, as there would be additional mitigation measures included in the contractor's specifications. Furthermore, the state and federal permits that would be required before this project proceeds with construction typically include a variety of conditions specifically related to the protection of water quality and natural resources from additional construction-related impacts (see "Chapter 5: Consultation and Coordination"). Mitigation measures provided below are organized by impact topic.

COASTAL RESOURCE AND SOILS / WETLAND RESOURCES / WILDLIFE AND WILDLIFE HABITAT

- Equipment use in vegetated wetland areas would be avoided to the greatest extent possible. Mats composed of individual timbers cabled together would be used to minimize impacts where avoidance is not possible.
- A contractor kickoff meeting would be held to ensure that all workers are apprised of proper protocol to follow in the event of an emergency, including contact information for first responders.
- Appropriate measures would be employed to prevent or control spills of fuels, lubricants, or other contaminants from entering waterways or wetlands. These include safe handling and refueling procedures and proper deployment of containment measures such as oil booms. Actions would be consistent with state water quality standards and Clean Water Act Section 401 certification requirements. A hazardous spill plan would be approved by

the park prior to construction. This plan would state what actions would be taken in the case of a spill, notification measures, and preventive measures to be implemented, such as the placement of refueling facilities, storage, and handling of hazardous materials, etc.

- Regulations require that a Stormwater Pollution Prevention Plan (SWPPP) must be prepared prior to submitting a registration statement for permit coverage under the Virginia Stormwater Management Permit (VSMP).
- During the shoreline stabilization design phase, the NPS will prepare and implement Erosion and Sediment Control Plans that comply with the Virginia Erosion and Sediment Control Law. The NPS will be responsible for overseeing on-site contractors, conducting regular field inspections, and taking prompt action against non-compliance, if necessary. Appropriate erosion and siltation controls would be maintained during construction, and all exposed soil or fill material would be permanently stabilized at the earliest practicable date. A Type II turbidity curtain would be used to minimize the movement of turbid water away from the construction site. A Type II curtain extends from the water surface below the water line to the river bottom and is rated for a slight current of no greater than five feet per second and mild wind conditions. A float in the top of the curtain and weights along the bottom keep the curtain hanging vertically in the water.
- Best management practices (BMPs) for drainage and sediment control would be implemented to prevent or reduce nonpoint source pollution and minimize soil loss and sedimentation in drainage areas. BMPs would include all or some of the following actions, depending on site-specific requirements:
    - Disturbed areas would be kept as small as possible to minimize exposed soil and the potential for erosion;
    - Regular site inspections would occur during construction to ensure that erosion-control measures were properly installed and are functioning effectively.
- Should high wave and water conditions be forecasted, equipment would be moved to a safe location within the study area or to another location outside the study area.
- The contractor would not leave vehicles idling for more than five minutes when parked or not in use.
- Wildlife collisions would be reported to park personnel.

VEGETATION

- If required, stockpile materials would be placed in grassy areas at the mouths of Felgates Creek and Indian Fields Creek so as to avoid impacting previously undisturbed or unmaintained areas. Erosion prevention and sediment control measures would be placed down-gradient of each area to contain any potential spills or sediment run-off.
- Where plantings or seeding are required, native plant material would be obtained and used in accordance with NPS policies and guidance. In an effort to avoid introduction of non-native/noxious plant species, no hay or straw bales would be used during revegetation or for temporary erosion control.
- Management techniques would be implemented to foster rapid development of target native plant communities and to eliminate invasion by exotic or other undesirable species. Techniques may include the use of hydroseeding and a tackifier, plant inspection at delivery and before installation to ensure plant health, plant installation during appropriate planting windows and with due regard for tide forecasts, and inspection of

installed plants. Planted areas would be monitored after construction to determine if efforts are successful or if plant mortality warrants replanting and/or controlling non-native plant species.

SPECIAL STATUS SPECIES

- The NPS would coordinate with the DGIF, DCR, and USFWS regarding any need for a time-of-year restriction on construction in observance of bald eagle nest building and rearing. The breeding and nesting season is typically noted as December 15 to July 15 (USFWS & DGIF 2000).

ARCHEOLOGICAL RESOURCES

- Construction access would be restricted to an approach from the water using barge ports. This recognizes the inadequate load rating of the parkway and the presence of archeological resources in close proximity to the shoreline in upland areas at multiple locations.
- Park cultural resources staff would be available during construction to advise or take appropriate actions should any archeological resources be uncovered during construction.
- If during construction previously undiscovered archeological resources were uncovered, all work in the immediate vicinity of the discovery would be halted and the procedures outlined in the 2010 Programmatic Agreement, Stipulation VII.A1 through A5 (Post Review Discoveries) would be implemented. Construction may proceed only after NPS has determined that implementation of the actions undertaken to address the discovery are complete.
- The NPS would ensure that all contractors and subcontractors are informed of the penalties for illegally collecting artifacts or intentionally damaging archeological sites or historic properties. Contractors and subcontractors also would be instructed on procedures to follow in case previously unknown archeological resources are uncovered during construction.

ELEMENTS CONSIDERED BUT DISMISSED

The VA Study Team performed a functional analysis of the various different shoreline treatment approaches available for use. The advantages, disadvantages, and key functional objectives of each treatment were discussed. Each Sub-Reach was subsequently evaluated in a comprehensive manner by the Study Team to determine which treatment(s) best suit the project purpose and need (NPS 2011a).

SUMMARY COMPARISON OF ALTERNATIVES

Table 3 provides a summary comparison of the alternatives presented above.

Table 3: Summary of Alternatives

Resource	Alternative 1: No-Action	Alternative 2: NPS Preferred	Alternative 3
Reach IA	No new shoreline treatment would be installed and no augmentation of the riprap under the Felgates Creek bridge would be carried out. NPS would perform emergency maintenance or after-the-fact reparations to infrastructure or resources threatened or damaged by landward migration of the shoreline.	Shoreline treatment would consist of a rock sill with pocket beaches occurring at purposeful breaks in the sill. , with a large (~200-ft long) central beach. The revetments protecting the pilings of the bridge over Felgates Creek would be rehabilitated.	Shoreline treatment would consist of a wooden sill with two minor pocket beaches occurring at purposeful breaks in the southern portion of the sill. The revetments protecting the pilings of the bridge over Felgates Creek would be rehabilitated.
Reach I	No new shoreline treatments would be installed and no revetment rehabilitation would take place (including under the bridges at the Felgates or Indian Field Creeks). NPS would perform emergency maintenance or after-the-fact reparations to infrastructure or resources threatened or damaged by landward migration of the shoreline.	A gap sill would be installed at Sub-Reach “a” at Poley Point, with zones of saltmarsh cordgrass and/or saltmeadow cordgrass established. For the remainder of Reach I, the proposed shoreline treatment is rehabilitation of the existing revetment.	A gap sill would be installed at Sub-Reach “a” at Poley Point, with zones of saltmarsh cordgrass and /or saltmeadow cordgrass established. For the remainder of Reach I, the proposed shoreline treatment is steel sheet piling installed at the toe of the existing scarp.
Reach II	No new shoreline treatments would be installed and no revetment rehabilitation would take place (including under the bridge at Indian Field Creek). NPS would perform emergency maintenance or after-the-fact reparations to infrastructure or resources threatened or damaged by landward migration of the shoreline. (e.g., shoreline treatment at kilometer 5).	Reach II would receive a variety of shoreline treatments, including revetment rehabilitation, rock sills and pocket beaches, gap (rock) sills, rock sill rehabilitation, and NPS Breakwater rehabilitation. Areas landward of sills and of the NPS Breakwaters may be planted with saltmarsh cordgrass and/or saltmeadow cordgrass.	Reach II would receive a variety of shoreline treatments, including the installation of steel sheet piling and new areas of revetment, rock sills, and gap (rock) sills and pocket beaches. The NPS Breakwaters would not be rehabilitated. Areas landward of sills may be planted with saltmarsh cordgrass and/or saltmeadow cordgrass.

Table 3: Summary of Alternatives (Cont'd)

Resource	Alternative 1: No-Action	Alternative 2: NPS Preferred	Alternative 3
Reach III	No new shoreline treatments would be installed and no revetment rehabilitation would take place. NPS would perform emergency maintenance or after-the-fact reparations to infrastructure or resources threatened or damaged by landward migration of the shoreline. (e.g., shoreline treatment at kilometer 3).	The area between NWS Yorktown and Ballard Creek would be protected by new rubble mound and shore-attached breakwaters. The existing revetment just upstream of Ballard Creek near kilometer 3 would be rehabilitated with a spur included to move the point of wave diffraction farther offshore. The revetment along the base of the York River Cliffs also would be rehabilitated.	The area between NWS Yorktown and Ballard Creek would have a new revetment installed along the back beach at the toe of the existing slope. The existing revetment just upstream of Ballard Creek near kilometer 3 would be rehabilitated, though the spur proposed for Alternative 2 would not be included. Steel sheet piling would be installed along the base of the York River Cliffs.
Reach IV	No revetment rehabilitation would take place. NPS would perform emergency maintenance or after-the-fact reparations to infrastructure or resources threatened or damaged by landward migration of the shoreline.	The existing revetment along the shoreline would be rehabilitated.	Same as Alternative 2.
Meets Purpose and Need?	No. The existing structures along the York River shoreline, recognized as being deficient in their capacity to defend upland resources against shoreline erosion, would remain in their current configuration.	Yes. The shoreline treatments proposed would reduce the risk to the parkway and other upland resources from landward migration of the shoreline. Living shoreline approaches such as gap sills would enhance and restore tidal wetland areas. Areas of revetment rehabilitation also may have their splash aprons vegetated with saltmeadow cordgrass, further improving shoreline habitat.	Yes. The shoreline treatments proposed would reduce the risk to the parkway and other upland resources from landward migration of the shoreline. Living shoreline approaches such as gap sills would enhance and restore tidal wetland areas. The substantial use of steel sheet piling limits the degree of habitat restoration relative to Alternative 2.

SUMMARY COMPARISON OF IMPACTS OF THE ALTERNATIVES

Table 4 provides a summary of the impacts related to each alternative. A more detailed explanation of the impacts is presented in "Chapter 4: Environmental Consequences."

Table 4: Summary of Environmental Consequences

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Coastal Resources and Soils	No shoreline treatments would be installed beyond those required on an emergency basis to address imminent threats to park resources. Though localized areas of sand accretion may continue, shoreline erosion and the loss of land area, shoreline habitat and wetlands would continue to be the dominant process occur under the No-action Alternative. Iterative shoreline repairs may result in a patchwork of non-complementary shoreline treatments that would potentially impact the hydrology of the nearshore zone and exacerbate shoreline erosion in adjacent areas **Project Impact**: minor to moderate, long-term adverse impact **Cumulative Impact**: contributes a noticeable adverse increment to a long-term, beneficial cumulative impact	Would address shoreline erosion throughout the study area by implementing a variety of shoreline treatment approaches that are best suited to the local setting, including revetment rehabilitation, rock sills and marsh plantings, gaps sills and pocket beaches, and shore-attached breakwaters. The interruption of natural sediment transport and resulting impacts are unlikely because: a) very little sediment is attributable to shoreline erosion; b) the study area has already been significantly armored; c) living shoreline approaches would be charged with sediment to establish an equilibrium plan form and assist with sediment bypass; and d) the York River shoreline downstream of the study area is already significantly armored. **Project Impact**: long-term, beneficial impact **Cumulative Impact:** contributes a noticeable beneficial increment to long-term, beneficial cumulative impacts	A comprehensive repair and stabilization of the shoreline would be carried out. Steel sheet piling would be used instead of revetment rehabilitation. In general, impacts would be similar to Alternative 2, though the use of steel sheet piling may require riverbank cut back to a greater degree than that of Alternative 2. The interruption of natural sediment transport and resulting impacts are unlikely because: a) very little sediment is attributable to shoreline erosion; b) the study area has already been significantly armored; c) living shoreline approaches would be charged with sediment to establish an equilibrium plan form and assist with sediment bypass; and d) the York River shoreline downstream of the study area is already significantly armored. **Project Impact**: long-term, beneficial impact **Cumulative Impact**: contributes a noticeable beneficial increment to long-term, beneficial cumulative impacts

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Wetland Resources	Because currently deficient means of shoreline protection would not be improved, tidal wetlands would continue to be subject to the combined effect of coastal storm surges and sea level rise; likely resulting in erosion of their substrate and subsequent loss of plant cover. **Project Impact**: moderate, long-term adverse impact **Cumulative Impact**: contributes a noticeable adverse increment to long-term, moderate adverse cumulative impacts	A variety of approaches to shoreline stabilization and repair would be implemented, including revetment rehabilitation, rock sills and marsh plantings, gaps sills and pocket beaches, and shore-attached breakwaters. Living shoreline approaches would be installed wherever existing tidal wetland systems are present. **Project Impact**: short-term, minor adverse impact on wetlands (construction related); long-term and beneficial impact on all wetlands (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts	A variety of approaches to shoreline stabilization and repair would be implemented, including steel sheet piling, rock sills and marsh plantings, gaps sills and pocket beaches. The installation of new revetments would impact wetland bodies that Alternative 2 would not, but the overall benefit would outweigh this adverse impact. **Project Impact**: short-term, minor adverse impacts (construction related); long-term moderate adverse impacts on unvegetated wetlands (post construction); long-term and beneficial impact on vegetated wetlands (post construction) **Cumulative Impact**: contributes an appreciable adverse increment to long-term, adverse cumulative impacts
Floodplains	Current conditions impacting the floodplain would continue. Storm systems would continue to erode the riverbanks along the edge of the floodplain. Existing shoreline defensive structures would be repaired or replaced on an as needed basis, which may or may not require the placement of fill materials in the floodplain beyond their current configuration. **Project Impact**: long-term, negligible adverse **Cumulative Impact**: contributes an imperceptible adverse increment to long-term, negligible adverse cumulative impacts	The placement of fill materials would occur within FEMA-designated flood zones in order to rehabilitate existing structures and install new shoreline treatment approaches. Because of the project setting near the mouth of the York River, there would be no additional impedance of this flow through the study area. **Project Impact**: long-term, negligible adverse **Cumulative Impact**: contributes an imperceptible adverse increment to long-term, negligible adverse cumulative impacts	The placement of fill materials would occur within FEMA-designated flood zones in order to rehabilitate existing structures and install new shoreline treatment approaches. Because of the project setting near the mouth of the York River, there would be no additional impedance of this flow through the study area. **Project Impact**: long-term, negligible adverse **Cumulative Impact**: contributes an imperceptible adverse increment to long-term, negligible adverse cumulative impacts

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Wildlife and Wildlife Habitat	No changes to shoreline conditions within the project area are proposed except on an as-needed or emergency basis in response to an imminent threat to infrastructure or upland resources or the catastrophic storm damage. There would be little immediate change in wildlife habitat. **Project Impact**: long-term, minor adverse impact **Cumulative Impact**: contributes a noticeable adverse increment to long-term, moderate adverse cumulative impacts	Would stabilize the shoreline using a combination of defensive and living shoreline approaches; protecting upland habitats from erosion and enhance and expanding tidal wetland habitat. This would by extension improve nursery habitat and shelter for finfish and turtles and foraging area for waterbirds. **Project Impact**: short-term, negligible adverse impacts (construction related); long-term beneficial impacts (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts	Would stabilize the shoreline using a combination of defensive and living shoreline approaches, though to a somewhat lesser extent than Alternative 2 (no breakwater systems proposed). Would protect upland habitats from erosion and enhance and would help expand tidal wetland habitat. This would by extension improve nursery habitat and shelter for finfish and turtles and foraging area for waterbirds. **Project Impact**: short-term, negligible adverse impacts (construction related); long-term beneficial impacts (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts
Vegetation	With no shoreline improvements proposed, tidal wetlands within the study area would continue to be subject to the combined effect of coastal storm surges and sea level rise; likely resulting in erosion of their substrate and subsequent loss of plant cover. Upland vegetation also would be vulnerable to landward migration of the shoreline. **Project Impact**: minor, long-term adverse impact **Cumulative Impact**: contributes a noticeable adverse increment to long-term, minor adverse cumulative impacts	Would stabilize the shoreline using a combination of defensive and living shoreline approaches and would protect upland vegetation from erosion and enhance and expand tidal wetland vegetation through the implementation of rock sills, gap rock sills, and breakwater rehabilitation and creation. **Project Impact**: short-term, minor adverse impact (construction related); long-term beneficial impact (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts	Similar to Alternative 2, though may incur the additional loss of grassy and shrubby bank vegetation if sheet pile installation must move landward of the toe of revetted areas. Also involves permanent impacts to wetland vegetation not included in Alternative 2. These would be offset by the projects overall benefits on vegetation. **Project Impact**: short-term, minor adverse impact (construction related); long-term beneficial impact (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Special Status Species	Conditions in the proximity of the existing bald eagle nest and along the shoreline within the study area would remain unchanged. Shoreline recession may result in the loss of candidate trees for eagle nesting, but this would not adversely impact the species because of the relative abundance of suitable trees along the shoreline. **Project Impact**: long-term, negligible and adverse **Cumulative Impact**: No past, present, and reasonably foreseeable future actions have or continue to contribute to the cumulative impact on special status species in and around the study area.	Stabilization of the shoreline in the study area would protect upland habitat from erosion. Suitable nesting trees for the bald eagle may persist for longer periods of time relative to the No-action Alternative. The protection and enhancement of tidal marsh fringes would enhance overall wildlife habitat and nursery areas for fish. This may help sustain or improve the availability of food sources for the bald eagle. **Project Impact**: short-term, minor and adverse (construction phase); long-term beneficial (post construction) **Cumulative Impact**: No past, present, and reasonably foreseeable future actions have or continue to contribute to the cumulative impact on special status species in and around the study area.	Stabilization of the shoreline in the study area would protect upland habitat from erosion. Suitable nesting trees for the bald eagle may persist for longer periods of time relative to the No-action Alternative. The protection and enhancement of tidal marsh fringes would enhance overall wildlife habitat and nursery areas for fish. This may help sustain or improve the availability of food sources for the bald eagle. **Project Impact**: short-term, minor and adverse (construction phase); long-term beneficial (post construction) **Cumulative Impact**: No past, present, and reasonably foreseeable future actions have or continue to contribute to the cumulative impact on special status species in and around the study area.

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Cultural Landscapes	Iterative and emergency repairs along the shoreline in response to storm-induced or catastrophic shoreline erosion, when considered cumulatively, could result in the gradual and permanent degradation of the cultural landscape. Should a portion of the parkway itself be lost to erosion during an event and reconstruction efforts require design changes that differ from the original roadway plan, the cultural landscape would be impacted until such time that the road and the affected area could be reconstructed. Reconstruction efforts may not be able to replicate the pre-event conditions **Project Impact**: short-term, minor and adverse impacts (i.e., during construction for preventative or emergency maintenance); long-term, minor to moderate adverse impacts **Cumulative Impact**: contributes an imperceptible to appreciable adverse increment to long-term, minor to moderate adverse impacts	No changes would be made to the parkway character-defining features except along the shoreline to repair and rehabilitate existing structures and install new structures. Impacts on the spatial character of the parkway during construction would be caused by the presence of construction equipment within the viewshed, the noise this equipment may emit, and the possible use of select grassy areas for equipment staging **Project Impact**: short-term, minor and adverse impacts (construction related); long-term, negligible impact, neither adverse or beneficial (below level of detection) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term beneficial impacts	No changes would be made to the parkway character-defining features except along the shoreline to repair and rehabilitate existing structures and install new structures. Impacts on the spatial character of the parkway during construction would be caused by the presence of construction equipment within the viewshed, the noise this equipment may emit (more pronounced than for Alternative 2 due to use of sheet piling), and the possible use of select grassy areas for equipment staging. **Project Impact**: short-term, minor and adverse impacts (construction related); long-term, minor adverse impact (sheet pile related **Cumulative Impact**: contributes an appreciable beneficial increment to long-term beneficial impacts

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Historic Structures	No changes would be made except in response to the need for emergency reparations. Accordingly, catastrophic shoreline recession in response to a storm event or subsequently in response to a storm-weakened condition could result impacts to loss of historic structures. **Project Impact**: long-term, negligible to moderate adverse impact **Cumulative Impact**: contributes an imperceptible to appreciable adverse increment to long-term, moderate adverse impacts	No changes would be made to the parkway character-defining features except along the shoreline to repair and rehabilitate existing structures and install new structures. **Project Impact**: long-term, negligible impact, neither adverse or beneficial (below level of detection) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term beneficial impacts)	No changes would be made to the parkway character-defining features except along the shoreline to repair and rehabilitate existing structures and install new structures. **Project Impact**: long-term, negligible impact, neither adverse or beneficial (below level of detection) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term beneficial impacts

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Archeological Resources	Shoreline recession would continue, potentially resulting in the gradual winnowing out and displacement of archeological resources from upland areas. Catastrophic shoreline or river bluff erosion may accelerate this process. Iterative and emergency repairs along the shoreline in response to these events could require the earthwork in areas bearing archeological resources, resulting in additional impacts. **Project Impact**: long-term, minor to moderate adverse impacts **Cumulative Impact**: no past, present, and reasonably foreseeable future actions have contributed or continue to contribute to the cumulative impact on archeological resources in and around the study area	With respect to terrestrial archeology, areas of disturbance for Alternative 2 would be limited primarily to the previously engineered slope of the riverbank where no resources have been identified. The single exception would be downstream of Indian Field Creek where some excavation into hydraulic fill would be carried out. No National Register eligible resources are present at this location. Design of the shoreline treatment should be capable of avoiding the single resource identified during the underwater archeology investigation (remnants of marine railway). **Project Impact**: no effect on archeological resources (This impact assessment is subject to SHPO review of the completed reports and subsequent coordination with the SHPO NPS per the conditions of the PA). **Cumulative Impact**: no past, present, and reasonably foreseeable future actions have contributed or continue to contribute to the cumulative impact on archeological resources in and around the study area	With respect to terrestrial archeology, areas of disturbance for Alternative 3 would be limited to the previously engineered slope of the riverbank where no resources have been identified. Design of the shoreline treatment should be capable of avoiding the single resource identified during the underwater archeology investigation (remnants of marine railway). However, the impact assessment is subject to SHPO review of the completed reports and subsequent coordination with the SHPO NPS per the conditions of the PA. **Project Impact**: no effect on archeological resources (This impact assessment is subject to SHPO review of the completed reports and subsequent coordination with the SHPO NPS per the conditions of the PA). **Cumulative Impact**: no past, present, and reasonably foreseeable future actions have contributed or continue to contribute to the cumulative impact on archeological resources in and around the study area

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Visitor Use and Experience	Current visitor use and experience opportunities would continue. Access to and travel along the parkway would continue as normal. The parkway would remain at risk for damage as a result of shoreline recession. **Project Impact**: short-term to long-term, minor to moderate adverse impact (reflecting unpredictability of shoreline recession) **Cumulative Impact**: contributes a noticeable to appreciable adverse increment to long-term, moderate adverse cumulative impacts	Existing structures along the York River shoreline within the study area would be rehabilitated and new structures installed in order to provide comprehensive risk reduction against shoreline erosion for the parkway and other upland resources. **Project Impact**: short-term, minor adverse impacts (construction related); long-term beneficial impacts (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts	Per Alternative 2. However, pile driving would result in noise levels greater than for Alternative 2. The pile drive would be a more visible piece of construction equipment. **Project Impact**: short-term, minor to moderate adverse impacts (construction related); long-term beneficial impacts (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts
Public Safety	Current public safety conditions within the study area would continue. Potential impacts would be caused by shoreline erosion and unpredictable bank slumping. Damaged road surfaces would pose a risk to traffic. Construction in close proximity to passing traffic would increase the likelihood of conflicts between passenger vehicles and equipment. **Project Impact**: short-term, minor to moderate adverse impacts **Cumulative Impact**: contributes a noticeable to appreciable adverse increment to a long-term, noticeable, adverse cumulative impact	Existing structures along the York River shoreline would be rehabilitated and new structures installed in order to provide comprehensive risk reduction against shoreline erosion for the parkway and other upland resources. Impacts on public safety would be accordingly improved, as the risk of parkway close or damages to the parkway itself and upland habitat would be greatly diminished. **Project Impact**: short-term, minor and adverse (construction related); long-term and beneficial (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts	Existing structures along the York River shoreline would be rehabilitated and new structures installed in order to provide comprehensive risk reduction against shoreline erosion for the parkway and other upland resources. Impacts on public safety would be improved per Alternative 2, but the use of a pile driver for construction may result in noise levels requiring mitigation in areas frequented by park visitors. **Project Impact**: short-term, minor to moderate adverse impacts (construction related); long-term beneficial impacts (post construction) **Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts

Table 4: Summary of Environmental Consequences (Con'd)

Resource	Alternative 1: No-action	Alternative 2: NPS Preferred	Alternative 3
Infrastructure and Park Operations	The park would continue to maintain existing infrastructure within the study area. Access to the parkway and popular recreational areas at Felgates Creek and Indian Field Creek would be maintained and these areas managed per current procedures. Staff from the Maintenance and Protection Divisions may be mobilized in unpredictable fashion to deal with episodes of shoreline erosion, including first response, damage assessment, traffic control, and carrying out and monitoring the progress of reparations.	Existing structures along the York River shoreline would be rehabilitated and new structures installed in order to provide comprehensive risk reduction against shoreline erosion for the parkway and other upland resources. Potential impacts on park infrastructure and operations would be improved accordingly, as the threat of parkway damage, damage to stormwater systems, and the loss of the upland habitat so important to the historic viewshed would be diminished. Construction oversight may be required, and long-term management of visitor activities at new beach areas may be required.	Existing structures along the York River shoreline would be rehabilitated and new structures installed in order to provide comprehensive risk reduction against shoreline erosion for the parkway and other upland resources. Potential impacts on park infrastructure and operations would be improved accordingly, as the threat of parkway damage, damage to stormwater systems, and the loss of the upland habitat so important to the historic viewshed would be diminished.
	Project Impact: short-term to long-term, minor to moderate adverse impacts	**Project Impact**: short-term, minor adverse impacts (construction phase); long-term, minor adverse impacts (associated with beach visitor management); long-term beneficial impacts (protection of upland infrastructure)	**Project Impact**: short-term, minor adverse impacts (construction phase); long-term beneficial impacts (protection of upland infrastructure)
	Cumulative Impact: contributes a noticeable to appreciable adverse increment to long-term, noticeable adverse cumulative impacts	**Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts	**Cumulative Impact**: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

In accordance with the DO-12 Handbook, the NPS identifies the environmentally preferable alternative in its NEPA documents for public review and comment [Sect. 4.5 E(9)]. The environmentally preferable alternative is the alternative that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified by the Responsible Office after weighing long-term environmental impacts against short-term impacts in evaluating and considering what is the best protection of the resources. In some situations,

such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative (43 CFR 46.30).

Alternative 2 best protects and preserves the cultural and natural resources of and along the parkway by reducing the risk to the parkway from landward migration of the shoreline, presenting greater opportunity for wetland enhancement and restoration, and offering better consistency with established means of shoreline defense for the Chesapeake Bay area (i.e., construction methods, application, and overall appearance of the completed treatment). Based on the analysis of environmental consequences of each alternative in Chapter 4, Alternative 2 is the environmentally preferable alternative.

3
AFFECTED ENVIRONMENT

This chapter describes the affected environment and environmental consequences associated with the alternatives presented in "Chapter 2: Alternatives." Organized by resource topic, this chapter describes the resources that could be impacted by the proposed project. Resources examined in detail include coastal resources and soils, wetlands, floodplains, wildlife and wildlife habitat, vegetation, special status species, cultural landscapes, historic structures, archeological resources, visitor use and experience / recreation, site access and circulation, public safety, and infrastructure and park operations. Resources dismissed from further consideration are discussed in "Chapter 1: Purpose and Need."

This chapter distills the issues and concerns into distinct subjects for discussion analysis associated with each resource topic. NEPA requires consideration of context, intensity, and duration of adverse and beneficial impacts (direct, indirect, and cumulative) and measures to mitigate for impacts. NPS policy also requires that unacceptable adverse impacts and impairment of resources be evaluated in all environmental documents; therefore, these items are addressed in the "Conclusion" section under each alternative impact analysis for each impact topic.

COASTAL RESOURCES AND SOILS

The study area lies within the Coastal Plain physiographic province of Virginia. This province is characterized by flat to rolling topography and with occasional steeply dissected hillsides. The maximum elevation within the study area is approximately 60 ft MLW along the top of the bluff of the York River in Reach IV. The lower York River is a microtidal river-estuary (i.e., with tidal range less than 2m; Walker 2005) and a major tributary of the Chesapeake Bay, the largest estuary in the United States (Chesapeake Bay Program 2004, Friedrichs 2009). The mean tidal range is 2.3 ft at the confluence with the Chesapeake Bay, 1.0 ft at West Point, Virginia (approximately 21 miles upstream of the study area), and increases to over 3.3 ft in the freshwater tidal portions farther west due to the narrowing of the river valley. The salinity distribution ranges from freshwater to seawater. The drainage area of the York River is 2,662 square miles.

GEOLOGY

About 35 million years ago, near the end of the Eocene epoch, a meteor or comet struck the southern portion of the Chesapeake Bay (Hobbs 2009). The resultant impact crater had a

profound effect on landform, geology, and the marine ecosystem in the middle and lower Bay regions, including the lower reach of the York River where the project area lies. Subsequent to the creation of the basin and the rapid infilling of impact breccias (coarse grained rock composed of angular broken rock fragments), the basin represented an area of preferential sedimentation due to its form. This resulted in compaction of the breccia and differential compaction of the thick layers of sediment within the basin and incited tectonic events that persisted through the 1600's (Ramsey 1992). These tectonic adjustments produced several stages of marine transgression or sea level rise, followed by retreat (regression). Three such transgressions occurred during the Pliocene epoch (Krantz 1990; 1991), resulting in ideal conditions for a diversity of coastal marine organisms to thrive in more landward locations (Johnson and Ramsey 1987). One of the more unique geologic expressions of these transgressions is the presence of fossilized shellbed layers in the "Yorktown Formation" (Hobbs 2009), which can be seen in several locations along the project corridor where bank erosion has exposed the shell-bearing strata. One of the best known outcrops of the Yorktown Formation is at Cornwallis Cave (Figures 2b and 3b).

Superimposed atop the Yorktown Formation are Later Tertiary and Quaternary strata that were deposited in a series of marine transgressions that were initiated by glaciation rather than tectonic processes. From Hardaway and Duhring (2010):

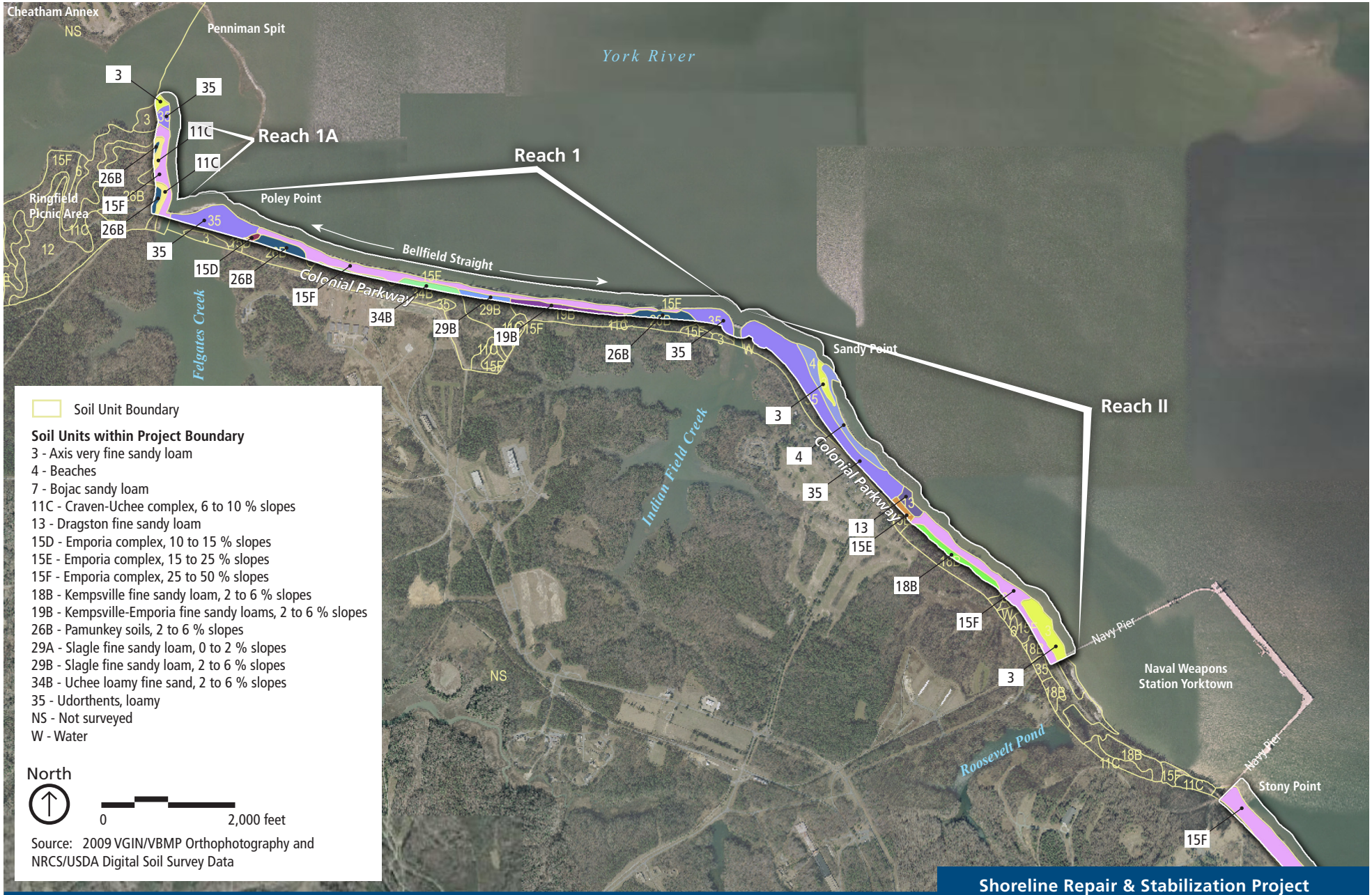
> *The nature of the deposition has been that during high stands of sea level, marine processes cut into the shore, eroding older sediments and [depositing] them in the nearshore. This has resulted in a terrace-and-scarp geomorphology in which each terrace is the upper surface of stratum that [have] been reworked and exposed by a regressing sea and each scarp essentially marks toe landward limit of a marine transgression.*

These more recent sediments are weakly cemented and are easily eroded when exposed in steep faces. Yorktown Formation outcrops tend to be more erosion resistant, creating headland features where they are intermingled with younger deposits such as at the Point of Rocks (Figures 2b and 3b).

SOILS

The Natural Resource Conservation Service (NRCS) soil survey mapping shows that the study area is underlain by several soil types, including the following series: Axis, Beaches, Bohicket, Bojac, Craven-Uchee, Dragston, Emporia, Kempsville, Kempsville-Emporia, Pamunkey, Slagle, Uchee, Udorthents, Urban Land, and Water. Among these, Bohicket and Axis soils are classified as hydric by the NRCS, and Beaches, Dragston, Emporia, Slagle, and Udorthents soils are known to contain minor hydric inclusions. Soils mapping is provided on Figures 16a and 16b.

While 14 soil types are present within the study area, Emporia, Udorthents, and Axis soils underlie the vast majority of the land area. Emporia complex soils are the most dominant soil. They are deep and well-drained soils formed in stratified loamy and clayey fluvial and marine sediments. Commonly associated with steep river scarps such as those along the York River Cliffs, these soils are classified as having a severe erosion hazard (NRCS 1985). Flatter areas



Shoreline Repair & Stabilization Project Environmental Assessment

National Park Service
U.S. Department of the Interior

Colonial National Historical Park

Figure 16a
Soil Survey Mapping

Shoreline Repair & Stabilization Project
Environmental Assessment

National Park Service
U.S. Department of the Interior

Colonial National Historical Park

Figure 16b
Soil Survey Mapping

landward of the bluff line and in areas of hydraulic fill such as around the mouths of Felgates and Indian Field Creeks are mapped as Urdothents. These are deep and well to moderately well drained soils occurring in areas of disturbance by excavation and grading. The erosion hazard for Urdothents ranges from slight to severe. The last dominant soil unit mapped within the study area is Axis very fine sandy loam. This is a deep, nearly level and very poorly drained soil occurring in tidal marshes. The most extensive occurrence is along the shoreline immediately upstream of the west pier of NWS Yorktown where nearshore transport has been obstructed and sediments have accumulated. Axis soil also occurs at Sandy Point just downstream of the mouth of Indian Field Creek and at the mouth of Ballard Creek.

WAVE CLIMATE

The dominant force shaping the geomorphology of the York River shoreline is wave energy. The greater the open fetch and the wind speed generated across that fetch, the greater the wave energy will be that is impinging on the shoreline. Coastal storms such as nor'easters and hurricanes often produce storm surges that allow the wave energy to be applied at higher elevations along the shoreline, a condition that can exacerbate erosion. Most of the Pleistocene stratigraphy – the most recent formations which underlay the existing soil column in the study area – consists of weakly cemented sediments. Therefore, when exposed in steep bluffs or valleys, it can be easily eroded by wave action. Outcroppings of more resistant formations tend to form headlands such as those at the Point of Rocks.

The width and depth of the nearshore zone can affect significantly the wave energy acting on the shoreline (VIMS 2006). Within the project area, the distance from the shoreline to a depth of -4 ft MLW ranges from 100 ft in Reach IV to over 500 ft in Reach II, with the exception of the mouth of Felgates Creek where the depth of -4 ft MLW lies just 20 ft from the shoreline. Shallow nearshore areas may experience slightly less pronounced wave attack because incoming waves "feel the bottom" of the river and the frictional resistance may trip and break the waves some distance from the shoreline before they can impact the river bank. However, the water level at the time of the storm can dictate the degree to which this effect may be manifested. In other words, if water is higher than usual closer to shore, wave breaking will occur close to the shore.

At the study area, wind-driven waves can be especially severe due to the proximity to the Chesapeake Bay. This is because wind-driven waves are not only produced over the considerable local fetches of the York River but they can be augmented by conditions in the bay during nor'easters. Waves produced in the bay can be refracted at the mouth of the river so that they propagate upstream. Furthermore, these waves approach the study area with little reduction in energy because the river channel is relatively deep (i.e., waves are not tripped by shallow river bottom).

NEARSHORE SEDIMENT TRANSPORT

In the York River, order of magnitude estimates for the relative contributions of sources of sediment in transport are (Rinehimer, 2008):

- 55 percent of sediment is from the freshwater tributaries of the Pamunkey and Mattaponi Rivers, which coalesce to form the York River approximately 21 miles upstream of the study area
- 32 percent of sediment is from the Chesapeake Bay and marine sources
- 13 percent from shoreline erosion

Within the study area, contributions from tributary streams are thought to be minimal. Evidence of sediment deposition at the mouth of tributaries such as Ballard Creek in Reach III, Sub-Reach "b" are typically relatively small ebb shoals and of the differential flow patterns that result as the tributary flow interacts with littoral flow patterns in the river. Thus, the depositional features form from sediment moving in the littoral system combined with the minor supply carried by the tributary, rather than being a wealth of sediment contributed from its watershed.

As the project shoreline has already been armored by revetments, essentially in its entirety, contributions of sediment to littoral drift from shoreline erosion, already the least abundant source within the York River, are minimal. The same is true of what remains of the southern York River shoreline downstream of the study area. Of the approximately 3.4 miles of shoreline remaining before the confluence with the Chesapeake Bay, over 90 percent of this distance has been modified by shoreline treatments, primarily revetments. This distance represents less than 10 percent of the total length of the York River. Shoreline defenses along the York River at the USCG Station Yorktown, located immediately downstream of the project area, were recently augmented to include a new stone revetment.

Considering the degree of shoreline armoring with the study area, very little sediment is being added to littoral drift. The configuration, geographic extent, and evolution of depositional features downstream of the study area are governed primarily by the resuspension of bottom sediments in the lower York River and Chesapeake Bay during storm events such as nor'easters rather than by contributions of sediment from upstream reaches via littoral drift. This contention is supported by the lack of strong and persistent depositional features along the shoreline such as prograding spits and deflected creek mouths. As a result, concerns regarding the disruption of nearshore sediment transport processes that might be significant along an unobstructed open shoreline, are minimal in the study area because the sediment supplies and transport patterns have long been altered by anthropogenic forces.

The physical characteristics of each Reach, their wave climate and existing structures are described below. The geographic limits of each are described in "Chapter 2: Alternatives" and depicted in Figures 4 through 6.

REACH IA

Reach IA is roughly 2,000 ft in length and lies along the eastern side of the headland between Felgates Creek and King Creek; atop which the Ringfield Picnic Area is located. The headland has very steep to near vertical bluffs on all sides where the stratigraphy is exposed. Materials are of the Shirley Formation, which consists of a variety of semi-consolidated sediments (e.g., fluvial, estuarine, marsh, shallow marine) dating to the Late Middle Pleistocene epoch of about 185,000 years.

Photograph 9. View of eroding riverbank along Reach IA (April 2, 2011, Source: VHB).

The east-facing bluff along Reach IA is broken at the mid-point by a small, bowl-shaped valley with a marsh at its base. This marsh is located behind a sandy beach which extends along the entire length of Reach IA. This thin beach is comprised of materials that have eroded out of the neighboring banks.

Reach IA has a significant fetch to the east (4 mi), though wave energy is diminished in part by the presence of Penniman Spit. The spit acts to trip waves before they impinge on the shoreline. However, the efficacy of the spit for this purpose has lessened with its gradual and ongoing decay. This erosion is thought to be caused in part by increasing shoreline defense treatments in upstream areas. Such treatments often consist of shoreline armoring, which greatly decreases available sediment for downstream areas.

The long-term erosion rate for Reach IA is -2.1 ft/yr (VIMS 2006). Erosion of the bluffs at Reach IA has resulted in slumping and landward migration of the bluff line. Erosion is most active in the southern two-thirds of the reach where trees have fallen into slumped areas. Hurricane Isabel caused significant erosion along Reach IA, including damage to the bridge embankment at Felgates Creek. The embankment represents the only artificial shoreline protection structure in Reach IA.

REACH I

Reach I is roughly 9,000 ft in length and spans the shoreline from Felgates Creek to Indian Field Creek; an area commonly referred to as Bellfield Straight. With the exception of an unprotected sandy marsh strand (Poley Point) and pocket beach just downstream of the mouth of Felgates Creek, the shoreline along Reach I consists of a riprap revetment at the toe of a steep slope and engineering slope; a seawall constructed in the late 1930's (see Project Background in "Chapter 1: Introduction"). The grade of the slope ranges from 1.5:1 to 1:1 (horizontal : vertical). The elevation of the crest of the slope is fairly consistent through the reach at 28 to 30 ft MLW with locally higher and lower points. The crest elevation lessens gradually over the last 900 ft of its approach to Indian Field Creek. The crest elevation of the revetment is roughly 6 ft MLW.

Photograph 10. View along the existing revetment of Reach I at Bellfield Straight. The revetment has become detached from the toe of the slope and the bluff is eroding landward. (Source: VHB)

Like much of the shoreline within the study area, virtually all of the existing shoreline within Reach I is an engineered feature or the product of engineering associated with the original parkway construction. Though Poley Point, appears to be the product of natural accretion at the mouth of Felgates Creek, as described in "Chapter 1: Introduction," an appreciable amount of hydraulic fill was added to the York River shoreline to make the bridge approaches there. The installation of the stone revetments in the late 1930's was successful in stalling the landward migration of the shoreline that began occurring immediately after the parkway construction was completed. While the 1937 aerial photographs show relatively wide beaches at the mouths of both Felgates Creek and Indian Field Creek, the rate of shoreline change along Reach I for the period 1937 to 2002 was negative throughout, ranging from less than -1 ft/yr to up to -3 ft/yr (VIMS 2006). After 2002, Hurricane Isabel had a pronounced impact on Reach I because the revetment was overtopped by the storm surge and crashing waves. This resulted in slope erosion and slumping behind the revetment to the extent that certain areas have detached from the slope.

Photograph 11. An example of gully formed in the riverbank along Bellfield Straight. The Colonial Parkway is visible in the background (March 16, 2010, Source: VHB).

The distance from the parkway's northern edge of pavement to the edge of the scarp is typically 20 to 30 ft, though it is locally as little as 10 ft where erosional gullies or scarp slumping has occurred.

Like Reach IA, the underlying geology for Reach I is the Shirley Formation. However, the low-lying grassy area to the east of the mouth of Felgates Creek is underlain by hydraulic fill material placed in the creek mouth to facilitate the bridge crossing. The reach is subject to wind-driven waves from multiple directions, including the northwest, north, and northeast.

REACH II

Reach II commences at Indian Field Creek and runs roughly 7,400 ft downstream to the west pier of NWS Yorktown. A variety of shoreline treatments are present in Reach II. Immediately downstream of Indian Field Creek, the riprap revetment described for Reach I continues for roughly 1,000 ft to Sandy Point. Thereafter, marsh toe sills occur in intermittent fashion, the most continuous of which is located just upstream of the NPS Breakwaters. Those upland areas that have a wide marsh fringe and/or a sill are relatively stable areas as opposed to those without a sill. The sill elevation is generally about 2 ft MLW.

Between 1937 and 1960, pronounced accretion occurred along Reach II. During this period, Sandy Point took its form (Figure 2a); a spit attached to the shoreline downstream of the mouth of Indian Field Creek and deflected easterly by the current of the York River. Aerial photographs suggest that Reach II obtained its most seaward configuration in the early 1960's and has been

gradually receding since that time. The degree of recession is illustrated by the fact that in 2002, the position of the shoreline at Sandy Point was the most landward since 1937. In a number of locations in Reach II, the 2002 shoreline was located landward of the 1937 shoreline. Just downstream of the so-called NPS Breakwaters at Sub-Reach "g" (which include the location of the reparations at Kilometer 5), the maximum horizontal recession between 1960 and 2002 was roughly 110 ft.

Photograph 12. View of existing rock sill in Reach II, Sub-Reach " d' " downstream of the mouth of Indian Field Creek (April 2, 2010, Source: VHB).

The entire shoreline of Reach II was overtopped during Hurricane Isabel and trees were uprooted. The five broken concrete breakwaters that constitute the NPS Breakwaters also were overtopped during Hurricane Isabel, resulting in significantly upland bank erosion. The elevation of these structures ranges from 2 ft to 3 ft MLW. This elevation is insufficient to protect the bank from erosion, as storm surges can easily overtop the breakwaters and wave energy can then act directly on the bank.

Photograph 13. New revetment installed at kilometer 5 in response to erosion caused by Hurricane Isabel (March 16, 2010, Source: VHB).

Downstream of the breakwaters, the top of the upland bank of the York River

increases significantly in elevation from approximately 10 ft to 28 ft MLW, resulting in very steep slopes down to the shoreline. A riprap revetment has been installed seaward of the bluff to protect against erosion. Continuing downstream, the York River shoreline turns inland notably at the location of an unnamed marsh and comes very close to the parkway at kilometer 5. At this location, erosion caused by Hurricane Isabel brought the top of the bank to within 6 ft of the parkway road base. Emergency reparations were required and a stone revetment was installed. Reach II ends just downstream of kilometer 5, where sediment has accumulated against the west pier of NWS Yorktown.

Like Reaches IA and I, the underlying geology for Reach II is the Shirley Formation. Like the crossing at Felgates Creek, the bridge at Indian Field Creek joins areas of hydraulic fill material. The reach is subject to wind-driven waves from multiple directions, including the northwest, north, and northeast. Nor'easters can result in wave attack that approaches the shoreline in a sub-parallel manner, causing significant erosion and moving sand in an onshore/offshore direction (VIMS 2006). Northwest winds tend to drive shoreline sediments downriver and erode the marsh fringe. These winds often follow nor'easters, exacerbating the loss of sediment along the shoreline. Within Reach II, Sub-Reaches "b," "c," "d," "h," and a stretch of shoreline between "f" and "g" have not been treated previously.

Photograph 14. Existing revetment in Reach II, Sub-Reach "g" (April 2, 2010, Source: VHB).

REACH III

Reach III runs for roughly 6,900 ft downstream from the eastern pier of NWS Yorktown (coincident with Stony Point) south to Yorktown Creek. It consists generally of two shoreline types. Between the pier and Ballard Creek, no means of shoreline treatment is currently in place. A sandy beach is present, which narrows in a downstream direction to a point of problematic erosion at kilometer 3, where emergency stabilization was required after Hurricane Isabel to protect the parkway from the migrating shoreline. Downstream of kilometer 3 and just beyond the marsh and sandy shoal at the mouth of Ballard Creek, the shoreline is hardened with a stone revetment along the toe of the York River Cliffs. Like all the revetments in the study area, this one also was overtopped during Hurricane Isabel and the resulting erosion produced near vertical faces in the river bank. The crest elevation of the revetment is roughly 4 ft MLW.

Like all of the upstream Reaches, Reach III is underlain by the Shirley Formation. The exposure to wave attack in Reach III is somewhat variable. The east pier of NWS Yorktown protects the shoreline from storms coming out of the northwest. However, the entire reach is exposed to the northeast and east, with the latter being particularly long. The average rate of shoreline change for Reach III for the period 1937 to 2002 was -1.3 ft/yr. The most extreme recession has occurred along the York River Cliffs, portions of which experienced a maximum rate of shoreline change of -14 ft/yr between 1960 and 1963 (VIMS 2006). During the last period examined in the SMP (1994-2002), the average rate of shoreline change ranged from approximately:

- -1 to -7 ft/yr at Sub-Reach “a;”
- -3 to -6 ft/yr at Sub-Reach “b;” and
- -1 to -3 ft/yr at Sub-Reach “c”

Photograph 15. Eroded and vertical riverbank at Reach III along the York River Cliffs. The Yorktown Victory Center lies landward of this location. Trees have been undermined and have fallen onto the revetment below (April 2, 2010, Source: VHB).

REACH IV

Reach IV commences at the headlands of Point of Rock and continues downstream for roughly 7,400 ft to the USCG Station Yorktown. Private property is intermingled with NPS property along this Reach. Most of Reach IV has been treated with a stone revetment having a crest elevation ranging from approximately 4 ft MLW at the west end to approximately 6 ft MLW to the east. Low concrete (Jersey wall type) structures have been installed in two locations. Some private property owners have graded the steep riverbank to more gentle and stable slopes.

Photograph 16. Typical view of the steep riverbank along Reach IV, showing the existing revetment in the foreground (April 2, 2010, Source: VHB).

An assessment by the USACE found that the revetment provides sufficient protection during normal conditions but minimal protection during moderate storm events. Larger and more rare coastal storms such as Hurricane Isabel will overtop the revetment and erode the already steep river bank, the elevation of which ranges from 35 ft MLW at the east end to 65 ft MLW at Point of Rocks.

Reach IV contains the more erosion resistant stratigraphy of the Yorktown Formation, which is evident at the headlands at Point of Rocks. However, Reach IV is the most exposed of all five Reaches and suffered significant erosion during Hurricane Isabel. The average rate of change at Reach IV was -0.4 ft/yr for the period 1937 to 2002, and -1.0 for the period 1994 to 2002. With the exception of the Point of Rocks area, and one very short portion of the lower Reach, the 2002 shoreline was the most landward manifestation of the shoreline since 1937.

WETLAND RESOURCES

REGULATORY CONTEXT

The identification of wetlands within the study area is necessary to ensure their protection in accordance with federal laws (Section 404 of the Clean Water Act and the Rivers and Harbors Act of 1899) and state laws (Virginia Wetlands Act of 1972 and Virginia Code Sections 62.1-44.2 *et seq*.). At the federal level, the Environmental Protection Agency (EPA) and the USACE define wetlands as:

> *…areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions* (33 CFR 328.3(b); 40 CFR 230.3(t)).

By statute, the State of Virginia uses the federal definition for wetlands with one exception: tidal wetlands are defined as extending to the mean high tide line where no emergent vegetation exists, and to 1.5 times the mean tide range where marsh is present (Title 28.2, Chapter 12, Code of Virginia). In most cases, federal and state wetland jurisdiction is overlapping.

Under the federal definition, a wetland requires the presence of three parameters: hydric soil, a dominance of hydrophytic vegetation, and hydrology at or above the ground surface. This determination is tied to Section 404 of the Clean Water Act, which provides for the protection of water quality of "waters of the United States," including wetlands, and instructs the COE to issue permits for activities that result in the discharge of dredged or fill material into these areas. Alternatively, the United States Fish and Wildlife Service (FWS) defines wetlands as:

> *…lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year* (Cowardin et al. 1979).

The FWS definition is more comprehensive than the EPA/COE definition, recognizing that physical or chemical conditions such as wave action, currents, or high salinity may prevent development of hydric soils or hydrophytic vegetation in some wetland types. Therefore, some unvegetated and/or nonhydric soil sites, such as mudflats or high-energy shorelines, may not exhibit all three attributes but are still classified as wetlands.

WETLAND DELINEATION

Certified professional wetland scientists performed a wetland delineation within the project area from March 31 to April 16, 2010 using the technical criteria and procedures outlined in the Interim Regional Supplement to the USACE Wetland Delineation Manual: Atlantic and Gulf

Coastal Plain Region (Regional Supplement, USACE 2008). In addition to the Regional Supplement (USACE 2008), the wetland delineation and classification efforts were kept consistent with the National Park Service Procedural Manual #77-1: Wetland Protection (NPS 2008), including the use of a wetland classification scheme based on Cowardin et al. (1979). The seaward limit of unvegetated estuarine (i.e., intertidal) wetlands was determined to correspond to Mean Lower Low Water (MLLW), the elevation of which is approximately -0.12 ft relative to Mean Low Water (MLW). This determination is based on bathymetric mapping derived from a hydrographic survey performed in March 2011 cross referenced with available data from the National Oceanographic and Atmospheric Administration (NOAA) tide gauge station at Sewell's Point, Virginia for the tidal epoch dating 1983 to 2001. Mean High Water at the study area is +2.57 ft relative to MLW. The landward limit of unvegetated estuarine wetlands corresponds to Mean Higher High Water (MHHW, the average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch), which is approximately 0.2 ft above MHW, or roughly +2.77 ft relative to MLW. Upland contours were established using topographic data derived from a combination of aerial survey (November, 2010) and land-based survey (November 2010 and February 2011). See "Chapter 1: Purpose and Need" for additional information on tidal datums.

The following sections provide a brief description of the wetlands within the study corridor, moving from northwest to southeast. The results of the wetland delineation are mapped on Figures 17 through 19. These figures include the -0.12-ft contour line that designates the seaward limit of estuarine wetlands throughout the study area. A full report of the wetland investigation is available under separate cover (NPS 2011b). Table 5 provides a key for the Cowardin classes shown on Figure 17 through 19.

Table 5: Key to Cowardin Classifications for Delineated Vegetated Wetlands

Code	System	Subsystem	Class	Subclass	Modifier
E2EM1N	estuarine	intertidal	emergent	persistent	regularly flooded
E2EM1P	estuarine	intertidal	emergent	persistent	irregularly flooded
E2FO1P	estuarine	intertidal	forested	broad-leaved deciduous	irregularly flooded
E2FO4P	estuarine	intertidal	forested	needle-leaved deciduous	irregularly flooded
E2SS1P	estuarine	intertidal	scrub-shrub	broad-leaved deciduous	irregularly flooded
E2SS3P	estuarine	intertidal	scrub-shrub	broad-leaved evergreen	irregularly flooded
PFO1A	palustrine	n/a	forested	broad-leaved deciduous	temporarily flooded
PSS1A	palustrine	n/a	scrub-shrub	broad-leaved deciduous	temporarily flooded
PSS1B	palustrine	n/a	scrub-shrub	broad-leaved deciduous	saturated

Ringfield Picnic Area Shoreline (Area A)

At the northwesternmost terminus of the study area, a recreational site known as the Ringfield Picnic Area (now closed) overlooks the shoreline along the western flank of Felgates Creek. The wetland boundary through this area was established along the upper limit of tidal influence, which encompasses a mosaic of habitat types including irregularly flooded emergent tidal marsh, scrub-shrub habitat, and non-vegetated beach.

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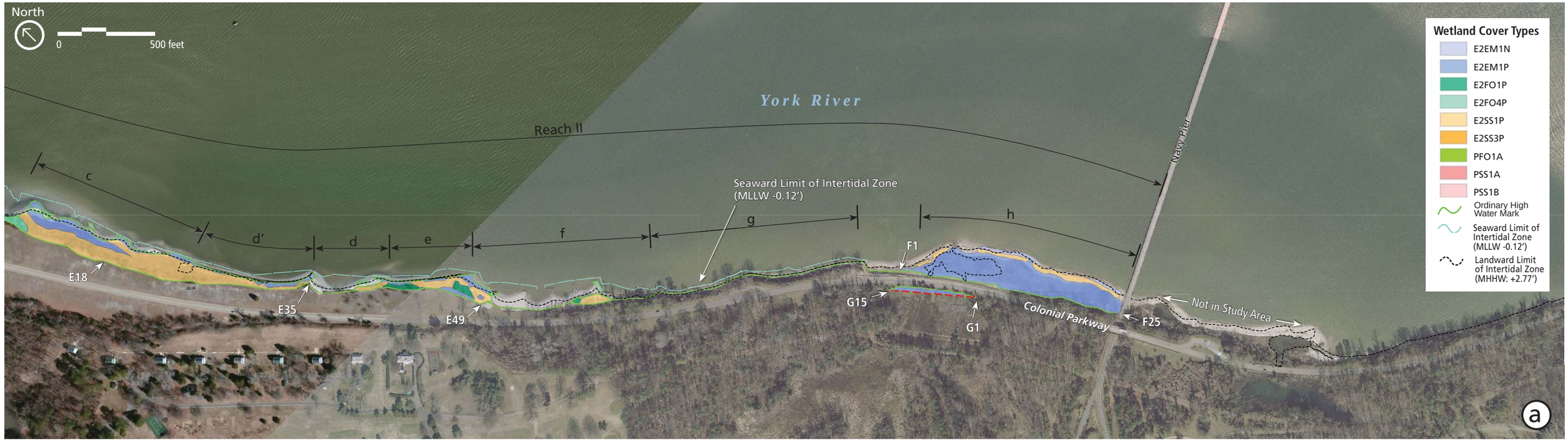
Figure 17
Field-Delineated Wetlands - Reaches IA and I



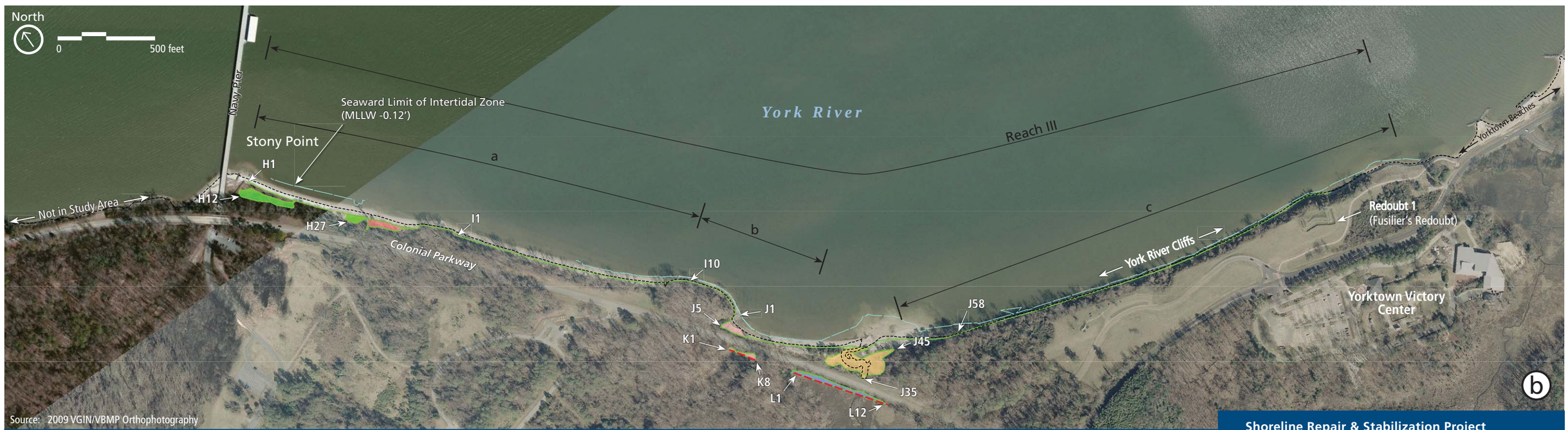


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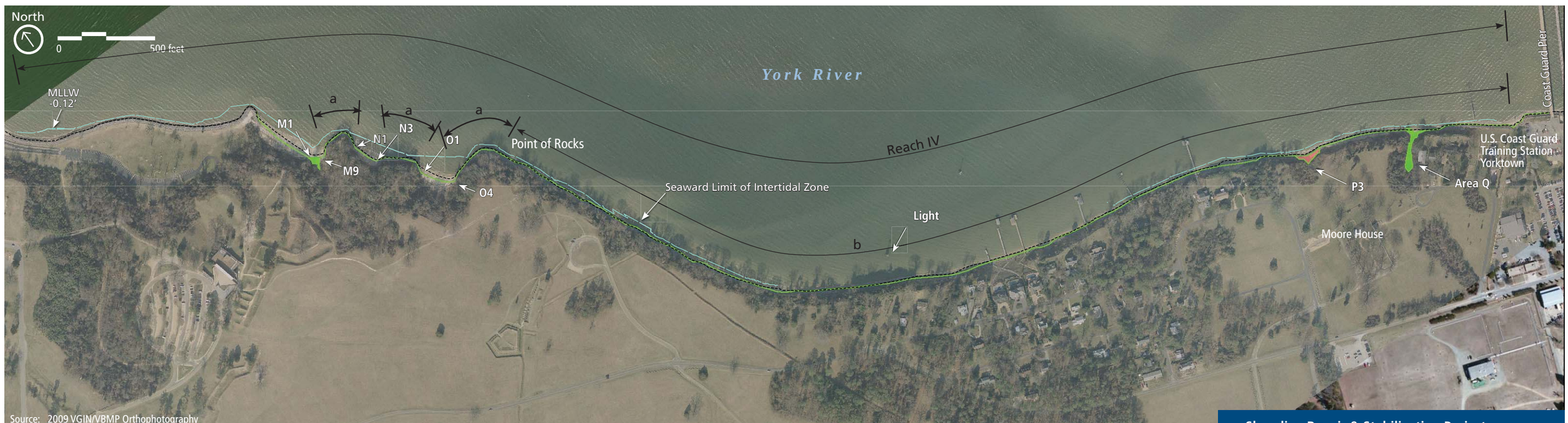
Figure 18
Field-Delineated Wetlands - Reaches II and III

Wetland Cover Types

- E2EM1N
- E2EM1P
- E2FO1P
- E2FO4P
- E2SS1P
- E2SS3P
- PFO1A
- PSS1A
- PSS1B
- Ordinary High Water Mark
- Seaward Limit of Intertidal Zone (MLLW -0.12')
- Landward Limit of Intertidal Zone (MHHW: +2.77')



Source: 2009 VGIN/VBMP Orthophotography

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Figure 19
Field-Delineated Wetlands - Reach IV

Felgates Creek/Poley Point (Area B)

East of the Felgates Creek inlet, the marsh complex (Area B) at the mouth of the creek shows more apparent zonation of emergent and scrub-shrub tidal wetlands established in bands roughly parallel to the shoreline. Outside of the scrub-shrub fringe on the parkway side of the marsh, there is a narrow band of emergent wetlands that is maintained by occasional mowing. Though the vegetation has been cropped, the wetland plants that dominated this zone were readily identifiable from leaves by comparison with samples from the adjacent, undisturbed wetland areas.

Bellfield Straight

Bellfield Straight is the long, nearly linear reach of the York River shoreline between Felgates Creek and Indian Field Creek, so named because of the historic Bellfield Plantation in close proximity to the south. This entire stretch of shoreline has been hardened by a rip-rap revetment. No vegetated wetlands were found along this reach.

Indian Field Creek

The shorelines on both sides of the inlet at Indian Field Creek have been hardened as described above for Bellfield Straight. As noted, no vegetated wetlands were found on either side of the mouth, or along the abutting segments of the York River shoreline.

Sandy Point Southward (Area E)

As shown on the USGS topographic map (Figure 2a), a small spit of land known as “Sandy Point” is located just east of the Indian Field Creek inlet. From this point eastward, Area E includes a mosaic of intertidal habitat types, including emergent and scrub-shrub wetlands similar to Felgates Creek, as well as some maritime fringe forest habitats. Tidal flooding is irregular in these forested patches and probably only occurs during spring tides or storm surges. Portions of the marsh eastward have been colonized by the problematic invasive common reed (*Phragmites australis*), which co-dominates with other species. On the inland side of the scrub-shrub fringe line, there are a few wetland areas maintained by occasional mowing as described for Felgates Creek above.

Navy Pier North (Areas F and G)

The “Navy Pier” – a large, trapezoidal, closed-circuit military pier extending for nearly half a mile into the river – roughly bisects the project area along the York River shoreline. Because the 3,300-foot portion of the shoreline between the two pier landings is on Department of Defense property, this reach was not included in the study area. However, the region just west (upstream) of the pier contains a fairly large tidal marsh with a scrub-shrub fringe along the marsh/river interface (Area F). Several culverts convey small tidal channels under the parkway to a tidal emergent marsh on the south side of the road (Area G).

Navy Pier South (Areas H and I)

East of the Navy Pier, shoreline wetland habitat types change character due to the presence of non-tidal, freshwater inputs from drainages originating on the south side of the parkway.

Palustrine scrub-shrub and forested wetlands (Area H) are found behind a narrow rise that is situated just above the fairly broad, sandy beach that accompanies this segment of the shoreline. Eastward, vegetated wetlands dissipate.

Ballard Creek (Areas J, K, and L)

At the mouth of Ballard Creek, several different wetland types were delineated in connection with the multiple hydrologic influences present at this location. For example, Area K is a non-tidal freshwater scrub-shrub system on the south side of the parkway. On the river side of the parkway, a combination of tidal and non-tidal scrub-shrub habitats is present, the former in association with freshwater drainage inputs, and the latter with intertidal sections of the Ballard Creek-York River confluence. Additionally, the floodplain of Ballard Creek on the south side of the parkway (Area L) is a tidal emergent marsh vegetated.

York River Cliffs

As described for Bellfield Straight above, the York River Cliffs section of the project area is a long, fairly straight reach of shoreline that has been hardened with rip-rap. No vegetated wetlands were found along this reach.

Point of Rocks North (Areas M, N, and O)

The section of the York River shoreline known as “Point of Rocks” sits just to the southeast of the recreation beaches and picnic areas of the Yorktown Waterfront. The section of shoreline north of Point of Rocks is very similar to that described for Navy Pier South above, in that the limit of jurisdiction for the majority of the irregular shoreline in this area is the high tide line along sandy beaches and rip-rap revetments. One small, groundwater-fed wetland was delineated as an extension of Area M – this feature is a seep that has developed at the base of long upland draw that extends to the south.

Point of Rocks South

The shoreline south of Point of Rocks has been hardened as described above for Bellfield Straight and York River Cliffs. No vegetated wetlands were found along this reach.

Moore House (Areas P and Q)

At the southeastern terminus of the project area, two small wetland features (Areas P and Q) associated with groundwater seepage were delineated near the historic Moore House region of the Park – one palustrine forested wetland and one palustrine scrub-shrub wetland. In Area P, wetland hydrology includes soil saturation and pockets of standing water. At Area Q, groundwater discharge originates from a springbox located at the head of a narrow draw just inside the treeline north of Moore House.

Areas of Unvegetated Intertidal Wetlands

Areas of unvegetated intertidal wetlands within the study area can be broadly separated into two categories:

1. In areas of existing stone revetment, the unvegetated intertidal wetland area consists of both the steep stone surface of the lower revetment and the comparatively low slope sandy shelf that extends seaward from the toe of the revetment. This shelf may contain localized stone boulders or other materials used in shoreline armoring that have become displaced over time by wave action. Additionally, where the revetment has detached from the riverbank, the intervening area may also consist of localized boulder material resting on a sandy or muddy substrate.

2. In areas where structural shoreline defense is absent or consists of living shoreline approaches such as rock sills, the unvegetated wetlands that occur between patches of vegetated wetlands or seaward of these features consist predominantly of a sandy, low-gradient substrate. At the mouths of creeks, sediment texture may be finer (i.e., silt and mud).

The bathymetry of both areas is subject to periodic modification as wave energy reworks the relatively mobile sediments of the nearshore.

FUNCTIONS AND VALUES ASSESSMENT

In order to make unbiased comparisons of functions and values, wetland scientists have developed assessment methodologies using a wide variety of techniques. One such technique is the Highway Methodology (USCOE 1995). The Highway Methodology was used to assess wetland functions and values within the study corridor. Five representative tidal wetland areas along the shoreline of the York River were assessed as part of this project: Area A (Ringfield), Area B (Felgates Creek), Area E (Sandy Point), Area F (Navy Pier North), and Area J (Ballard Creek). Wetland Areas A, B, and J retain several functions and values attributed to their important tidal fringe position within the greater York River ecosystem. Principal functions and values for these wetland areas include sediment/shoreline stabilization, wildlife habitat, recreation, and visual quality/aesthetics. Additionally, Wetland Area B has the added benefit of accessibility, making it a prime location for educational/scientific value. Area E is similar to the other wetlands areas in functional capacity, interspersion of habitat types, and beneficial uses; however, the presence of the invasive species common reed reduces wildlife habitat functions, decreases biological diversity, and has an effect on visual quality and aesthetic values. Though Area F is a tidal fringe system, several functions and values are diminished by its close proximity to the Navy pier. Specifically, the pier reduces the visual quality associated with the wetland and has potential effects on recreational/educational uses of the wetlands due to the Navy's vigilant monitoring of hikers/pedestrians around the pier. In addition, although it is unclear whether water quality functions are negatively impacted by the ongoing ship traffic to the pier, scientists detected a strong hydrocarbon odor while sampling soils off the outer fringe of the marsh at Area F. Finally, access to Area F is very limited. There are no direct access points, and the shoulder along the Colonial Parkway is narrow at this location.

Functions and values attributed to wetlands within the study corridor are relatively similar due to similar hydrogeomorphic position (Brinson 1993) and habitat condition. Based on the Highway Methodology model (USACE 1995) and best professional judgment, this assessment suggests:

- Wetland Area B retains slightly higher functional capacity than the other wetlands evaluated.
- Wetland Areas A and J retain most wetland functions and values typically attributable to coastal fringe marshes.
- Wetland Area E is similar in this respect but slightly degraded by invasive species colonization.
- Wetland Area F retains some functions but minimal values due to the restrictions on access and aesthetics imposed by the adjacent Navy pier.

FLOODPLAINS

The Federal Emergency Management Agency (FEMA) published updated Flood Insurance Rate Maps (FIRMs) for the study area in June 2009 (FEMA 2009a, 2009b, 2009c, 2009d). The entire York River shoreline lies within a Special Flood Hazard Area (Zone AE) that is subject to inundation by the 100-year flood. A base flood elevation of 7.3 ft NGVD (8.0 ft MLW) extends from the upstream point at Reach IA through both Reaches I and II and to the midpoint of Reach III at Ballard Creek. At this point and through the remainder of Reach II, Zone AE increases to 8.0 ft NGVD (8.7 ft MLW). The York River shoreline at Reach IV also lies within the 100-year floodplain, though is classified as Zone VE. This represents a coastal flood zone with velocity hazard (wave action). The base flood elevation for Reach IV is 12 ft NGVD (12.7 ft MLW), with the exception of the Point of Rocks area, where it is 11 ft NGVD (11.7 ft MLW). The areas within the embayments at Point of Rocks area classified as Zone AE with base flood elevations ranging from 7.5 ft to 9.0 ft NGVD (8.2 ft to 9.7 ft MLW).

Two portions of the study area classified as “Other Flood Areas,” which corresponds to areas subject to inundation by the 500-year flood. These are the estuarine emergent and scrub-shrub wetlands at Poley Point in Reach I (Figure 7) and estuarine emergent, scrub-shrub, and forested wetlands at Sandy Point in Reach II (Figure 7).

It should be noted that the flood zone of the York River at the study area is different from a floodplain. Floodplains are lands adjacent to freshwater streams and rivers that are inundated by rising stage in response to a higher than normal influx of upstream water supply (e.g., storm events, excessive snowpack, etc.). Floodplains are important resources as they can store floodwaters and attenuate downstream flooding and mitigate flood-related impacts. Flood zones are areas subject to the risk of flooding and flood damage regardless of location or type of flooding. Flood zones include broad bottomland floodplains adjacent to non-tidal streams as well as low-lying coastal areas subject to tidal storm surges. Flood zones affected by tidal storm surges are locations where water is actually pushed up from normal sea level to an elevation much higher than the mean high tide due to extremely high winds. The York River at the study area has an average water level that approximates sea level. Because sea level is viewed as having an infinite storage capacity, the study area is not subject to flooding caused by upstream sources. For this reason, none of the proposed alternatives would truly affect floodplain values.

With the exception of shoreline defense structures and stormwater outfalls, no park infrastructure is located in designated flood zones. The same is true with respect to visitor attractions.

However, such areas are not restricted to park visitors. The beach areas at Poley Point and Sandy Point are frequently used by sunbathers and for recreational fishing.

WILDLIFE AND WILDLIFE HABITAT

YORK RIVER ESTUARY AND WILDLIFE HABITAT

As part of the greater Chesapeake Bay ecosystem, the lower York River estuary provides habitat for numerous species of wildlife. This is due in large part to the productive environment provided by the mixing of fresh river water with saline ocean water, resulting in a large diversity of aquatic, intertidal, riparian, and shoreline habitats. Overall, the Chesapeake Bay harbors some 350 species of finfish, 170 species of shellfish, and 200 species of birds and waterfowl (Reay and Moore 2009). The York River provides habitat for a large number of these species, owing to its prevalence of tidal creeks, marshes, shoals, deep water channels, and shoreline habitats (Chesapeake Bay Program 2004). Several of these habitat types are represented within the study area, particularly in association with marshes and fringe habitats near inlets such as Felgates Creek, Indian Field Creek, and Ballard Creek.

WILDLIFE

Waterfowl and Other Bird Species

Within the York River ecosystem, approximately 192 species of birds have been documented (Brown and Erdle 2009). Waterfowl and other migratory birds along the Atlantic Flyway stop in this region for food and shelter among the marshes and other coastal habitats found here. The York River harbors a diversity of ducks such as canvasbacks (*Aythya valisineria*), pintails (*Anas acuta*), and ruddy ducks (*Oxyura jamaicensis*), and is a nesting area for raptors such as the osprey (*Pandion haliaetus*) and the northern harrier (*Circus cyaneus*) (Chesapeake Bay Program 2004). Marshes support populations of clapper rail (*Rallus longirostris*), seaside sparrow (*Ammodramus maritimus*), marsh wren (*Cistothorus palustris*), and sedge wren (*C. platensis*). Sandy berms and river fringe flats provide habitat for American oystercatchers (*Haematopus palliates*) and least terns (*Sternula antillarum*), and blue herons (*Ardea herodias*) can be seen foraging along various shoreline habitats throughout this region. Threats to bird populations in the lower York River include loss of habitat due to invasive species (e.g., common reed) and sea-level rise, increases in predation, and human disturbance (Brown and Erdle 2009).

Nekton and Fisheries

"Nekton" refers to fish and other free-swimming organisms that live in the water column and control their own movements, independent of water currents or other factors such as wind-driven waves. In the York River, nektonic species include various finfishes, cartilaginous fishes such as sharks and rays, and other important inhabitants such as the blue crab (*Callinectes sapidus*). VIMS, which is stationed on the York River across from the study site, has been assessing fish populations through its Juvenile Fish Survey since mid 1900s (Hewitt, Ellis, and Fabrizio 2009). Over the years, VIMS has documented more than 130 species of fish in the river, from top predators (e.g., sharks) to plankton feeders such as anchovies (*Anchoa mitchilli*). Included among

these species are anadromous fish (i.e., fish that migrate upstream to freshwater during spawning season) such as American shad (*Alosa sapidissima*), and blueback herring (*Alosa aestivalis*). Other important species include members of the drum family such as Atlantic croaker (*Micropogonias undulates*), spot (*Leiostomus xanthurus*), and silver perch (*Bairdiella chrysoura*), flatfishes such as summer flounder (*Paralichthys dentatus*) and hogchoker (*Trinectes maculatus*), introduced species such as channel catfish (*Ictalurus punctatus*), bottom dwellers such as oyster toadfish (*Opsanus tau*), catadromous species (i.e., species that migrate to ocean waters to spawn) such as the American eel (*Anguilla rostrata*), and recreationally important species such as striped bass (*Morone saxatilis*) (Hewitt, Ellis, and Fabrizio 2009).

Major threats to fishes within the York River include loss of habitat and overfishing for commercially important species. With respect to habitat, nutrient loads from non-point source runoff within the watershed lead to algal blooms, which in turn can lead to reductions in dissolved oxygen in certain portions of the water column (Reay 2009). Other habitat-altering activities can include point-source pollution, dredging for navigation, and loss of nursery grounds such as beds of submerged aquatic vegetation (SAV) and marsh due to development in the coastal zone. In addition, overharvesting, particularly of reproductively mature fishes that are commercially more desirable due to their larger size, inevitably leads to reduction in the amount of young that can be produced in a given year (Hewitt, Ellis, and Fabrizio 2009).

The Virginia Coastal Zone Management Program maintains a database of coastal resources and mapping under the heading "Coastal GEMS" (http://www.deq.state.va.us/coastal/coastalgems.html). Based on data review under this program, there are no unique fisheries management areas that coincide with the project area. However, the entire river adjacent to the project area is mapped as a confirmed anadromous fish use area.

Benthic Invertebrates

The term "benthic invertebrates" refers to invertebrate species of animals that live on or in the substrate of a water body (i.e., "bottom dwellers"). In estuaries, benthic organisms are often regarded as significant components of the food web, providing resources for a variety of predators and also performing important ecological functions (Bruno and Bertness 2001; Welsh 2003). Benthic invertebrates are also known to show rapid and measurable responses to changes in the environment; for this reason, the benthos are often cited as indicators of habitat degradation or, conversely, habitat integrity depending on the composition and relative abundance of the species present (Woodin 1991; Gillett and Schaffner 2009). In soft-sediment estuaries like the lower York River, ecological functions of benthic organisms can include oxygenation of sediments from burrowing, consuming and "reworking" detritus (non-living organic matter) into forms that are usable for other species, sediment irrigation and structural complexity within the soft substrate, resuspension of sediments and nutrients due to bioturbation (i.e., the stirring or mixing of sediment by living organisms), and influence on nutrient cycles (Bruno and Bertness 2001; Welsh 2003; Gillett and Schaffner 2009).

The most common benthic inhabitants within the York River include sponges, cnidarians (the "stinging" species like jellyfish), flatworms, ribbon worms, nematodes (an abundant type of round worm), segmented worms, and various arthropods such as barnacles, sea spiders, and

crabs (Gillett and Schaffner 2009). Another important group, both ecologically and commercially, is the benthic mollusks, which includes the bivalves such as clams, oysters, and mussels. The mollusks also include gastropods (i.e., "snail-like" mollusks) such as the introduced rapa whelk (*Rapana venosa*), which can be problematic in the benthic community due to its heavy predation of commercially important shellfish species such as oysters and clams. Other introduced mollusks include Asian clams (*Corbicula* spp.), which are potentially invasive, and the non-native Pacific oyster (*Crassostrea gigas*) and Suminoe oyster (*C. ariakensis*), both of which were introduced to help supplement the overharvested native eastern oyster (*C. virginica*) (National Research Council 2004).

Crustaceans and Shellfish

Juvenile and adult mature crabs, including the blue crab (*Callinectes sapidus*), migrate to the lower salinity water of Chesapeake Bay tributaries, tidal creeks and salt marshes in order to forage on benthic fauna (Pugh 2005). Unvegetated sand and mud habitats in these locations also provide nursery habitat and overwintering locations. Within the study area, these include the York River and the various tributaries such as Felgates Creek and Indian Fields Creek, all of which have been and continue to be used for crab potting.

Based on data review under the Coastal GEMS program database, the project area contains no Baylor Grounds (i.e., public oyster grounds), but does lie adjacent to several private oyster leases, particularly at the northeastern end of the project area (i.e., between Felgates Creek and Indian Field Creek) and at the southeastern end near the Coast Guard Pier (Figures 20 through 22). In addition, there is one oyster gardening site near the Coast Guard Pier, and two state-constructed oyster reefs, both at the mouth of Felgates Creek. Further, based on aquaculture suitability models, several portions of the project corridor are appropriate for clam aquaculture, and nearly all nearshore habitat along this segment of the York River is suitable for oyster aquaculture. However, the tidal sections of Felgates Creek and Indian Field Creek are identified as shellfish condemnation zones, as well as the portion of the river interior to the Navy Pier. Shellfish condemnation zones represent waterways that have been designated by the Virginia Department of Heath, Division of Shellfish Sanitation as closed for the taking of shellfish. These closures are based on regular fecal coliform monitoring by the Division.

The Chesapeake Bay Program maintains an annual benthic monitoring study to assess habitat integrity in the Bay and its tributaries. The program uses a metric termed the Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI), which is a rating based on the types and densities of benthic organisms found in sediment samples taken throughout the Bay. Current data show that 73% of the York River estuary does not meet restoration goals established by the Chesapeake Bay Program, and this has been attributed to low benthic organism abundance and biomass (Gillett and Schaffner 2009). Degraded sites identified in this study point to portions of the river-estuary system where low dissolved oxygen has been a recurring problem. As cited above, low oxygen levels in the water column are due to nutrient inputs and man-induced changes within the watershed that lead to problems such as algae blooms (Reay 2009)

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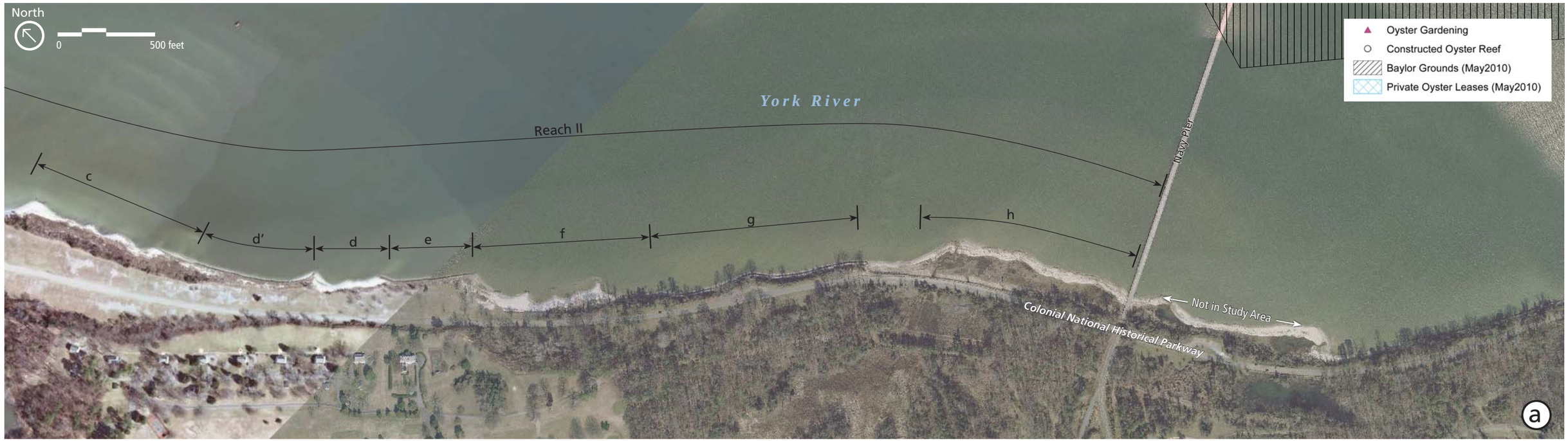
Shoreline Repair & Stabilization Project
Environmental Assessment

National Park Service
U.S. Department of the Interior

Colonial National Historical Park

Figure 20
Potential and Existing Shellfish Ground and Leases - Reaches IA and I



Source: 2009 VGIN/VBMP Orthophotography

Shoreline Repair & Stabilization Project
Environmental Assessment

National Park Service
U.S. Department of the Interior

Colonial National Historical Park

Figure 21
Potential and Existing Shellfish Ground and Leases - Reaches II and III

Source: 2009 VGIN/VBMP Orthophotography

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Figure 22

Potential and Existing Shellfish Ground and Leases - Reaches IV

Amphibians and Reptiles

A herpetological survey of the park was conducted between 2001 and 2003 to document the amphibians (frogs, salamanders) and reptiles (turtles, lizards, snakes) present as well as their habitat and to provide park staff with conservation and management recommendations (Mitchell 2005). The principal habitat types identified within the study area include beaches, marsh, and grasslands. Two observation and capture stations were established within the study area: the shoreline just downstream of Poley Point and at the mouth of Ballard Creek.

Most amphibian and reptile species within the park occupy both aquatic and terrestrial habitats and thus require connectivity between these habitats; one species – the diamond-backed terrapin (*Malaclemys terrapin*) – is habitat specific. It occupies only estuarine marshes and is the only truly estuarine reptile in the world (Mitchell 2005). A number of such marsh features are present within the study area, chiefly at or near the mouths of Felgates Creek, Indian Fields Creek, and Ballard Creek. Another estuarine marsh is situated along the shoreline immediately upstream of the west pier of NWS Yorktown. However, the study did not observe any diamond-backed terrapins at either of the two sampling locations. Just one individual was observed in a marsh on Powhatan Creek in the Jamestown Unit of the park. Species that were observed in beach, grassland, and marsh habitats within the limits of the park as whole are presented in Table 6. With respect to the study area, the herpetological inventory recommended that additional survey work be conducted on to better understand the abundance and distribution of diamond-backed terrapin habitat; mortality rates and distribution for amphibians, reptiles, and other invertebrates along the parkway be determined; and raccoon populations be monitored in relation to primary turtle nesting sites (Mitchell 2005). According to the College of William & Mary Center for Conservation Biology (CCB), the beach at Reach IA has potential as a nesting site for diamond-back terrapins. The other beaches (Poley Point and Sandy Point) lack sufficient upland or marsh or are visited too frequently by park visitors to make them desirable nesting locations (CCB 2011a). A recent field survey of the study area found the greatest number of individual turtles reside upstream of the shoreline within the creeks proper (CCB 2011a).

Table 6. Amphibians and Reptiles Potentially Occurring in the Study Area				
Amphibian and Reptile Species		Habitat Where Observed		
Scientific Name	Common Name	Beach	Grassland	Marsh
Frogs				
Bufo americanus	American Toad		1	
Bufo fowleri	Fowler's Toad		4	2
Gastrophryne carolinensis	Eastern Narrowmouth Toad			1
Hyla chrysoscelis	Cope's Grey Tree Frog		1	
Hyla cinerea	American Green Tree Frog			7
Hyla squirella	Squirrel Treefrog		1	
Pseudacris crucifer	Spring Peeper		1	5
Pseudacris feriarum	Upland Chorus Frog			1
Rana clamitans	Green Frog			1
Rana utricularia	Southern Leopard Frog	1	25	2
Salamanders				
Ambystoma mabeei	Mabee's Salamander		11	
Ambystoma opacum	Marbled Salamander		8	
Eurycea cirrigera	Southern Two-Lined Salamander			5
Turtles				
Chelydra serpentina	Common Snapping Turtle			2
Chrysemys picta	Painted Turtle			1
Kinosternon subrubrum	Eastern Mud Turtle	1	5	1
Malaclemys terrapin	Diamondback Terrapin			1
Pseudemys rubriventris	Northern Red-Bellied Cooter		1	5
Terrapene carolina	Common Box Turtle		2	1
Lizards				
Cnemidophorus sexlineatus	Six-Lined Racerunner	1		
Eumeces fasciatus	Five-Lined Skink			1
Scincella lateralis	Little Brown Skink		1	
Snakes				
Carphophis amoenus	Eastern Worm Snake		1	
Coluber constrictor	Eastern Racer			1
Elaphe obsoleta	Black Rat Snake		1	
Lampropeltis getula	*Eastern Kingsnake*		1	
Nerodia sipedon	Northern Water Snake		1	

Source: Mitchell 2005

Essential Fish Habitat

The Mid-Atlantic Fishery Management Council is responsible for managing fishery resources in federal waters, including those off the coast of the Chesapeake Bay. The council, established by the Magnuson-Stevens Fishery Conservation and Management Act, has identified essential fish habitat (EFH) for the geographic 10-minute by 10-minute block that includes the project area. The fish species that may occur in this block are listed in Table 7. For the sandbar shark, Habitat Areas of Particular Concern (HAPC), including nursery and pupping grounds, are mapped as intersecting the study area (NOAA 2011). None of the species listed in Table 7 are federally listed as threatened or endangered.

Table 7: Summary of Essential Fish Habitat Species by Life Stage

Scientific Name	Common Name	Eggs	Larvae	Juvenile	Adult
Carcharhinus obscurus	Dusky shark		X	X	
Carcharhinus plumbeus	Sandbar shark		X HAPC	HAPC	X HAPC
*Centropristis striata**	Black sea bass*			X	X
*Paralicthys dentatus**	Summer flounder*		X	X	X
*Peprilus triacanthus**	Atlantic butterfish*			X	X
*Pomatomus saltatrix**	Bluefish*			X	X
Rachycentron canadum	Cobia	X	X	X	X
Sciaenops occelatus	Red drum	X	X	X	X
Scomberomorus cavalla	King mackerel	X	X	X	X
Scomberomorus maculates	Spanish mackerel	X	X	X	X
Scopthalmus aquosus	Windowpane flounder			X	X

HAPC: Habitat Areas of Particular Concern

*species managed by the Mid-Atlantic Fishery Management Council

Source: NOAA 2011

VEGETATION

SUBMERGED AQUATIC VEGETATION (SAV)

Submerged aquatic vegetation (SAV) is the term used for plants that grow completely underwater. SAV is an important component of the Chesapeake Bay ecosystem, including the lower York River estuary adjacent to the study area. Localized colonies of SAV or “seagrasses” provide food and shelter for waterfowl, fish, shellfish, and other invertebrates (Chesapeake Bay Program 2004), and serve as important nursery grounds for many types of marine life. SAV beds also return dissolved oxygen to the Bay through photosynthesis, and help to improve water quality by trapping sediments that would otherwise be suspended in the water column, thereby reducing the turbidity or “cloudiness” of the water (Moore 2009). Similarly, SAV beds help to reduce shoreline erosion by dissipating the energy of waves and currents that roll across the shallow, near-shore zones of the Bay where seagrasses grow (Chesapeake Bay Program 2004).

There are several different species that compose the SAV flora of the Chesapeake Bay, and their relative distribution throughout the Bay is determined by gradients such as salinity, turbidity, and

current velocity (Moore 2009). The most common SAV species within the lower-to-mid portions of the Bay include eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*), the former occurring in the lower, more saline sections, and the latter dominant in the Bay's middle regions (Chesapeake Bay Program 2004, Moore 2009).

On an annual basis, scientists at the Virginia Institute of Marine Science (VIMS) review the status and distribution of SAV within the Chesapeake Bay under multiple grants from sources such as the U.S. Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the Virginia Department of Environmental Quality, and the Maryland Department of Natural Resources. Data collected under the SAV Program at VIMS are available from the late 1970s onward. Based on the most current available mapping (Orth et al. 2010), SAV is nearly absent from the project area. The only occurrence of SAV beds noted in the VIMS 2010 report is at the very southeastern end of the project corridor near the Coast Guard Pier in Reach IV (Figure 23). As noted in the VIMS report, these are relatively low-density SAV beds, with less than 10% cover based on the mapping conventions provided.

WETLAND VEGETATION

The wetland vegetation of the York River coastline has been well documented through the work of Perry and Atkinson (1997, 2009) among others. From their research as well as other data sources (e.g., Chesapeake Bay Program; http://www.chesapeakebay.net/dataandtools.aspx), the salinities expected along the project area are in the mesohaline range (i.e., 5 to 18 ppt). The resultant emergent tidal marsh communities that occur within this zone are composed of halophytic (salt-tolerant) plant species such as saltmarsh cordgrass (*Spartina alterniflora*), saltmeadow hay (*S. patens*), salt grass (*Distichlis spicata*), and black needlerush (*Juncus roemerianus*) (Perry and Atkinson 1997). Diversity in these marshes tends to be low, a condition which is attributed to the combination of environmental stresses imposed by tidal inundation, salinity, and exposure to the often high-energy forces of waves and wind. Nonetheless, a very distinct zonation can emerge within these mesohaline tidal marshes in which the dominant species – saltmarsh cordgrass – can be seen to transition abruptly into zones dominated by the other species (for example, black needlerush "stands"). Such zonation often accords with elevation changes in the marsh (Perry and Atkinson 2009), or may be due to other potential factors such as groundwater inputs (Mitsch and Gosselink 2000).

As an extension of the typical zonation character in mesohaline tidal marshes, scrub-shrub wetlands are found on the landward side of the York River fringe marsh systems approximately around the high tide line (Perry and Atkinson 2009). Tidal scrub-shrub fringe areas are typically vegetated with salt-tolerant woody shrubs such as groundsel tree (*Baccharis halimifolia*), saltbush (*Iva frutescens*), and wax myrtle (*Morella cerifera*). Occasionally, this scrub-fringe will transition into a narrow band of maritime forest dominated by loblolly pine (*Pinus taeda*), sugarberry (*Celtis laevigata*), eastern red cedar (*Juniperus virginiana*), and black cherry (*Prunus serotina*) – species with marginal tolerance to salinity and saturated soils, presumably persisting in a zone that is only irregularly exposed to tidal inundation (Silberhorn 1999).

Submerged Aquatic Vegetation
(VIMS, 2008)

Source: 2009 VGIN/VBMP Orthophotography

Shoreline Repair & Stabilization Project
Environmental Assessment

National Park Service
U.S. Department of the Interior

Colonial National Historical Park

Figure 23
Submerged Aquatic Vegetation Mapped in 2008

UPLAND VEGETATION

Uplands within the project corridor are characterized by a mixture of vegetation types that are attributed to different management regimes within the park. Examples include: 1) areas maintain by mowing that are kept in a lawn-like or meadow-like condition; 2) regenerative-growth fallow areas that are occasionally "bush-hogged" to improve views of the York River along the parkway; and, 3) unmaintained forest along the York River escarpment and adjacent terrace.

Much of the upland sections along the project corridor are composed of lawn-like or meadow-like grounds that are maintained by periodic mowing. This is the prevailing condition from the northwestern end of the corridor at Felgates Creek to the Navy Pier (Reaches I and II), and also portions of the southeastern segments (Reaches III and IV) that overreach battlefield elements within the Park. Common species in such areas include grasses such as tall fescue (*Festuca* spp.), perennial rye (*Lolium perenne*), Bermuda grass (*Cynodon dactylon*), and crab grass (*Digitaria sanguinalis*), and forbs (non-grasses) such as bulbous buttercup (*Ranunculus bulbosus*), chickweed (*Stellaria media*), dovesfoot cranebill (*Geranium molle*), and English plantain (*Plantago lanceolata*).

Regenerative-growth habitats are densely vegetated with a variety of species, including saplings of trees that "coppice" or sprout from their cut stumps, shrubs, woody vines, and various herbaceous "volunteers" or species that colonize after the woody canopy has been removed by cutting. These areas are found along the bank of the river in places where maintenance crews occasionally clear sight lines for parkway travelers. Examples include the Bellfield Straight portion of the corridor, the upper bank near Redoubt 1, and in various other shorter segments throughout. Typical species include black cherry, sugarberry, tulip tree (*Liriodendron tulipifera*), black locust (*Robinia pseudo-acacia*), spicebush (*Lindera benzoin*), Virginia creeper (*Parthenocissus quinquefolia*), greenbrier (*Smilax* spp.), blackberry (*Rubus* spp.), and muscadine grape (*Vitis rotundifolia*). Such areas also represent a point of introduction for potentially problematic exotics species such as Chinese privet (*Ligustrum sinense*), English ivy (*Hedera helix*), and Japanese honeysuckle (*Lonicera japonica*).

Large sections of unmaintained forest can be found along the York River embankment and upland terrace within the project corridor, particularly in the areas surrounding the Navy Pier, and in portions of Reach IV at the southeastern end of the project corridor. Common species include sugarberry, black walnut (*Juglans nigra*), eastern red cedar (*Juniperus virginiana*), paw paw (*Asimina triloba*), several species of oaks (*Quercus* spp.) and hickories (*Carya* spp.), black cherry, flowering dogwood (*Cornus florida*), muscadine grape, Virginia creeper, and Virginia wild rye (*Elymus virginicus*). Of note, the presence of prehistoric shellbed layers in the soils along the shoreline of the York River (i.e., "Yorktown Formation") creates a unique soil condition marked by high levels of calcium carbonate, the primary structural component of marine shells. Where these shellbed layers are exposed along the slope (or very shallow in the soil profile), soil chemistry tends to be higher in pH than the surrounding terrain. The alkalinity of the soil attracts several species that are unique to calcareous (i.e., high-calcium) substrates (Ware and Ware 1992), such as bitternut hickory (*Carya cordiformis*), southern sugar maple (*Acer barbatum*), and wild columbine (*Aquilegia canadensis*).

INVASIVE SPECIES

Throughout the coastal zone in the Chesapeake Bay, the most problematic invasive species is common reed (*Phragmites australis*). The invasive strain of this prolific grass was introduced to the Bay region from Eurasia during the 19th Century, presumably carried to Atlantic seaports via dry ship ballast. Wetlands and shorelines along the coast that have been exposed to recent sedimentation or soil disturbance often serve as points of introduction for common reed (Bart et al. 2006, Packett and Chambers 2006). The species' ability to expand rapidly is due primarily to its robust network of underground stems (rhizomes) and roots that can develop even from a single stem (Norris et al. 2002), allowing common reed to establish dense stands that effectively out-compete other species within the area. Further, because common reed is a tall grass (up to 12 feet), it can shade out other lower-growing species. The combination of fast, aggressive expansion and large stature tends to result in nearly monotypic stands of common reed (i.e., dense stands in which common reed is the only inhabitant). Therefore, common reed is a management concern throughout the Bay, because it has the potential to reduce biodiversity at local and regional scales.

There are several locations along the project corridor where common reed occurs, and these are scattered throughout the project area in every Reach. The Park has initiated a management program aimed at treating occurrences of common reed with approved aquatic herbicides. This program is ongoing, and has recently (summer 2010) treated several patches of common reed within the study area. Control methods for common reed often need to be repeated over several growing seasons to be completely effective; therefore, the park's invasive management plan includes monitoring and adaptive strategies for this species.

SPECIAL STATUS SPECIES

The DCR Division of Natural Heritage (DCR-DNH) has identified several natural heritage resources within the project area. According to the Biotics Data System maintained by DCR-DNH, the Poley Point Conservation Site and the Ballard Creek Ravines Conservation Site are within the study area. The biodiversity significance ranking for each site is B5 and B1, respectively. This ranking is based on rarity, quality, and the number of resource element occurrences; on a scale of 1 to 5, 1 being the most significant. The natural heritage resource of concern for both sites is the state-threatened bald eagle (*Haliaeetus leucocephalus*). Correspondence with the DCR-DNH is included in "Appendix A: Relevant Correspondence."

FEDERAL AND STATE LISTED SPECIES

A query of the Virginia Department of Game and Inland Fisheries (VDGIF) database resulted in a total of 19 potential special status species in the vicinity of the study area. These are included in Table 8, where they are separated into species that may have habitat within the study area and those that have limited or no habitat within the study area. Many of these are species of concern, which are not afforded protection under either the Endangered Species Act of 1973 or the Virginia Endangered Species Act.

The federal and state listed species that are potentially impacted by the proposed action are described below. Colonial waterbirds, migratory birds, and other species of concern are also addressed in this section. Those species with limited or no habitat in the study area have been excluded from the discussion.

Table 8: Special Status Species Occurring on VDGIF Database for Study Area

Common Name	Scientific Name	Status*
SPECIES WITH POTENTIAL HABITAT WITHIN THE STUDY AREA		
Bald Eagle	*Haliaeetus leucocephalus*	FSST
Brown creeper	*Certhia americana*	SS
Caspian tern	*Sterna caspia*	SS
Forster's tern	*Sterna forsteri*	SS
Great egret	*Ardea alba egretta*	SS
Northern harrier	*Circus cyaneus*	SS
Peregrine falcon	*Falco peregrines*	ST
SPECIES HAVING LIMITED OR NO SUITABLE HABITAT WITHIN THE STUDY AREA		
Hermit thrush	*Catharus guttatus*	SS
Kemp's turtle	*Lepidochelys kempii*	FESE
Little blue heron	*Egretta caerulea caerulea*	SS
Loggerhead sea turtle	*Caretta caretta*	FTST
Loggerhead shrike	*Lanius ludovicianus*	ST
Mabee's salamander	*Ambystoma mabeei*	ST
Purple finch	*Carpodacus purpureus*	SS
Red-breasted nuthatch	*Sitta Canadensis*	SS
Roseate tern	*Sterna dougallii dougallii*	FESE
Winter wren	*Troglodytes troglodytes*	SS
Yellow-belllied sapsucker	*Sphyrapicus varius*	SS

*FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FS=Federal Species of Concern; SS=State Special Concern

Source: DGIF 2010

Raptors

Bald Eagle

Breeding habitat for bald eagles is generally within forested woodlands near large bodies of water. Overwintering habitat is often in coastal areas along large rivers and lakes. Nests are constructed of large sticks and built within the canopy in large trees, often near edges of waterbodies. The eagle is an opportunistic feeder, preferring fish, but also feeding on large birds, mammals, and carrion (Buelher 2000). Threats to survival include human disturbance of nest sites, habitat loss, biocide contamination, decreasing food supply, and illegal hunting (USFWS 1990). The bald eagle was removed from the federal list of endangered species in 2007, though it remains protected under the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, and the Lacey Act. The bald eagle remains a state listed threatened species (Roble 2010).

According to the 2010 Virginia Eagle Nest Survey Report published by the College of Williams and Mary Center for Conservation Biology (CCB), an active and occupied bald eagle nest was

observed in the Ringfield Picnic Area landward of Reach IA, but was not productive (CCB 2010).

Northern Harrier

The preferred habitat of the northern harrier is marshes, open fields, and farms. Nests are built on the ground in marshy areas and typically surrounded by low shrubs or tall grasses. They forage over fields and marshland and generally take small mammals, but also take birds, herps and insects. Though the northern harrier is described as a common transient and winter resident of coastal Virginia, only five to ten pairs are believed to breed annually in the state (DGIF 2011). Their transient nature combined with the lack of marshy habitat in the study area proper suggests the northern harrier occupies the study area infrequently.

Peregrine Falcon

Peregrine falcons are native to the cliffs and canyons of the Allegheny and Blue Ridge Mountains of Virginia. In the wild they typically nest on high rocky cliffs in small dug-out depressions, called scrapes. They also are known to nest in manmade environments on bridges and tall buildings. Peregrine falcons mostly feed on birds they catch in the air, including ducks, pheasants, and pigeons.

After the peregrine falcon was extirpated as a nesting species in the 1960s, it was placed on the federal Endangered Species List from 1970 through 1999. The peregrine falcon is ranked as being extremely rare, with five or fewer populations or occurrences in the state, and especially vulnerable to extirpation (Roble 2010). In Virginia it is still considered a State Threatened species, but 17 known breeding pairs have been identified in the Hampton Roads area and on the Eastern Shore. This is due to an effort begun in 1978 to reintroduce peregrine falcons to Virginia. It was hoped that young falcons released in coastal Virginia would return to the cliffs of the western part of the state. The birds released as part of this program did not migrate to western Virginia, however. They instead made homes along the coast, many settling under bridges (DGIF 2011).

A falcon nesting box has been constructed within the structure of the Route 17/ Coleman Bridge. The box was first placed on the bridge in the late 1980s. Currently, no nesting pair inhabits the box, the last positive observation being made in 1992 (CCB 2011b). No peregrine falcons have otherwise been sighted in close proximity to the study area and suitable nest building habitat is not present (USFWS 2011).

Colonial Waterbirds

As their name suggests, colonial waterbirds nest in dense assemblages. Herons, egrets, ibises, gulls, terns, skimmers, cormorants, and pelicans are types of waterbirds that exist in Virginia. They are considered good indicators of ecosystem health due to their position in the aquatic food web. Colonial nesting behavior has advantages for the species, however, it results in fewer total breeding areas which can compound the effects of habitat degradation or loss. Threats to survival include human disturbance, predation, habitat loss, and contaminant. Due to such factors

(primarily habitat loss in the barrier island/lagoon system), colonial waterbird abundance in coastal Virginia declined by more than 16 percent between 1993 and 2003 (Watts 2004).

In the 2003 study conducted by Watts, surveys in multiple coastal Virginia locations revealed nearly 80,000 breeding pairs of 24 different colonial waterbird species. The majority of the breeding pairs was gull species, and found within eastern shore habitat areas. While the study area for this EA does not fall within this seaside region, the 2003 study also included surveys within the western shore of Virginia, ranging down the coast from the mouth of the Potomac River south to the James River. Seven species were found during the 2003 study in the western region, with the Great Blue Heron as the dominant species at 7,112 breeding pairs. Other species include the great egret, snowy egret, green heron, yellow-crowned night heron, herring gull, and double-crested cormorant. None of these species are federally listed as threatened or endangered (Roble 2010), though the great egret is a state species of special concern.

Migratory Birds

Migratory birds that may occur within the study area and are listed as state species of concern include the brown creeper (*Certhia Americana*), Caspian tern (*Sterna caspia*), and Forster's tern (*Sterna forsteri*). The brown creeper is a common to uncommon transient and winter resident, breeding at higher elevations in mountains and valleys. As the name suggests, it is closely associated with nesting and foraging in trees, gathering insects and mast as food sources. Therefore would be found only within upland forested areas of the study area as a transient.

Habitat for the Caspian tern is likely restricted to feeding areas over open water, as sandy or pebbly beaches suitable for nesting habitat are not common and where present are not of a size sufficient to support their colonial tendencies. The Caspian tern breeds in July or July but is typically observed in the area in fall and winter.

The Forster's tern breeds in marshy areas along the Eastern Shore of Virginia in May and June. While the study area does not represent especially suitable nesting habitat, the Forster's tern is a common transient and summer resident of the Chesapeake Bay. It flocks westerly up tidal rivers from July through October.

Other Species of Concern

The Virginia Department of Conservation and Recreation's Division of Natural Heritage (VDNH) searches the Biological and Conservation Data System (BCD) for occurrences of natural heritage resources within the project area. According to the information in their files, the project area has not been surveyed by VDNH staff. However, VDNH staff note that the slopes to the west of the Coleman Bridge are known to support a Coastal Plain calcareous forest with southern sugar maple (*Acer barbatum*), which is a globally rare community type (Fleming et al. 2010). In addition, the Yorktown onion, a non-native species of historical importance, may grow within the project area. The Yorktown Onion is protected by law, as Section 17-35, Subsection B, of the York County Code states that "Gathering or collecting the Yorktown Onion shall be prohibited." Neither of these plants have been observed within the study area.

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a state species of concern and was proposed for listing as federally endangered by NOAA in October, 2010. It is protected from harvest due to historic overfishing of native populations throughout the Atlantic coast (Chesapeake Bay Program 2004; Hewitt, Ellis, and Fabrizio 2009). Principal threats to the Atlantic sturgeon include dredging and associated loss of spawning habitat, water quality, and collisions with watercraft.

Though it was not identified through a search of the VDGIF database, the fish has been documented in the York River and the James River is currently the only known spawning river for the fish within the Chesapeake Bay area (NOAA 2010). Atlantic sturgeon are opportunistic benthic feeders, taking worms, crustaceans, aquatic insects, snails, and sand lances. It requires solid substrates upon which to lay its adhesive eggs. As the nearshore waters of study area are dominated by sandy materials, breeding habitat is relatively absent.

CULTURAL RESOURCES

REGULATORY FRAMEWORK

The NPS has entered into a PA with the Virginia SHPO, invited signatories (USACE, Catawba Indian Nation, and Virginia Council of Indians), and concurring parties (York County and Federal Highways Administration). For this project, the PA is the guiding instrument for compliance with the NHPA under Section 106. In accordance with the Advisory Council's regulations for implementing Section 106 of the NHPA (36 CFR Part 800 Protection of Historic Properties) and with the processual steps outlined in the PA, the cultural resources within the area of potential effect (APE) are being identified, evaluated, and impacts to listed or eligible historic properties avoided, minimized, or mitigated. Compliance with Section 106 was achieved with execution of the PA.

Concurrent with the Section 106 process, the CEQ regulations that implement NEPA also require assessment of impacts on cultural resources including Cultural Landscapes, Historic Structures, and Archeological Resources if these resources occur within the APE which in this case is the Affected Environment. In this EA, impacts on cultural resources also are described in terms of type, context, duration, and intensity, as defined above, which is consistent with CEQ regulations.

The following discussion is focused on Cultural Landscapes. This section is then followed by ones devoted to Historic Structures and Archeological Resources.

CULTURAL LANDSCAPES

The APE for the project was outlined in Table 1. Except for those project parts that would affect off-shore locations, all of the actions are confined to the existing parkway right-of-way which is the Affected Environment. The maximum landward extent of disturbance would occur in Reach III, Sub-Reach "c" where project impact could occur up to 150 ft inward from the top of the bluff. Otherwise, modifications Reaches I, II, and III ("a" and "b") would be restricted to

distances no greater than 20 ft from the south edge of the parkway pavement. In the case of Reach IV, all actions would be confined to the shoreline and bluff face.

The cultural landscapes associated with the Colonial National Historical Park include some of the most significant locations in our Nation's history. Here, on the York River peninsula, Revolutionary and Civil War battles and events heralded major changes to the social fabric of the nascent and, then, maturing country. Beginning in 1930, the parkway was envisioned as a route to take citizens to these places of importance in our history. The parkway itself was eventually determined to be worthy of inclusion onto the National Register of Historic Places (O'Donnell 1997). The parkway is the only one of the cultural landscapes in the vicinity under consideration in this EA. This is not to imply that other historic elements are not present; it simply means that the parkway landscape report subsumes cultural resources, like archeological sites from all periods of occupation, into the parkway landscape.

O'Donnell (1997) provides a detailed assessment of the parkway in her work entitled *Cultural Landscape Report for Colonial Parkway* (CLR). She provides a detailed history of the use of the parkway's eventual route, the development of the parkway design, its routing issues, and the elements which contribute to its function and character. In Chapter V of the work, O'Donnell (1997) focuses considerable attention on the character-defining features of the parkway and their current status. She groups these features into 11 categories: spatial organization/context, spatial character, topography, circulation, vegetation, shoreline, drainage features, structures, small scale features, cultural resources (including archeological sites), and parkway uses. Since 1958, the integrity of most of these features has been maintained; however, two of the categories have seen degradation of condition. These are spatial organization/context and shoreline.

The spatial organization/context feature as defined by O'Donnell (1997) is focused on the landscape thru which the parkway was routed. Since its inception, that landscape has been altered by the introduction of urban and suburban development. Alterations to the setting have been most pronounced in proximity to the various settlements and military facilities. O'Donnell (1997) noted that much of the development has occurred along the James River reach of the parkway. The section of the parkway adjacent to the York River has been less impacted by the development trend.

The shoreline feature, however, has been significantly altered and shoreline maintenance is the very focus of this EA. It was recognized from the onset that the prevailing tidal currents and periodic storm surges could affect the integrity of the parkway in particular along the York River shore. O'Donnell (1997) judged the integrity of the shoreline character in that year as at least moderate and the degradation has been ongoing since that date.

HISTORIC STRUCTURES

The APE for the project is outlined in Table 1 and for Historic Structures, is the same as for Cultural Landscapes (see above). The only historic structures known to be in direct or indirect impact areas are those associated with the parkway. O'Donnell (1997) provides a detailed assessment of the parkway in her work entitled *Cultural Landscape Report for Colonial Parkway*. As noted under *Cultural Landscapes* in Chapter 3, O'Donnell (1997) groups the

character-defining features of the parkway into 11 categories. Of these, structures (including bridges) and small scale features (including culverts) are noted. Also noted are cultural features including redoubts. Based on current design information, none of these structures or features would be affected by the project.

ARCHEOLOGICAL RESOURCES

Terrestrial archeological investigations within the study area were conducted by The William and Mary Center for Archaeological Research (WMCAR) in 2007-2008 and 2011. Their initial efforts were focused on the entire parkway corridor and this work was done between 2007 and 2008. The area of potential effect (APE) for this effort was, with minor adjustments, the Affected Environment for this EA. The results of 2007-2008 Phase I survey were reported in a document entitled *Archaeological Survey of the Colonial Parkway from Neck of Land to Yorktown Colonial National Historical Park, James City and York Counties and the City of Williamsburg, Virginia* (WMCAR 2009).

Modifications to and expansion of the Affected Environment APE were made between the initial WMCAR investigations in 2007-2008 and 2010. As defined in the 2011 scopes of work for terrestrial and off-shore investigations, the additional areas of investigation were:

- Terrestrial and Off-shore Reach I - from the point of land known as the Ringfield Picnic Area, at the mouth of Felgates Creek, downstream to the mouth of Indian Field Creek. The seaward extent is 200 ft from the current shoreline.

- Terrestrial and Off-shore Reach II - from the mouth of Indian Field Creek downstream to the northern end of the Naval Weapons Station Enclosure Piers. The seaward extent is 200 ft from the current shoreline.

- Terrestrial and Off-shore Reach III - from the southern end of the Naval Weapons Station Enclosure Piers to the mouth of Yorktown Creek. From the eastern pier to Ballard Creek, the seaward extent is 300 ft from the shoreline. East of Ballard Creek and along the York River Cliffs, the seaward extent is 200 ft from the current shoreline.

- Off-shore Reach IV- from Point of Rocks to the common boundary of the Park and the U.S Coast Guard Training Center in the vicinity of the Moore House. The seaward extent is 200 ft from the current shoreline.

The 2011 terrestrial work was conducted by WMCAR and the off-shore investigations were completed by Tidewater Atlantic Research, Inc., Washington, North Carolina. The results of all investigations completed to date are summarized below.

Terrestrial Archeological Investigations

The 2011 terrestrial project commenced on April 11, 2011, and the results of that investigation were reported in a draft report dated June, 2011. The review and report finalization will continue through summer and is currently scheduled to be completed in early fall, 2011.

The terrestrial archeological investigations completed to date have documented, either through literature review or field investigations, 14 archeological sites. The 2011 terrestrials tasks included Phase I survey of approximately 17 acres not subjected to survey during the 2007-2008 work, Phase II testing of five sites identified during the 2007-2008 effort, and Phase II level documentation consisting of historic map and aerial photograph analyses of a sixth site. The purpose of this latter work was to determine if the particular site location within the project APE is composed of hydraulic fill.

During the course of the investigations, 17 previously reported sites were identified and 52 other sites were newly recorded. While both prehistoric, Native American and historic, Colonial and Post-Colonial era sites were identified during the course of the investigations, Phase II investigations were eventually focused on prehistoric sites and dual component prehistoric / historic sites and their accurate boundary definition. The prehistoric components were all ascribed to the Middle and Late Woodland periods and most of the historic components dated to the 18th and 19th centuries though one plantation site had a 17th century component. To date, sites have been assessed in the Felgates Creek/Bellfield Straight Area, Bellfield Straight approach to Indian Field Creek, Indian Field Creek/Sandy Point, NWS West Pier, and York River Cliffs/Yorktown Victory Center and eligible properties are present in all of these stretches. None of the eligible sites, however, would be affected by the proposed actions and no further work is recommended at them unless the project specifications change.

Marine Archeological Investigations

Off-shore investigations were completed during May and June 2011 by Tidewater Atlantic Research (TAR). No prior off-shore investigations had been conducted in support of the project and the 2011 work was directed to completing Phase I-level investigations. This effort included a background and literature review; remote-sensing survey of off-shore areas; and diver reconnaissance survey in pre-designated off-shore areas. The marine scope of work also called for pedestrian survey of the reported location of a terrestrial site (44YO0152) that lies in the low-tide zone.

The various marine efforts resulted in the identification of 543 magnetic anomalies, 4 acoustic anomalies, and 1 semi-submerged terrestrial feature. Most of the magnetic anomalies were interpreted as small, ferrous objects and these were not subjected to additional investigation.

Of the remaining anomalies and anomaly clusters, 38 were determined to be modern debris including dock components, ferrous culverts, pipes, rebar, signposts, and tires. No object was ever found at one location despite probing of the location. The remaining magnetic anomalies had signatures similar to the ones investigated and they were not pursued further. The four acoustic anomalies were determined to represent a heavy equipment tire, an iron culvert, and pipes. No additional archeological investigation was recommended for any of these anomalies or acoustic targets.

During the course of the investigations, part of a marine railway was identified. The railway is thought to be associated with the U.S. Navy Mine Depot. Details of this feature have been passed

along to project designers and proposed shoreline treatment(s) in this area would avoid this feature.

VISITOR USE AND EXPERIENCE

NPS *Management Policies 2006* (NPS 2006) states that enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy parks. Over the past 10 years (2001-2010), visitation to Colonial NHP has been relatively consistent, averaging approximately 5.4 million people annually, and trending upward (NPS 2010b). Approximately 60 percent of these visitors traveled to the park for recreational purposes, primarily between the months of April and October.

Visitors to the park have access to a variety of resources through existing roadways and trails. The parkway, spanning from Jamestown Island to Yorktown, runs along and in close proximity to the York River in the study area. The parkway is open to noncommercial vehicles, including tour buses, and bicycles. The parkway provides access to several resources within the study area, including a number of scenic overlooks complete with interpretive signage, the Bellfield Plantation Site (Reach I), Indian Field Creek (between Reach I and Reach II), Officer's Quarter (Reach II), Bracken's Pond (Reach II), Stony Point (Reach III), and various resources within Yorktown (Reach IV). Park resources within Yorktown include the Battle Trenches, Yorktown Monument, Yorktown Victory Center, and the Yorktown Battlefield Visitor's Center. Access to and recreational use of the Ringfield Picnic Area, located north of the parkway within Reach I, was discontinued in about 1995 due to budgetary constraints and has remained closed since.

In addition to the parkway, Yorktown (Reach IV) can be accessed through a variety of local and state roads. As discussed in the *Alternative Transportation System Plan/EA/AoE* for the park, the Yorktown Unit of the park is directly adjacent to the surrounding community providing vehicular and pedestrian access and making it convenient for visitors to access the surrounding community. The parkway terminates at the Yorktown Visitor's Center, at which point it intersects with the local road system. Visitors may use this road system to travel along the perimeter of the unit and/or enter parts of the surrounding community. Tour roads also run through portions of the battlefield sites at the unit. Pedestrians and bicyclists may also use these roads or the paths that run through the unit. Park visitors may also appreciate the entire York River shoreline from the water by boat, with the exception of the NWS Yorktown (though no boat launching/landing is permitted from/onto park property).

The York River shoreline is a resource enjoyed by commuters and park visitors alike. Forming the eastern boundary of the park, the shoreline is valued both for its aesthetic value and for its recreational use. The NPS estimates that in 2009, approximately 3.3 million people visited the park for recreation purposes, using the parkway as the main conduit for access to park resources, notwithstanding the commuters who use the parkway on a regular basis. Motorists can stop at six pull-offs to enjoy views of the York River and to experience the history of the location. Roadside markers at these pull-offs provide the historic context for each stopping point. Three of these pull-offs provide access to beach areas and adjacent grassy areas where Felgates Creek (one pull-off) and Indian Field Creek (two pull-offs) join the York River. The parking capacity of the pull-

off at Felgates Creek is routinely exceeded on weekends and on weekdays during the summer months, resulting in overflow parking on grassy areas adjacent to the parkway.

Because the alignment of the parkway and its surrounding vegetation has not changed noticeably over the past 50 years, visitor experience remains similarly unchanged, and people continue seek the "natural" experience that the park affords. The park's GMP recognizes the appeal and the importance of the York River viewshed, noting that "One example of a view that should be preserved is the historic and natural view of the York River as seen from Colonial Parkway." (NPS 1993a). The visual integrity of the park shoreline is discussed in more detail within the Cultural Landscapes section of "Chapter 3: Affected Environment."

Although launching watercraft is not permitted from the parkway, people frequently fish from shore. Pull-offs offer safe parking and direct access. Additionally, because the Yorktown Formation has been exposed by wave action along portions of the shoreline, fossil shells and are intermingled with sandy sediments. It is common to see beachcombers collecting these fossils as well as modern shells on beaches throughout the study area. Sandier beaches provide sunbathing opportunities and picnic areas.

PUBLIC SAFETY

The parkway spans east to west from Jamestown Island to the Yorktown Settlement. The parkway provides access to Colonial NHP units and several resources within those units, as described in the Visitor Use and Experience section, above. Several scenic lookout points, or other points of interest, are demarcated along the routing, offering pull-offs for drivers and cyclists.

The parkway is a three lane road with graded grass shoulders. One lane each provides east-bound and west-bound travel along the parkway, while the third, central lane, serves as a passing lane. While the two travel lanes and central passing lane are unmarked, signage along the parkway adheres to the Manual on Uniform Traffic Control Devices (MUTCD) in accordance with 23 CFR Part 655, Subpart F. Bicyclists are permitted to use the parkway though no dedicated bicycle lanes are provided. Pedestrian access is restricted to areas around the pull-offs and to grassy areas and the shoreline in their vicinity. Commercial vehicles are prohibited from using the parkway, with the exception of tour buses, and access to the route is limited to relatively few locations over its entire 23-mile length.

Traffic along the parkway peaks during the summer months, concurrent to peak visitation. Based on 2010 traffic counts within the study area (between Yorktown and the Cheatham Annex/Virginia Route 199 interchange), westbound traffic is consistently higher than eastbound traffic. In 2010 westbound traffic was greatest in July (41,431 motor vehicles) and lightest in April (15,882 motor vehicles). Similarly, the eastbound lane experienced the heaviest traffic volume in July (29,604 motor vehicles) and the lightest volume in April (11,445 motor vehicle).

Level of Service (LOS) ratings, which range from LOS A (little to no delay, under capacity) to LOS F (extensive delays, over capacity), have been developed by the Transportation Research Board to quantify vehicular capacity and quality of vehicle flow. LOS is typically defined in

terms of average delay per vehicle for the peak 15-minute period that occurs within the morning and evening peak traffic demand hours. LOS D or better is generally considered acceptable. In 2002, the parkway was operating between LOS A and LOS B, which indicates very good conditions with minimal congestion (URS 2002).

Between 2001 and 2005, 93 passenger vehicle crashes occurred over the 6.32 miles of the parkway between the Naval Weapons Station entrance (closed) near Ballard Creek and the exit to Virginia Route 199 at Cheatham Annex (located roughly 2.4 miles west of the east end of the study area). These crashes included only road segment and intersection crashes and not parking lot crashes (CH2MHill 2011). This section of the parkway has a crash rate several times higher than any other segment along the route (135 crashes per 100 million vehicle miles traveled, or 100MVMT). The crash rates for this section and for the overall parkway are less than that for the seven parks in the Northeast Region that have crash data (267.3 crashes per 100MVMT) but greater than the rural two-lane crash rate for Virginia (86 crashes be 100MVMT). Based on data for the 16-year period between 1990 and 2005, the principal crash type in the study area is collision with an animal. The largely undeveloped U.S. Navy property, which adjoins the study area, contains a large population of deer and these animals are a common sight along the parkway. The second most common crash type in the study area is collision with a fixed object followed by rear-end collisions and sideswiping during overtaking. The 2011 Transportation Safety Management Plan noted that commuter traffic represents a significant component of overall parkway traffic and that commuters can be aggressive drivers that may exceed the posted speed limit and pass slower vehicles frequently (CH2MHill 2011). Between 1990 and 2005, there have been two collisions with a pedestrian or bicyclist within the 6.32-mile segment between the Naval Weapons Station and the Virginia Route 199 exit at Cheatham Annex.

Following Hurricane Isabel in 2003, the parkway was closed throughout the study area while downed trees were removed and eroded gullies along Bellfield Straight repaired. Access to the shoulder of the parkway at kilometers 3 and 5 has been temporarily restricted in the past during periods of time when shoreline repair was underway.

The public is permitted to access any portion of the study area by foot with the exception of gated areas delineating the Naval Weapons Station property and at the Ringfield Picnic Area. Foot travel within the study area occurs primarily in the vicinity of the pull-offs, particularly those at Felgates and Indian Field Creeks. Overflow parking on grassy areas adjacent to the parkway at these two locations presents a potential safety issue, as persons entering and exiting their vehicles may be positioned temporarily within the travel lane of the parkway.

A minimum of two Park Rangers patrol the parkway between 6:00 am and midnight, though dispatch operates on a 24-hour clock. There is concurrent jurisdiction over the parkway between Park Rangers, State Police, and County Police, any of whom can issue tickets for traffic violations and act as first responders. However, accident investigation and criminal activity are under the sole jurisdiction of the NPS. The NPS dispatcher is automatically informed of any 911 call for any emergency within the park and NPS and U.S. Navy dispatchers coordinate as necessary depending on the nature of the emergency and its location.

INFRASTRUCTURE AND PARK OPERATIONS

Park infrastructure within the study area includes the surface of the parkway and associated drainage features and safety features (e.g., guardrails, traffic control signage); bridges over Felgates and Indian Field Creeks; the overpass at the North Pier of the Naval Weapons Station, and roadside markers and pull-off areas. No operational comfort stations or potable water sources are provided within the study area.

The NPS is responsible for maintaining all infrastructure and grounds within the study limits. This includes the maintenance of shoreline treatment measures and the installation of new measures to prevent the loss of resources to shoreline recession. Examples of the latter activity include the installation of stone revetments at parkway markers kilometer 3 and kilometer 5 in 2007 in response to storm-induced erosion. Bridge maintenance is also an NPS responsibility. The Maintenance Division currently employs 26-full time personnel. Within the study area, routine maintenance consists primarily of mowing (roadside areas, open grassy areas, and areas around pull-offs) and refuse collection. Mowing is necessary for aesthetic and safety purposes (i.e., maintaining site distances for traffic, emergency access to roadside areas for fire trucks and other emergency vehicles). This mowing is performed frequently and to a point roughly 10 feet from the edge of pavement. Mowing in areas beyond this extent is typically performed twice a year, depending on moisture conditions. Mowing and/or brush cutting of the sideslopes along Bellfield Straight are performed on an as-needed basis so as to prevent large woody plants from forming and to allow easy visual observations of the slope condition. Woody plants are discouraged from colonizing the slopes as they may be uprooted by wave action during storms and thus remove a large portion of the soil column to which they are attached; and to maintain the viewshed of the York River and the cultural landscape along the corridor. Park staff also empty refuse bins at the pull-offs at Felgates and Indian Field Creeks and pick up random occurrences of rubbish along the parkway on a daily basis.

Non-routine procedures performed by the maintenance division include the removal of tree hazards (e.g., tree throws intersecting the travel lanes or damaged or old trees that present a potential hazard to park visitors); reparation of stormwater-induced erosion gullies along the flanks of Bellfield Straight; repair and maintenance of traffic safety signage; performing temporary partial or full road closures to address safety concerns; and the removal and disposal of animal carcasses.

Colonial NHP has 15 employees in the Protection Division who are responsible for patrolling the entire Park. Park rangers are responsible for the full range of protection duties, including law enforcement (patrol, criminal and accident investigations), emergency medical care, wildland fire suppression, and response to search and rescue incidents. Rangers must provide patrol and response coverage 24 hours per day. This coverage includes speed enforcement and response to incidents along the parkway.

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ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental consequences associated with the alternatives presented in "Chapter 2: Alternatives." It is organized by impact topic, which distills the issues and concerns into distinct subjects for discussion analysis. DO-12 requires consideration of context, intensity, and duration of adverse and beneficial impacts (direct, indirect, and cumulative) and measures to mitigate for impacts.

GENERAL METHODOLOGY FOR ASSESSING IMPACTS

The CEQ regulations that implement NEPA require assessment of impacts to the human environment, which includes natural and cultural resources. As required by NEPA, potential impacts are described in terms of type (beneficial or adverse), context (site-specific, local, or regional), duration, and level of intensity (negligible, minor, moderate, or major). Both indirect and direct impacts also are described; however, they may not be identified specifically as direct or indirect. These terms are defined below. Overall, these impact analyses and conclusions were based on the review of existing literature and studies, information provided by on-site experts and other government agencies, professional judgments, and park staff insight.

TYPE OF IMPACT

Impacts can be beneficial or adverse. Beneficial impacts would improve resource conditions, while adverse impacts would deplete or negatively alter resources.

Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Direct: An impact that is caused by an action and occurs at the same time and place.
Indirect: An impact that is caused by an action but is later in time or farther removed in distance, but still reasonably foreseeable.

CONTEXT

Context is the setting within which an impact occurs and can be site specific, local, parkwide, or regionwide. Site-specific impacts would occur at the location of the action, local impacts would occur within the general vicinity of the project area, parkwide impacts would affect a greater portion outside the project area yet within the park, and regionwide impacts would extend beyond park boundaries.

Site specific: The impact would occur within project site.
Local: The impact would occur within the general vicinity of the project area.
Parkwide: The impact would affect a greater portion outside the project area yet within the park.
Regional: The impact would affect localities, cities, or towns surrounding the park.

DURATION

Impacts can be either short-term or long-term. A short-term impact would be temporary in duration and would be associated with the construction process. Depending on the resource, impacts would last as long as construction was taking place, or up to one year after construction is completed. Long-term impacts last beyond the construction period, and the resources may need more than one year after construction to resume their preconstruction condition. Impact duration for each resource may differ and is presented for each resource topic, where applicable.

Short-term: Impacts that occur only during construction or last less than one year.
Long-term: Impacts that last longer than one year.

LEVEL OF INTENSITY

Impact intensity is the degree to which a resource would be adversely affected. Because the definitions for level of intensity (negligible, minor, moderate, major) vary by resource, separate definitions are provided for each impact topic analyzed.

CUMULATIVE IMPACT METHODOLOGY

Cumulative impacts are defined as impacts which result when the impact of the proposed action is added to the impacts of past, other present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions (40 CFR 1508.7).

Cumulative Impact Scenario

To determine the potential cumulative impacts, existing and anticipated future projects in the vicinity of the study area were identified. These included lands owned and administered by the NPS, the U.S. Navy (USN), the U.S. Coast Guard (USCG), and York County, Virginia. Potential projects identified as cumulative actions include planning or development activity that has been completed in the recent past, is currently being implemented, or is expected to be implemented in

the reasonably foreseeable future. The projects identified as contributing to cumulative impacts on the resources addressed by this EA include the installation of shoreline defense structures at USCG Training Station Yorktown, recreational and shoreline improvements at Yorktown Waterfront, emergency reparations at parkway stations kilometer 3 and kilometer 5, and potential future shoreline defensive structures at Cheatham Annex.

Cumulative Impact Contribution Methodology

In defining the contribution of each alternative to cumulative impacts, the following terminology is used:

Imperceptible: The incremental effect contributed by the alternative to the overall cumulative impact is such a small increment that it is impossible or extremely difficult to discern.

Noticeable: The incremental effect contributed by the alternative, while evident and observable, is still relatively small in proportion to the overall cumulative impact.

Appreciable: The incremental effect contributed by the alternative constitutes a large portion of the overall cumulative impact.

COASTAL RESOURCES AND SOILS

METHODOLOGY

The analysis of coastal resources and soils within the study area is based on a review of existing data for the project area and shorelines in similar geomorphic settings and recent scientific literature. This analysis also included water quality conditions. In order to determine the level of impact intensity, the following definitions for negligible, minor, and major were used:

Negligible: An action that would have a very small impact on the shoreline. The consequences of such action would have no measurable impact on the shoreline. Impacts (chemical, physical, biological) would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality conditions.

Minor: An action that would have a small but measurable impact on the shoreline. The results would require scientific effort to measure and would include subtle changes in shoreline profile, nearshore slope, and vegetation along the shore. It would be difficult to determine whether such changes were a result of natural forces or the effects of the action alternative. Minor impacts also include those that are short-term in nature. Impacts (chemical, physical, biological) would be detectable, but would be well below water quality standards or criteria and within historical or desired water quality conditions.

Moderate: An action would have a noticeable impact on the shoreline. Such effects could be permanent, could be the result of the action alternative, and could require mitigation and/or shoreline stabilization to minimize. Loss of land area and shoreline habitat or wetland area at the land/water interface could result. Impacts (chemical, physical, biological) would be detectable, but would be at or below water quality standards or criteria and within historical or desired water quality conditions.

Major: An action would have significant impact on the shoreline. Such effects would be permanent, would clearly be the result of the action alternative, would occur quickly, and could require mitigation and/or shoreline stabilization to minimize. Loss of land area and shoreline habitat or wetland area at the land/water interface would result. Impacts (chemical, physical, biological) would be detectable, and would be frequently altered from the historical baseline or desired water quality conditions, and/or chemical, physical, or biological water quality standards or criteria would be slightly and singularly exceeded on a long-term basis.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under the No-action Alternative, no shoreline treatments would be installed beyond those that might be required on an emergency basis to prevent an imminent threat to park infrastructure and/or public safety. The shoreline and the highly erodible soils of the upland areas of the study area would remain susceptible to wave attack during storm events. Landward migration of the shoreline and loss of land area would continue to occur in multiple locations within the study area. Areas most susceptible to erosion include Reach IA, which has a particularly long east fetch, and Bellfield Straight in Reach I where toe of slope erosion is occurring where the revetment has detached from the riverbank and where localized riverbank slumping and gullies exist. The parkway is located in close proximity to the shoreline at Bellfield Straight. Loss of land area would also continue to occur at Reach III which is currently characterized by sections of near vertical riverbank. Reach IV, located closest to the mouth of York Creek, is most exposed to wave attack.

In portions of the study area where the slope of the land/sea interface is less pronounced and broad low-lying areas are present (e.g., Poley Point, Sandy Point), the combined effect of coastal storm surges and sea level rise may result in the loss of shoreline habitat and tidal wetlands (potential impacts to wetlands are discussed separately in the following section). The ongoing decay of Penniman Spit would likely make such habitat at Reach IA more susceptible to wave attack.

Shoreline erosion and the loss of land area, shoreline habitat and wetlands would continue to occur under the No-action Alternative. These losses would be a result of natural processes that are protected by NPS *Management Policies* (NPS 2006). Accordingly, they do not necessarily represent an adverse impact on coastal resources and soils. As described in “Chapter 2: Alternatives,” interference with these processes is generally prohibited with the exception of

certain circumstances, such as to address a threat to resources identified in the park's enabling legislation (e.g., the parkway). Under the No-action Alternative, ad hoc reparations such as those carried out at kilometer 3 and kilometer 5 would continue. The cumulative effect of these iterative actions could result in a patchwork of non-complementary shoreline treatments that would potentially impact the hydrology of the nearshore zone and exacerbate shoreline erosion in adjacent areas. Therefore, Alternative 1 would result in a minor to moderate, long-term adverse impact on coastal resources and soils.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on coastal resources and soils in and around the study area. These projects include the installation of shoreline defense structures at USCG Training Station Yorktown, recreational and shoreline improvements at Yorktown Waterfront, emergency reparations at parkway stations kilometer 3 and kilometer 5, and potential future shoreline defensive structures at Cheatham Annex. All of these projects involve the installation of shoreline treatments designed to reduce the risk of erosion of upland resources caused by landward migration of the shoreline. However, because these actions often involve the armoring of the shoreline using defensive approaches such as revetments, they can deprive downstream areas of sources of sediment that are necessary to sustain features such as tidal marsh fringes and spits. Lack of sediment accretion can lead to the decay and erosion of such features, which subsequently leaves landward resources more vulnerable to wave attack.

Shoreline treatment is yet to occur at Cheatham Annex (directly upstream of the study area). Should the approaches that are eventually selected include the implementation of offensive, living shoreline approaches such as rock sills with vegetated back beaches or headland control approaches such as shore-attached breakwaters, this might allow for a continuation of sediment transport through to downstream areas, including the study area.

As a whole, these cumulative actions aim to reduce the exposure of erodible soils and land area along the shoreline and thus would result in a long-term, beneficial impact on coastal resources and soils. This impact, when combined with Alternative 1, would have long-term, beneficial cumulative impacts on coastal resources and soils. Alternative 1 would contribute a noticeable adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

To reduce the risk of shoreline erosion on the parkway and cultural and archeological resources, Alternative 2 would implement a variety of shoreline treatment approaches that are best suited to the local setting, including revetment rehabilitation, rock sills and marsh plantings, gaps sills and pocket beaches, and shore-attached breakwaters. Resulting impacts to land area would be minimal and would include minor cut back into the riverbank in areas where revetment rehabilitation is proposed. The riverbank along Bellfield Straight was engineered previously as a

seawall shortly after the construction of the parkway. Therefore, the soil column at this location has likely been previously disturbed to an appreciable degree.

Potential impacts to water quality in shoreline habitats within and downstream of the study area posed by land disturbance remobilized nearshore sediments during construction would be minimized via the use of Type II turbidity curtains during construction. By implementing shoreline stabilization and protection approaches in a comprehensive manner, Alternative 2 also would diminish the risk of impacts to shoreline habitats posed by riverbank slumping and the translocation of sediments and/or artificial materials (i.e., infrastructure) into sensitive natural environments. Gully formation along the top of the riverbank at Bellfield Straight would be addressed to halt landward migration towards the parkway surface.

In areas of revetment rehabilitation, the means of construction access would double as the foundation for the augmented structure, thus limiting the degree of encroachment both landward and seaward. In areas where rock and gap sill are proposed, the area used for construction access would be regraded as the equipment withdraws from the area and it would be revegetated subsequently with native saltmarsh and/or saltmeadow cordgrass. Shoreline habitat in these areas would thus be improved through post-construction wetland restoration and enhancement. Therefore, impacts on shoreline habitat would be temporary and construction related. Equipment staging in upland areas would be limited to grassy areas at Poley Point and Sandy Point and perhaps at the Yorktown Visitor Center. Mitigation measures would be undertaken to prevent soil disturbance and compaction, including the use of mats and low ground pressure vehicles (if available) to distribute loading evenly.

Alternative 2 would result in a comprehensive rehabilitation of existing structures within the study area and the targeted installation of offensive approaches to shoreline protection and habitat enhancement such as continuous and gapped rock sills and revegetated tidal marshes. Alternative 2 would be designed to substantially reduce the risk of erosion to upland soils and park infrastructure and resources for a storm with the equivalent storm surge elevation of Hurricane Isabel.

Offensive shoreline treatment approaches such as sills and breakwaters can trap sediment eroded from upstream locations and from the backshore areas. This may interrupt natural sediment transport and deprive downstream areas of sediment that would otherwise help sustain natural shoreline features. With respect to the elements proposed for Alternative 2, this result is unlikely because:

- as discussed in “Chapter 3: Affected Environment,” the provenance of sediment in transport in the York River is overwhelmingly from upstream tributaries feeding the York River and from the Chesapeake Bay, with relatively little contribution from shoreline erosion
- the study area is already significantly armored, meaning that it currently contributes very little sediment to downstream areas
- as discussed in “Chapter 2 Alternatives,” living shoreline approaches such as sills and shore-attached breakwaters would be backfilled with sediment to establish an equilibrium plan form such that sediment bypassing would be encouraged

- the York River shoreline downstream of the study area has been significantly altered to defend against erosion, meaning that few natural features remain that depend on sediment from upstream areas to be sustained

Sills and breakwaters can potentially result in localized riverbed scouring in response to changes in the local hydrodynamic regime. However, such impacts this can be minimized by careful design and accounting for the local wave climate and existing bathymetric conditions. Accordingly, when considering the negligible to relatively minor adverse impacts of the potential disruption of sediment transport and localized channel scouring against the benefits afforded by the shoreline treatment approaches, Alternative 2 would result in a long-term, beneficial impact on coastal resources and soils.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable future actions would result in a long-term, beneficial impact on coastal resources and soils. Alternative 2 would result in a thorough repair and stabilization of the shoreline within the project area, reducing the risk to highly erodible soils and the parkway posed by shoreline migration and also providing opportunities for the enhancement of shoreline habitat. The cumulative impact of past, present, and reasonably foreseeable future actions, when combined with Alternative 2, would have long-term, beneficial cumulative impacts on coastal resources and soils. Alternative 2 would contribute a noticeable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

Like Alternative 2, Alternative 3 would result in the comprehensive repair and stabilization of the shoreline within the project area. In general, impacts would be similar with a few exceptions. The use of steel sheet piling may require riverbank cut back to a greater degree than that of Alternative 2. This is because the presence of boulder material at the toe of the slope or possibly incorporated some distance into the slope during seawall construction at Bellfield Straight (Reach I, Sub-Reach “b”) may preclude driving the piling any distance into the substrate. Geotechnical investigations would be required to determine if additional cut back is necessary and where. In addition, whereas Alternative 2 proposes the use of headland control at two locations (NPS Breakwaters at Reach II, Sub-Reach “f” and Reach III, Sub-Reach “a”), Alternative 3 proposes the installation of new revetments at these two locations. This may require cut back to properly key these structures into the riverbank, thus resulting in greater upland land area impact relative to Alternative 2.

Though Alternative 3 may result in greater land area disturbance than would Alternative 2, it would nevertheless be designed to substantially reduce the risk of erosion to upland soils and park infrastructure and resources for a storm with the equivalent storm surge elevation of Hurricane Isabel. Beneficial impacts offset these relatively minor and proactive land disturbances. Accordingly, Alternative 3 would result in a long-term, beneficial impact on coastal resources and soils.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable future actions would result in a long-term, beneficial impact on coastal resources and soils. Like Alternative 2, Alternative 3 would address in comprehensive fashion the risks posed by landward migration of the shoreline, reducing the risk to highly erodible soils and the parkway posed by shoreline migration and also providing opportunities for the enhancement of shoreline habitat. The cumulative impact of past, present, and reasonably foreseeable future actions, when combined with Alternative 3, would have long-term, beneficial cumulative impacts on coastal resources and soils. Alternative 3 would contribute a noticeable beneficial increment to this cumulative impact.

CONCLUSION

Alternative 1: No-action

Alternative 1 would result in a minor to moderate, long-term adverse impact on coastal resources and soils. This is because no shoreline treatments would be installed beyond those that might be required on an emergency basis to prevent an imminent threat to park infrastructure and/or public safety. Natural processes, including shoreline erosion and nearshore sediment transport would continue unimpeded with the exception of storm-induced erosion and the resulting loss of land area poses an imminent threat to or directly damages the parkway. Loss of shoreline habitat and wetlands would continue to occur as sea level rises and coastal storm surges erode the riverbank and nearshore areas. Alternative 1 would contribute a noticeable adverse increment to long-term, beneficial cumulative impacts on coastal resources and soils.

Alternative 2: NPS Preferred Alternative

Alternative 2 would result in a long-term, beneficial impact on coastal resources and soils by implementing a variety of shoreline treatment approaches designed to address the risk of shoreline erosion throughout the study area. Resulting impacts to land area and would be minimal and would include minor cut back into the riverbank in areas where revetment rehabilitation is proposed. Such impacts would be offset by the beneficial impacts of the project. The potential for disruption of natural shoreline processes such as littoral drift would be minimal and mitigated by the purposeful post-construction nourishment and planting of sandy areas between the living shoreline treatments and the existing riverbank. Alternative 2 would contribute a noticeable beneficial increment to long-term, beneficial cumulative impacts on coastal resources and soils.

Alternative 3

Alternative 3 would result in a long-term, beneficial impact on coastal resources and soils by implementing a variety of shoreline treatment approaches designed to address shoreline erosion throughout the study area. Resulting impacts to land area and would be minimal and would include minor cut back into the riverbank in areas where revetment rehabilitation and new revetments are proposed. Such impacts, though somewhat higher than for Alternative 2, would be offset by the beneficial impacts of the project. The potential for disruption of natural shoreline

processes such as littoral drift would be minimal and mitigated by the purposeful post-construction nourishment and planting of sandy areas between the living shoreline treatments and the existing riverbank. Alternative 3 would contribute a noticeable beneficial increment to long-term, beneficial cumulative impacts on coastal resources and soils.

WETLAND RESOURCES

METHODOLOGY

The NPS has adopted a goal of 'no net loss' of wetlands, and has also set goals for a long-term net gain of wetlands service wide (NPS 2002). The impact analysis and conclusions for possible impacts to wetlands are based on a detailed delineation of all wetlands within the study area, a review of existing literature and studies, and park staff insights and professional judgment. The mapped locations of wetlands were compared with locations of proposed shoreline improvements, temporary haul roads, and barge ports. Predictions about short-and long-term site impacts were based on previous studies of impacts to wetlands from similar projects within the Chesapeake Bay. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: No measurable or perceptible changes in wetland size, integrity, or continuity would occur.

Minor: Any impact would be measurable or perceptible, but slight. A small change in size, integrity, or continuity could occur due to short-term indirect effects such as construction-related runoff. However, the overall viability of the resource would not be affected.

Moderate: Any impact would be sufficient to cause a measurable change in the size, integrity, or continuity of the wetland or would result in a small, but permanent, loss or gain in wetland acreage.

Major: The action would result in a measurable change in all three parameters (size, integrity, and continuity), or a permanent loss of large wetland areas. The impact would be substantial and highly noticeable.

According to NPS DO 77-1: Wetland Protection, an SOF is required when the preferred alternative would have adverse impacts on wetlands. Due to the proposed phased approach to performing shoreline improvements, SOF's would be prepared on a phase-by-phase basis as preliminary design plans are advanced to construction-ready documents. This allows for potential wetland impacts to be assessed and compensated for, as necessary, based on more informed plans.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under the No-action Alternative, tidal wetlands within the study area would continue to be subject to the combined effect of coastal storm surges and sea level rise; likely resulting in erosion of their substrate and subsequent loss of plant cover. Because the degree of shoreline armoring continues to expand along the York River and including areas upstream of the study area, the sediment supply that is necessary to sustain these tidal wetlands is becoming less plentiful. Moreover, the ongoing decay of Penniman Spit (also in part due to diminishing sediment supply) would likely make wetland areas along Reach IA (Wetland A) more susceptible to wave attack. With decreasing amounts of available sediment, wetland systems would likely be less apt to recover to their pre-storm extent after their loss to coastal erosion.

Under Alternative 1, the loss of upland habitat or infrastructure to shoreline erosion and landward migration could also result in influxes of sediment from slope failures or man-made materials (e.g., road bed, asphalt) into sensitive wetland areas. Reparations would be carried out on an as-needed basis in response to imminent threats or emergencies. As such, flexibility in the design approach with respect to wetland avoidance and minimization may be limited by the constraints posed by the degraded site conditions and scope of the reparations.

Because of the potential loss of wetlands from disturbance and/or loss by erosion, Alternative 1 would result in a moderate, long-term adverse impact on wetland resources. However, as this loss would be as a result of natural processes, mitigation would not be required in most cases. Wetland impacts resulting from negligence with respect to the management or protection of upland resources or infrastructure may require mitigation.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on wetlands in and around the study area. These projects include the installation of shoreline defense structures at USCG Training Station Yorktown, recreational and shoreline improvements at Yorktown Waterfront, emergency reparations at parkway stations kilometer 3 and kilometer 5, and potential future shoreline defensive structures at Cheatham Annex. All of these projects involve the installation of shoreline treatments designed to reduce the risk to upland resources posed by landward migration of the shoreline. However, because these actions often involve the armoring of the shoreline using defensive approaches such as revetments, they can deprive downstream areas of sources of sediment that are necessary to sustain features such as tidal marsh fringes and spits. Lack of sediment accretion can lead to the decay and erosion of such features, which subsequently leaves landward resources more vulnerable to wave attack.

As a whole, these cumulative actions aim to reduce the risk to erodible soils and land area along the shoreline. Recent shoreline treatments at the USCG Training Station Yorktown, completed in 2006, consist primarily of a bulkhead and new riprap toe protection and new stone revetment. A beach area was also renovated at the mouth of Wormley Creek, behind existing rubble mound breakwaters. Sprigs of vegetation were also installed in the graded beach face as erosion control.

Improvements at the Yorktown Waterfront include the installation of shore-attached, rubble mound breakwaters behind which a recreational beach has been created. This project involved impacts to non-vegetated wetlands and sub-aqueous lands. However, the placement of sand and reestablishment of an intertidal beach with some vegetated tidal wetland areas increased the diversity of the site as compared to pre-existing conditions. Emergency reparations at kilometer 3 and kilometer 5 resulted in minor impacts to an unvegetated estuarine wetland and a forested palustrine wetland. Shoreline treatment is yet to occur at Cheatham Annex (directly upstream of the study area). Should the approaches that are eventually selected include the implementation of offensive, living shoreline approaches such as rock sills with vegetated back beaches or headland control approaches such as shore-attached breakwaters, this might allow for a continuation of sediment transport through to downstream areas, including the study area.

Because the past, present, and reasonably foreseeable shoreline stabilization projects included in this analysis can or could involve both wetland impacts and wetland restoration or enhancement, the cumulative impact to wetlands is difficult to ascertain. With little known regarding the status or proposed approaches to shoreline treatment at Cheatham Annex (which would potentially have the most impact on the study area due to its upstream location), these cumulative actions may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wetland resources. This impact, when combined with Alternative 1, would have long-term, moderate adverse impacts on wetland resources because of the relative size of the study area and the number of wetland systems at risk. Alternative 1 would contribute a noticeable adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

Potential impacts to three of the five representative wetland areas previously discussed in the Wetland Resources section of “Chapter 3: Affected Environment” are discussed below in the context of Alternative 2. These include Area A (Ringfield Picnic Area, Reach IA), Area B (Felgates Creek, Reach I), and Area E (Sandy Point, Reach II). No shoreline treatments are proposed at the two remaining wetland Areas F (Navy Pier North, Reach II) and J (Ballard Creek, Reach III), where conditions are stable due to a local setting that is characterized by sediment accretion. Potential impacts to four other minor wetland bodies are also discussed.

The impact assessment for the Alternative 2 is based on superimposing the 30 percent design plan (which includes structures and planting zones) atop the delineated vegetated wetlands and the unvegetated intertidal wetland areas. Permanent impacts are considered to occur where proposed structures intersect these mapped vegetated wetlands and where proposed fill/planting zones overlay unvegetated wetland areas (i.e., impact associated with a conversion of wetland type). Areas where proposed structures and/or sandy fill and post-construction planting are proposed in subtidal areas and where the finished elevation of these components would be within the intertidal range were considered to represent areas suitable for use as compensatory mitigation.

The following sections discuss potential impacts to vegetated wetlands by wetland area, followed by a discussion of potential impacts to unvegetated wetlands. Impacts to vegetated and unvegetated wetlands are summarized in tabular format at the end of this section. It should be noted that the determination of both permanent and temporary impacts to vegetated wetlands as described above is conservative and could likely be diminished via design refinements and in-field avoidance at the time of construction.

Wetland Area A (Ringfield Picnic Area, Reach IA)

Wetland A contains a mosaic of three intertidal estuarine wetlands (Figure 17): emergent; scrub-shrub; and forested, each of which is irregularly flooded (i.e., less often than daily). The proposed shoreline treatment along Reach IA consists of two sections of rock sill with a pocket beach created between them at the location of an existing beach (Figure 7). Smaller pocket beaches would be installed at the southern end of the Reach near the parkway bridge over Felgates Creek. The proposed shoreline treatment at Wetland A acknowledges the presence of the wetland system by focusing the treatment seaward of it and represents an opportunity to protect and enhance this feature by accounting for sea-level rise in the treatment design.

The installation of the rock sills would be accomplished from the landward side of the proposed structure location. This would require the placement of clean fill sand to create a haul road. The precise location of the sill and therefore the haul road is subject to detailed design work. Based on the bathymetric conditions along Reach IA and the likely depth at which the base of the proposed sills would be installed (approximately -1.0 ft MLW), any impact on vegetated wetland areas for the construction the haul road and subsequent placement of the sandy planting substrate would be minimal. A cursory estimate of wetland impact based on the conceptual cross-section provided in Figure 10 suggests that roughly 1,750 ft^2 of emergent estuarine wetland may be temporarily impacted. Roughly 23,000 ft^2 of wetland would be created on the sandy backside of the sill via the installation of native cordgrass as plugs, effectively creating wetlands similar to the impacted features at a slightly higher elevation. This approach would protect and enhance wetland areas landward of the sill and diminish the effects of wave attack on the already vulnerable riverbank.

At the southern end of Reach IA, constructing the sill at the -1.0 ft MLW contour may not be possible as structures would be located within the channel at the mouth of Felgates Creek and may present an obstruction to creek flow or be more susceptible to erosive scour cause by tidal or storm surge flushing through the narrow passage at the bridge crossing. Therefore, the sills would likely be located closer to the shoreline and therefore the construction of the haul road may impact wetland features.

Wetland Area B (Felgates Creek/Poley Point, Reach I)

Wetland B consists of three intertidal estuarine wetland types (Figure 17). The most seaward component is a series of emergent and regularly flooded (i.e., daily) wetland patches. Landward of this strand, alternating bands of scrub-shrub and emergent, irregularly flooded wetlands occur, with the core of Wetland B being a tidal marsh. The proposed shoreline treatment at Wetland B is a gap rock sill, which would be installed seaward of the wetland line (Figure 7). Because the nearshore area here is very shallow (the location of the -1.0-ft MLW contour ranges from 10 ft to

160 ft offshore), the exact location of the sills would be subject to detailed design work. Nevertheless, like Reach IA at Wetland Area A, the proposed shoreline treatment at Wetland B acknowledges the presence of the wetland system and the opportunity to protect and enhance this feature. Construction access would be afforded in the same fashion as for Reach IA; seaward of the existing wetland boundary to the greatest extent possible. A cursory estimate of wetland impact suggests that roughly 6,200 ft^2 of emergent estuarine wetland may be temporarily impacted in Sub-Reach "a."

Though the rehabilitation of the revetment at the far western end of Sub-Reach "b" would be done in place (more akin to rock sill rehabilitation), construction access on the landward side of the revetment would result in temporary impacts to roughly 100 ft^2 of emergent estuarine wetland and structure placement would result in roughly 290 ft^2 of permanent impact to emergent estuarine wetlands and roughly 2,000 ft^2 of permanent impacts to estuarine scrub-shrub wetlands. Areas with post-construction restoration potential would receive plantings of native cordgrass and woody vegetation (as necessary), potentially diminishing permanent impacts.

Wetland Area E (Sandy Point, Reach II)

Wetland E contains a variety of intertidal estuarine wetlands, including emergent, scrub-shrub, and forested wetlands (Figure 17 and 18). The dominant feature is an irregularly flooded scrub-shrub wetland. Wetland E is discontinuous, broken by three sandy beaches that have formed downstream of seaward-pointing spurs in existing revetments and at the location of the NPS Breakwaters.

Under Alternative 2, a number of proposed shoreline treatments are proposed including revetment rehabilitation; rock spur, rock sill, and gap rock sill installation; rock sill rehabilitation; and breakwater rehabilitation (Figure 7 and 8). As discussed for Wetland Areas A and B, proposed shoreline treatments at Wetland E acknowledge the presence of the wetland system and the opportunity to protect and enhance this feature, taking into account the complexity of the shoreline at this location and the wave climate. Construction access would be afforded in the same fashion as for Reaches IA and I; seaward of the existing wetland boundary to the greatest extent possible. The nearshore at Sandy Point is very shallow. At Sub-Reaches "b´," "b," "c," and the upstream half of "d´," the -1.0-ft contour ranges from approximately 40 ft to 120 ft offshore. This allows greater for flexibility in the siting of the haul road seaward of vegetated wetlands.

Wetland E spans Reach II from Sub-Reach "b'" through Sub-Reach "f." Over this distance, temporary impacts to vegetated wetlands associated with the construction of the haul road and the feathering of sandy fill into existing wetland areas would amount to roughly 28,300 ft^2 of estuarine emergent wetlands and roughly 8,000 ft^2 of estuarine scrub-shrub wetlands. Permanent impacts associated with structure placement would amount to roughly 8,900 ft^2 of estuarine emergent wetlands and roughly 1,450 ft^2 of estuarine scrub-shrub wetlands. The development of a rock sill at what is currently a revetment at Sub-Reach "ab" would result in a minimum of 14,000 ft^2 of created estuarine emergent wetlands, offsetting permanent impacts to wetlands.

Other Wetland Areas (Wetlands H, J, P and Q)

Wetland H is located immediately downstream of the east pier at NWS Yorktown in Reach III and includes palustrine forested and scrub-shrub wetlands (Figure 18). These features are located behind the beach. The implementation of a new breakwater system at this location would not impact these wetlands. Wetland J is located at the mouth of Ballard Creek in Reach III (Figure 18). No shoreline treatment is proposed for this relatively stable area where sediment is accreting downstream of the creek mouth. Wetlands P and Q are relatively small palustrine located in Reach IV due north of the Moore House (Figure 19). Rehabilitation of the existing revetment at these wetlands may result in a minor degree of impact to their seaward fringe.

Unvegetated Wetlands

Each of the shoreline treatments proposed for Alternative 2 would involve some degree of encroachment on unvegetated intertidal wetlands for the rehabilitation of existing shoreline structures, the development of new shoreline structures, and the placement of sandy fill behind living shoreline approaches to establish a suitable substrate for cordgrass plantings. These living shoreline approaches represent the most seaward expansion of intertidal and subtidal fill.

While unvegetated wetlands have ecological value, the additional benefits of a fringe marsh have in large part been accepted by the regulatory agencies overseeing such work along the York River shoreline. The rationale for this is that impacts to unvegetated, subaqueous areas for living shoreline approaches are a better alternative than hardening the shoreline with revetments because of the marsh habitat created (Hardaway and Duhring 2010). Nevertheless, NPS policy as outlined in *Procedural Manual #77-1* (NPS 2012) recognizes that the conversion of unvegetated wetlands to vegetated wetlands is considered an impact.

Based on an assessment of the 30 percent design plans for Reaches I through IV and the conceptual approach for shoreline treatment at Reach IA, it has been determined that roughly 246,136 ft^2 of unvegetated intertidal wetlands would be impacted by the rehabilitation of structures, installation of new structures, and placement of sandy fill. This encroachment would be offset by roughly 247,467 ft^2 of created intertidal wetlands and intertidal structures and habitat in areas that are currently subtidal (e.g., stone breakwaters and their vegetated tombolo), resulting in a surplus of 1,331 ft^2.

It is worth noting that the greatest degree of unvegetated impact would result from revetment rehabilitation. This is because it is by far the dominant shoreline treatment approach in the study area. The seaward extent of this impact is relatively minor; it is the appreciable linear footage of the treatment approach that results in the relatively large area of impact. Regulatory agencies may require mitigation for these impacts. However, because of the net gain in intertidal wetland area described above and given the fact that impacts would be primarily the result of structure rehabilitation as opposed to the creation of a new revetment, regulatory agencies may not require mitigation.

Summary of Impacts to Vegetated and Unvegetated Wetlands

Table 9 presents a summary of the vegetated and unvegetated wetland impacts associated with Alternative 2. Permanent impacts to vegetated wetlands would total 12,582 ft^2 but would be offset by roughly 14,000 ft^2 of created wetland at Reach II, Sub-Reach "ab," resulting in a slight gain in vegetated wetland areas. Similarly, impacts to unvegetated intertidal wetlands (246,136 ft^2) would be offset by the development of roughly 247,467 ft^2 of intertidal wetlands and structures created in subtidal areas. Again, it should be noted that the determination of impacts to scrub-shrub wetlands is conservative and could likely be diminished via design refinements and in-field avoidance.

Table 9: Summary of Vegetated and Unvegetated Impacts for Alternative 2

Wetland Type	Permanent Impact (ft^2)	Temporary Impact[1] (ft^2)	Created Wetland Area (ft^2)	Potential Compensation[2] (ft^2)
estuarine emergent (E2EM)	9,153	36,291	14,000	4,847
estuarine scrub-shrub (E2SS)	3,429	7,961	0	-3,429
estuarine forested (E2FO)	0	0	0	0
palustrine forested (PFO)	0	0	0	0
unvegetated intertidal (E2)[3]	246,136	0	247,467	1,331
TOTAL	268,718	44,252	261,467	2,749

[1]: to be restored via post-construction planting

[2]: area of created wetlands minus permanent wetland impact

[3]: includes rocky shore, unconsolidated shore (US), and unconsolidated bottom (UB)

Overall, because Alternative 2 would employ living shoreline approaches wherever existing tidal wetland systems are present and because there would be no net loss of wetlands, the implementation of this alternative would result in short-term, minor adverse impacts on vegetated wetland resources (construction related) and long-term and beneficial impacts on both vegetated and unvegetated wetland resources.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wetland resources. This impact, when combined with Alternative 2, would have long-term, beneficial impacts on wetland resources because of the relative size of the study area and the number of at-risk wetland systems that would be enhanced by the proposed treatments. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

As per the discussion for Alternative 2, three of the five representative wetland areas previously discussed in the Wetland Resources section of "Chapter 3: Affected Environment," as well as

four other minor wetland features, are discussed below in the context of Alternative 3. Impacts to vegetated and unvegetated wetlands are summarized in tabular format at the end of this section.

Wetland Area A (Ringfield Picnic Area, Reach IA)

Under Alternative 3, an almost continuous wooden sill would be constructed along Reach IA as opposed to the rock sill and pocket beach proposed for Alternative 2 (Figure 13). Two small pocket beaches would be installed at the southern end of the Reach near Felgates Creek, similar to Alternative 2. The location of the wooden sill would be identical to the location of the rock sill for Alternative 2 and the means of construction access also would be the same. Therefore, the degree of potential impacts to wetlands would be essentially the same as that for Alternative 2. There would be slightly less structural footprint for the wooden sills within the subtidal areas, meaning slightly less potential compensatory area to offset impacts to unvegetated wetlands.

Wetland Area B (Felgates Creek, Reach I)

Under Alternative 3, the shoreline treatment approach at Wetland Area B would be identical to that for Alternative 2 (gap rock sill, Figure 13) and therefore the impact analysis is the same.

Wetland Area E (Sandy Point, Reach II)

Under Alternative 3, the shoreline treatment approach at Wetland Area E would be very similar to that for Alternative 2 with some minor variations (Figures 13 and 14). The principal differences are that revetment rehabilitation would occur at Sub-Reach “ab” as opposed to rock sill installation and new revetments would be installed at the existing pocket beach at Sub-Reach “b” and along the riverbank behind the NPS Breakwaters. At the latter location, both estuarine and palustrine wetlands are located in the area where the proposed revetment would be installed. This would result in permanent loss of a portion of some of these wetlands. Though remnants of these features may well persist subsequent to the installation of the revetment, this defensive approach would leave the nearshore area landward of the NPS Breakwaters vulnerable to coastal storm surges and wave attack and therefore susceptible to erosion and loss of the remnant wetland habitat.

With the exception of the rehabilitated and new revetments described above, the shoreline treatments proposed at Wetland Area E are living shoreline approaches similar to those discussed for Alternative 2. The minor adverse impacts to wetlands at the NPS Breakwaters would not offset the beneficial impact of the overall approach. Accordingly, overall impacts to wetlands would be considered beneficial. Mitigation for permanent impacts to wetlands at the location of the NPS Breakwaters may be required by regulatory agencies, though such mitigation may be possible within the project area itself due to the likelihood of an overall increase in wetland areas created by the application of multiple living shorelines approaches.

Other Wetland Areas (Wetlands H, J, P and Q)

Under Alternative 3, a new revetment is proposed for the area downstream of the east pier at NWS Yorktown and upstream of Ballard Creek (Figure 14). Portions of Wetland H would likely be impacted either temporarily during construction or permanently after revetment installation. Wetland J is located at the mouth of Ballard Creek in Reach III (Figure 18). No shoreline

treatment is proposed for this relatively stable area where sediment is accreting downstream of the creek mouth. Impacts to Wetlands P and Q (Figure 19) would be identical to Alternative 2 and would be dictated by the likelihood that revetment rehabilitation could be modified locally to protect these features.

Unvegetated Wetlands

Like Alternative 2, each of the shoreline treatments proposed for Alternative 3 would involve some degree of encroachment on unvegetated wetlands beyond that of the current suite of shoreline structures. Impacts arising from the implementation of living shoreline approaches would likely be considered self-mitigating impacts by regulatory agencies. Nevertheless, NPS policy as outlined in *Procedural Manual #77-1* (NPS 2012) recognizes that the conversion of unvegetated wetlands to vegetated wetlands is considered an impact.

Alternative 3 would involve at least as much construction phase unvegetated wetland impact as would Alternative 2 in locations of existing revetment and perhaps more as the footprint of the pile driver may require a wider haul road than would Alternative 2. However, post-construction impact on subaqueous land would actually be less than Alternative 2 because the materials comprising the haul road and the existing revetment could be repositioned landward and up against the exposed face of the sheet pile. Also, Alternative 3 does not propose any shore-attached breakwater systems as does Alternative 2, resulting in less unvegetated wetland impact. It is estimated that approximately 178,652 ft^2 of unvegetated wetland impacts would occur as a result of Alternative 3 versus approximately 246,136 ft^2 for Alternative 2. However, unlike the preferred alternative, Alternative 3 does not propose the same degree of created intertidal wetlands and intertidal structures and habitat in areas that are currently subtidal (64,078 ft^2 versus 247,467 ft^2 for Alternative 2) and therefore the area of potential compensation does not offset the impact area, resulting in a deficit of approximately -114,574 ft^2.

Summary of Impacts to Vegetated and Unvegetated Wetlands

Table 10 presents a summary of the vegetated and unvegetated wetland impacts associated with Alternative 3. Permanent impacts to vegetated wetlands would total approximately 18,589 ft^2. This is higher than Alternative 2 due to the installation of new revetments at three locations where vegetated wetlands currently reside, resulting in permanent impacts. As no created vegetated wetland areas are proposed for Alternative 3 to offset these impacts, compensatory mitigation would likely be required. Similarly, impacts to unvegetated intertidal wetlands (roughly 178,652 ft^2) are not offset by the development of roughly 64,078 ft^2 of intertidal wetlands and structures created in subtidal areas. Though the regulatory agencies may not require compensatory mitigation for these impacts, NPS policy as articulated in *Procedural Manual #77-1* (NPS 2012) does require compensation for such impacts.

As for Alternative 2, it should be noted that the determination of impacts to scrub-shrub and forested wetlands is conservative and could likely be diminished via detailed design and in-field avoidance during construction.

Table 10: Summary of Vegetated and Unvegetated Impacts for Alternative 3

Wetland Type	Permanent Impact (ft^2)	Temporary Impact[1] (ft^2)	Created Wetland Area (ft^2)	Potential Compensation[2] (ft^2)
estuarine emergent (E2EM)	9,033	35,415	0	-9,033
estuarine scrub-shrub (E2SS)	4,323	7,961	0	-4,323
estuarine forested (E2FO)	561	0	0	-561
palustrine forested (PFO)[3]	4,672	4,672	0	-4,672
unvegetated intertidal (E2)[4]	178,652	0	64,078	-114,574
TOTAL	197,241	48,561	64,078	-132,602

[1]: to be restored via post-construction planting

[2]: area of created wetlands minus permanent wetland impact

[3]: The amount of PFO associated with the revetment at Reach III, Sub-Reach "a" was estimated by equally dividing permanent and temporary impacts.

[4]: includes rocky shore, unconsolidated shore (US), and unconsolidated bottom (UB)

The proposed treatments for Alternative 3 would result in short-term, minor adverse impacts on vegetated wetland resources (construction related), long-term, moderate adverse impacts on unvegetated wetlands (post-construction), and long-term and beneficial impacts on vegetated wetland resources.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wetland resources. This impact, when combined with Alternative 3, would have long-term, adverse impacts on wetland resources. This is due to the degree of permanent impact to unvegetated wetlands. Alternative 3 would contribute an appreciable adverse increment to this cumulative impact.

CONCLUSION

Alternative 1: No Action

Alternative 1 would result in a moderate, long-term adverse impact on wetland resources. This is because no shoreline treatments would be carried out within the study area beyond those conducted in piecemeal fashion on an as-needed basis to address an imminent threat to infrastructure or catastrophic storm damage. Tidal wetlands within the study area would continue to be subject to the combined effect of coastal storm surges and sea level rise; likely resulting in erosion of their substrate and subsequent loss of plant cover. Alternative 1 would contribute a noticeable adverse increment to long-term, moderate adverse cumulative impacts.

Alternative 2: NPS Preferred Alternative

Alternative 2 would result in short-term, minor adverse impacts on wetland resources (construction related) and long-term and beneficial impacts on wetland resources (both vegetated and unvegetated). Alternative 2 would employ living shoreline approaches wherever existing

tidal wetland systems are present, optimizing the opportunities for habitat enhancement and restoration. Alternative 2 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

Alternative 3

Alternative 3 would result in short-term, minor adverse impacts on vegetated wetland resources (construction related), long-term, moderate adverse impacts on unvegetated wetlands (post-construction), and long-term and beneficial impacts on vegetated wetland resources. Unlike Alternative 2, Alternative 3 would likely involve permanent impacts to vegetated tidal and palustrine wetland systems resulting from the installation of new revetments. While Alternative 3 as a while would result in beneficial impacts to vegetated wetlands, these impacts would likely require compensatory mitigation. Alternative 3 would contribute an appreciable adverse increment to long-term, adverse cumulative impacts.

FLOODPLAINS

METHODOLOGY

The impact analysis and conclusions for possible impacts on the 100- and 500-year floodplains are based on the review of existing literature and studies, information provided by experts in the NPS and other agencies, and park staff insights, and professional judgment. The entire project area lies within the FEMA floodplain. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: There would be no change in the ability of a floodplain to convey floodwaters, or its values and functions. Project would not contribute to enhancing flood events.

Minor: Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and local. Project would not contribute to the flood. No mitigation would be needed.

Moderate: Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and local. Project could contribute to the flood. The impact could be mitigated by modification of proposed facilities in floodplains.

Major: Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and regional. Project would contribute to the flood. The impact could not be mitigated by modification of proposed facilities in the floodplains.

According to NPS DO-77-2: Floodplain Management, an SOF is required when an action is to occur within a floodplain. Due to the proposed phased approach to performing shoreline improvements, SOF's would be prepared on a phase-by-phase basis as preliminary design plans

are advanced to construction-ready documents. This allows for potential floodplain impacts to be assessed based on more informed plans.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under Alternative 1, current conditions impacting the floodplain would continue. The depth of floodwaters would continue to be dictated by a complex interplay of various factors, including long-term climatic trends and short-term weather patterns and storm events affecting the York River water; coastal storms such as nor'easters and hurricanes; seasonal tide cycles (e.g. spring and neap tides); and sea level rise. Storm systems would continue to erode the riverbanks along the edge of the floodplain. Existing shoreline defensive structures would be repaired or replaced on an as needed basis, which may or may not require the placement of fill materials in the floodplain beyond their current configuration. Overall, because of the project setting near the mouth of the York River, there would be no additional impedance of this flow through the study area. Alternative 1 would therefore result in a negligible, long-term adverse impact on floodplains.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the floodplain in and around the study area. These projects include the installation of shoreline defense structures at USCG Training Station Yorktown, recreational and shoreline improvements at Yorktown Waterfront, emergency reparations at parkway stations kilometer 3 and kilometer 5, and potential future shoreline defensive structures at Cheatham Annex. All of these projects involve the installation of shoreline treatments designed to reduce the risk to upland resources posed by landward migration of the shoreline. While some of these project have required or may require the placement of some fill materials in FEMA-designated flood zones, this is typically performed at abrupt interfaces between upland areas and jurisdictional waters and therefore minimizes seaward encroachments. Fill in wetland areas where some amount of flood storage may be possible is typically avoided. For this reason and because of the proximity of these projects to the Chesapeake Bay the infinite storage capacity of the ocean beyond, these actions would result in a long-term, negligible adverse impact on floodplains. This impact, when combined with Alternative 1, would have long-term, negligible adverse cumulative impacts on floodplains. Alternative 1 would contribute an imperceptible adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

Alternative 2 would result in the placement of fill materials within FEMA-designated flood zones throughout the study area in order to rehabilitate existing structures and install new shoreline treatment approaches. While the volume of projected fill is currently unavailable and dependent on detailed design work, the Alternative 2 minimizes flood zone encroachment by

reincorporating existing structures to the greatest extent feasible while designing to address both recognized deficiencies and projected sea level rise.

In accordance with the guideline of DO-77-2, Alternative 2 does not propose or promote human occupancy of a floodplain nor does it increase flood risk. No structures other than those expressly designed for shoreline repair, rehabilitation, and protection would be installed. Through the implementation of living shoreline approaches, Alternative 2 includes wetland restoration and enhancement opportunities that would encourage flood attenuation and shoreline protection using a natural systems approach. Roughly 7,600 linear feet of such treatments would be implemented. Lastly, because of the project setting near the mouth of the York River, there would be no additional impedance of this flow through the study area. Alternative 2 would therefore result in a long-term, negligible adverse impact on floodplains.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable future actions would result in a long-term, negligible adverse impact on floodplains. This impact, when combined with Alternative 2, would have long-term, negligible adverse cumulative impacts on floodplains. Alternative 2 would contribute an imperceptible adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

Alternative 3 would also result in the placement of fill materials within FEMA-designated flood zones throughout the study area in order to rehabilitate existing structures and install new shoreline treatment approaches. While the volume of projected fill is currently unavailable and dependent on detailed design work, the Alternative 3 minimizes flood zone encroachment by reincorporating existing structures while designing to address both recognized deficiencies and projected sea level rise. During construction, Alternative 3 may require more temporary fill in subaqueous lands relative to Alternative 2, as the footprint of the pile driver may require a wider haul road. Conversely, the completed project would have a slightly lesser overall flood zone encroachment than would Alternative 2. This is because a new revetment is proposed in the back beach area for Reach III, Sub-Reach “a” as opposed to the shore-attached breakwaters that would be constructed there under Alternative 2.

In accordance with the guideline of DO-77-2, Alternative 3 does not propose or promote human occupancy of a floodplain nor does it increase flood risk. No structures other than those expressly designed for shoreline repair, rehabilitation, and protection would be installed. Through the implementation of living shoreline approaches, Alternative 3 includes wetland restoration and enhancement opportunities that would encourage flood attenuation and shoreline protection using a natural systems approach. Roughly 5,400 linear feet of such treatments would be implemented. This is notably less than Alternative 2. Lastly, because of the project setting near the mouth of the York River, there would be no additional impedance of this flow through the study area. Alternative 3 would therefore result in a negligible, long-term adverse impact on floodplains.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable future actions would result in a long-term, negligible adverse impact on floodplains. This impact, when combined with Alternative 3, would have long-term, negligible adverse cumulative impacts on floodplains. Alternative 3 would contribute an imperceptible adverse increment to this cumulative impact.

CONCLUSION

Alternative 1: No Action

Alternative 1 would result in a negligible, long-term adverse impact on floodplains. Even though emergency actions may be required to address imminent threats to park resources or catastrophic storm damage, any fill material required in the flood zone would cause no impact because of the project setting near the mouth of the York River and the infinite storage capacity of the ocean to which it is connected. Alternative 1 would contribute an imperceptible adverse increment to long-term, negligible, adverse cumulative impacts.

Alternative 2: NPS Preferred Alternative

Alternative 2 would result in a negligible, long-term adverse impact on floodplains. Though it would result in the placement of fill materials within FEMA-designated flood zones throughout the study area, Alternative 2 minimizes flood zone encroachment by reincorporating existing structures to the greatest extent feasible. Moreover, the project setting near the mouth of the York River and the infinite storage capacity of the ocean to which it is connected means that floodplain impacts would be negligible. Alternative 2 would contribute an imperceptible adverse increment to cumulative impacts.

Alternative 3

Alternative 3 would therefore result in a negligible, long-term adverse impact on floodplains. Though it would result in the placement of fill materials within FEMA-designated flood zones throughout the study area, Alternative 3 minimizes flood zone encroachment by reincorporating existing structures into the design. Moreover, the project setting near the mouth of the York River and the infinite storage capacity of the ocean to which it is connected means that floodplain impacts would be negligible. Alternative 3 would contribute an imperceptible adverse increment to cumulative impacts.

WILDLIFE AND WILDLIFE HABITAT

METHODOLOGY

Available information on known wildlife and wildlife habitat was compiled and analyzed in relation to the management actions. The thresholds for the intensity of an impact are defined as follows:

Negligible: There would be no observable or measurable impacts on the abundance and diversity of native species and/or the quality of their habitat. Impacts would be of short duration and well within natural fluctuations.

Minor: Impacts would be detectable, but would not be outside the natural range of variability. Small changes to population numbers, number of species present, habitat quality, and other factors might occur. Occasional responses to disturbance by some individuals could be expected, but without interference to factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside critical reproduction periods for sensitive native species. Mitigation measures, if needed to offset adverse impacts, would be simple and very likely successful.

Moderate: Impacts on the abundance and diversity of native species and/or the quality of their habitat would be detectable and could be outside the natural range of variability. Changes to population numbers, number of species present, habitat quality, and other factors would occur, but species would remain stable and viable. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to factors affecting population levels. Sufficient habitat would remain functional to maintain the viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.

Major: Impacts on the abundance and diversity of native species and/or the quality of their habitat would be detectable, would be expected to be outside the natural range of variability, and would be extensive. Population numbers, number of species present, habitat quality, and other factors might experience large declines. Frequent responses to disturbance by some individuals would be expected, with negative impacts to factors resulting in a decrease in population levels. Loss of habitat might affect the viability of at least some native species. Extensive mitigation measures would be needed to offset any adverse impacts, and may not be successful.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

As the No-action Alternative proposes no changes to shoreline conditions within the project area except on an as-needed or emergency basis in response to an imminent threat to infrastructure or upland resources or the catastrophic storm damage there would be little immediate change in wildlife habitat. Tidal wetland habitats within the study area would continue to be subject to the combined effect of coastal storm surges and sea level rise; likely resulting in erosion of their substrate and subsequent loss of plant cover. Over time, this would result in less marsh fringe habitat and the loss of biologically productive habitat. Nursery grounds and shelter for fish and turtles and foraging areas for shorebirds would be lost. Loss of beach areas would impact habitat

for the diamond-backed terrapin. Under Alternative 1, the loss of upland habitat or infrastructure to shoreline erosion and landward migration could also result in influxes of sediment from slope failures or man-made materials (e.g., road bed, asphalt) into sensitive wetland areas, resulting in a similar loss of habitat. Because reparations would be carried out on an as-needed basis, flexibility in the design approach with respect to wetland avoidance and minimization may be limited by the constraints posed by the degraded site conditions and scope of the reparations. Wetland impacts may further diminish wildlife habitat.

The No-action Alternative would not impede the movement of nekton or directly affect usage of study area waters and marshland by waterfowl. However, because of the potential loss of productive marsh habitat as well as upland habitat caused by storm-induced erosion coupled with the effects of sea-level rise, Alternative 1 would result in a long-term, minor adverse impact on wildlife and wildlife habitat.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on wildlife and wildlife habitat in and around the study area. These projects include the installation of shoreline defense structures at USCG Training Station Yorktown, recreational and shoreline improvements at Yorktown Waterfront, emergency reparations at parkway stations kilometer 3 and kilometer 5, and potential future shoreline defensive structures at Cheatham Annex. The cumulative impact of these actions with respect to wildlife and wildlife habitat is tied to the potential impacts to wetland resources. For this reason, the analysis of cumulative impacts for the No-action Alternative is the same as for wetland resources; these cumulative actions may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wildlife and wildlife habitat. This impact, when combined with Alternative 1, would have long-term, moderate adverse impacts on wildlife and wildlife habitat because of the relative size of the study area and the number of wetland systems (i.e., habitats) at risk. Alternative 1 would contribute a noticeable adverse increment to this cumulative impact due to the potential loss of biologically productive marsh habitat and threat to wetland habitat caused by erosion and translocation of upland sediments or infrastructure.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

By stabilizing the shoreline using a combination of defensive and living shoreline approaches, Alternative 2 would reduce the risk to upland habitats from erosion and enhance and expand tidal wetland habitat. This would by extension improve nursery habitat and shelter for finfish, crabs, and turtles and foraging area for waterbirds. The use of rock sills, gap sills, pocket beaches, and vegetated marsh fringes would allow turtles and fish to migrate from the seaward to landward side of the structures (Hardaway et al. 2010). Use of the beach and backshore at Reach IA (Figures 2a and 3a) by the diamond-backed terrapin has been observed. The proposed use of a gapped sill and pocket beaches is favorable with respect to providing upland to aquatic connectivity for this turtle (CCB 2011a).

The rehabilitation of the NPS Breakwaters and the installation of a new breakwater system in Reach III would result in impacts to subaqueous lands potentially occupied by benthic macroinvertebrates and encroachment into waters used by free-swimming organisms. However, the habitat benefits of such means of headland control have been recognized by the USACE (USACE 1990). Following the monitoring of several such sites throughout the lower Chesapeake Bay, the USACE, in association with VIMS, determined that:

> *Rock breakwaters offer a substrate which does not naturally occur at these reaches in the James and 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 at high trophic levels.*

During construction of the Alternative 2, some disturbance of wildlife and wildlife habitat would likely occur as a result of encroachment on subaqueous lands and potentially within wetland areas for haul road construction and operation, and because of equipment traffic and noise. Free-swimming organisms and waterbirds would be able to evacuate the construction zone in advance of disturbance, but foraging and sheltering opportunities at these locations would be temporarily lost. Relatively less mobile benthic macroinvertebrates may be permanently impacted by the placement fill for haul roads and during final structure placement. Based on the fact that construction would be restricted primarily to shallow waters, potential impacts to EFH would likely be negligible.

The barge access to Reach IA would be positioned such that it would not interfere with the state-constructed oyster reefs at the mouth of Felgates Creek. Special care would be taken to prevent the mobilization of sediments in the vicinity of these structures; Type II turbidity curtains would be deployed around the construction site to contain suspended sediments.

Overall, Alternative 2 would have short-term, negligible adverse impacts (construction related) and long-term beneficial impacts on wildlife and wildlife habitat.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wildlife and wildlife resources. This impact, when combined with Alternative 2, would have long-term, beneficial impacts on wildlife and wildlife resources because of the relative size of the study area and the number of at-risk wetland habitats that would be restored or enhanced by the proposed treatments and the relative stability that would result for upland resources and habitat. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

The impact on wildlife and wildlife habitat resulting from Alternative 3 would be largely the same as for Alternative 3 with the following differences:

- Subaqueous encroachment may be slightly more extensive to accommodate the footprint of the pile driver.
- The noise and vibrations associated with pile driving may have an impact on wildlife and wildlife habitat over a greater distance than would construction using natural stone materials alone.
- The NPS Breakwaters would not be rehabilitated and the new breakwater system proposed for Reach III under Alternative 2 would not occur. Therefore, the secondary benefits of additional subaqueous habitat as discussed would not be realized. These areas would be treated using new revetments, which may involve permanent impacts to wetland areas (see "Chapter 4: Environmental Consequences").

Regardless of the potential impacts on wetlands and additional, temporary construction related Impacts that would occur as a result of Alternative 3, from an overall standpoint, Alternative 3 would have long-term beneficial impacts on wildlife and wildlife habitat. Construction related impacts would be short-term, negligible and adverse.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wildlife and wildlife resources. This impact, when combined with Alternative 3, would have long-term, beneficial impacts on wildlife and wildlife habitat because of the relative size of the study area and the number of at-risk wetland habitats that would be restored or enhanced by the proposed treatments and the relative stability that would result for upland resources and habitat. Alternative 3 would contribute an appreciable beneficial increment to this cumulative impact.

CONCLUSION

Alternative 1: No Action

Alternative 1 would result in a minor, long-term adverse impact on wildlife and wildlife habitat. Landward migration of the shoreline would result in the loss of marsh fringe and the nursery and foraging habitat and shelter it provides. Upland habitats, including mixed hardwood forest and grassland, would also be susceptible to disturbance and permanent loss as a result of riverbank slumping. Alternative 1 would contribute a noticeable adverse increment to long-term, moderate, adverse cumulative impacts.

Alternative 2: NPS Preferred Alternative

Alternative 2 would have short-term, negligible adverse impacts (construction related) and long-term beneficial impacts on wildlife and wildlife habitat. Shoreline treatments would be carried out in a manner that optimizes opportunities for wetland habitat restoration and enhancement and the rehabilitation of existing breakwaters and creation of new breakwaters would enhance subaqueous habitat for fisheries and expand tidal wetland and beach habitat. Alternative 2 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

Alternative 3

Alternative 3 would have short-term, negligible adverse impacts (construction related) and long-term beneficial impacts on wildlife and wildlife habitat. Though Alternative 3 does not present as many opportunities for habitat restoration and enhancement as does Alternative 2 and temporary construction related impacts may be greater, overall benefits outweigh these impacts. Alternative 3 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

VEGETATION

METHODOLOGY

Available information on plants and vegetative communities potentially impacted by the shoreline repair and stabilization project was provided by park staff and is summarized in "Chapter 3: Affected Environment." Predictions about short- and long-term site impacts were based on design conceptual design plans and previous projects with similar vegetation. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: No vegetation would be affected, or some individual plants could be affected as a result of the alternative, but there would be no impact to native species populations. The impacts would be on a small scale.

Minor: The alternative would affect some individual plants and would also affect a relatively small portion of that species' population. Mitigation to offset adverse impacts could be required and would likely be successful.

Moderate: The alternative would affect some individual plants and would also affect a sizeable segment of the species' population over a relatively large area. Mitigation to offset adverse impacts could be extensive but would likely be successful.

Major: The alternative would have a considerable impact on plant populations and affect a relatively large area in and out of the park. Mitigation measures to offset the adverse impacts would be required and extensive, and success of the mitigation measures would not be guaranteed.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

The dominant vegetation type within the study area and that most at risk from shoreline erosion and sea-level rise is wetland vegetation. Accordingly, the impact analysis for wetland resources is directly applicable here. Tidal wetlands within the study area would continue to be subject to the combined effect of coastal storm surges and sea level rise; likely resulting in erosion of their substrate and subsequent loss of plant cover. Over time, this would result in less marsh fringe habitat and the loss of biologically productive habitat. Upland vegetation also would be vulnerable to landward migration of the shoreline. Uprooted trees, a common occurrence where slope failures are ongoing in Reaches IA, III, and IV, would continue to occur. Gullies that have formed in the riverbank at Bellfield Straight would deepen, undermining areas of maintained grassland adjacent to the parkway. These impacts to upland vegetation may result in disturbances to downslope habitats, including wetlands. As discussed in "Chapter 3: Affected Environment," such disturbances can serve as points of introduction for the invasive common reed.

Because reparations to eroded riverbank areas would be carried out on an as-needed basis to address an imminent threat or emergency situation, flexibility in the design approach with respect to preserving vegetation may be limited by the constraints posed by the degraded site conditions and scope of the reparations. Considering the likelihood of continued loss of vegetation and perhaps increasing rates of shoreline retreat as sea level rise translates storm surges to higher elevations along the riverbank, Alternative 1 would result in a minor, long-term adverse impact on vegetation.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on vegetation in and around the study area. These projects include the installation of shoreline defense structures at USCG Training Station Yorktown, recreational and shoreline improvements at Yorktown Waterfront, emergency reparations at parkway stations kilometer 3 and kilometer 5, and potential future shoreline defensive structures at Cheatham Annex. All of these projects involve the installation of shoreline treatments designed primarily to reduce the risk to upland resources posed by landward migration of the shoreline. While these cumulative actions may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wetland vegetation, they all have a long-term beneficial impact on upland vegetation. When combined with Alternative 1, these actions would result in a long-term, minor adverse impact. Alternative 1 would contribute a noticeable adverse increment to this cumulative impact due to the potential loss of both types of vegetation to shoreline erosion and the potential creation of disturbed land surfaces amenable to colonization by invasive species.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

By stabilizing the shoreline using a combination of defensive and living shoreline approaches, Alternative 2 would protect upland vegetation from erosion and enhance and expand tidal

wetland vegetation. Potential impacts to wetland vegetation may occur during the construction process to install the haul road and/or related to the placement of sandy fill behind rock sills or gap rock sills and areas of breakwater rehabilitation and creation. However, these areas would be replanted with saltmarsh and/or saltmeadow cordgrass after final grading is established and impacts to wetlands would be considered temporary and the project self mitigating.

The occurrence of SAV in Reach IV (Figure 23) appears to lie largely outside the limits of construction. However, the upstream end of the feature does approach close to the shoreline. The barge access to Reach IV would be positioned such that it would not interfere with this SAV feature. The deployment of Type II turbidity curtains would contain suspended sediments and prevent their mobilization in the vicinity of the SAV and throughout the Reach.

Impacts to upland vegetation would be very limited; amounting to areas of minor riverbank cut back and loss of grassy and shrubby vegetation in areas where revetment rehabilitation is proposed. As work would be performed from the water, areas of soil disturbance that are not purposefully covered by armor stone would be rare. Where areas of bare soil remain following construction and should grassy vegetation be impacted in areas where material staging may occur (Poley Point and Sandy Point), any such impact would be mitigated by reseeding with native plants post construction. Revegetation plans would be drafted as part of the construction plan set, and the methods proposed (e.g., hydroseeding, use of tackifier, rate of application, species list for seed and any woody species) would be subject to NPS review and approval prior to construction. Accordingly, Alternative 2 would have a short-term, minor adverse impact (construction related) and a long-term beneficial impact on vegetation.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wetland vegetation and a long-term beneficial impact on upland vegetation. This impact, when combined with Alternative 2, would have long-term, beneficial impacts on vegetation as a whole because of the relative size of the study area and the number of at-risk wetland habitats that would be restored or enhanced by the proposed treatments and the relative stability that would result for upland resources and habitat. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

The impact on vegetation resulting from Alternative 3 would be largely the same as for Alternative 3 with the following differences:

- Riverbank cut back along areas where steel sheet piling is proposed may be more extensive than for corresponding areas of revetment rehabilitation under Alternative 2. This would result in a greater loss of upland grassy and scrubby areas.

- The NPS Breakwaters would not be rehabilitated and the new breakwater system proposed for Reach III under Alternative 2 would not occur. These areas would be treated using new revetments, which may involve permanent impacts to wetland vegetation (see "Chapter 4: Environmental Consequences"). Upland vegetation would likely also be permanently impacted in order to attach the revetment to the riverbank. This would require some degree of forest clearing and ground disturbance along the back beach at Reach III, Sub-Reach "a."

Regardless of the potential impacts on wetland vegetation that would occur as a result of Alternative 3, from an overall standpoint, Alternative 3 would have long-term beneficial impacts on both wetland and upland vegetation. Construction related impacts would be short-term, minor and adverse.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects may have either a long-term, imperceptible adverse impact or long-term, beneficial impact on wetland vegetation and a long-term beneficial impact on upland vegetation. This impact, when combined with Alternative 3, would have long-term, beneficial impacts on vegetation as a whole because of the relative size of the study area and the number of at-risk wetland habitats that would be restored or enhanced by the proposed treatments and the relative stability that would result for upland resources and habitat. Alternative 3 would contribute an appreciable beneficial increment to this cumulative impact.

CONCLUSION

Alternative 1: No Action

Alternative 1 would result in a minor, long-term adverse impact on vegetation. Landward migration of the shoreline would result in the loss of marsh fringe vegetation. Upland vegetation, including mixed hardwood forest and grassland areas, would also be susceptible to disturbance and permanent loss as a result of riverbank slumping. The translocation of eroded sediments into downgradient areas may present an opportunity for colonization by invasive plant species. Alternative 1 would contribute a noticeable adverse increment to long-term, minor adverse cumulative impacts.

Alternative 2: NPS Preferred Alternative

Alternative 2 would have short-term, minor adverse impacts (construction related) and long-term beneficial impacts on vegetation. Shoreline treatments would be carried out in a manner that optimizes opportunities for the establishment of wetland vegetation and protects upland vegetation from the impacts of shoreline recession. Alternative 2 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

Alternative 3

Alternative 3 would have short-term, minor adverse impacts (construction related) and long-term beneficial impacts on vegetation. Though Alternative 3 would likely involve a greater degree of impact to wetland and upland vegetation than would Alternative 2, overall benefits outweigh these impacts. Alternative 3 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

SPECIAL STATUS SPECIES

METHODOLOGY

The Endangered Species Act (16 USC 1531 et. seq.) mandates that all federal agencies consider the potential impacts of their actions on species listed as threatened or endangered. If the NPS determines that an action may adversely impact a federally listed species, consultation with the USFWS is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. *NPS Management Policies 2006* (NPS 2005) states that potential impacts of agencies actions will also be considered on state or locally listed species. The USFWS and Virginia DGIF were contacted for a list of rare, threatened, and endangered species and designated critical habitats that may be within the project area or affected by any of the alternatives. Information on possible threatened or endangered candidate species, and species of special concern was gathered from past studies and plans. Map locations of habitats associated with threatened, endangered, candidate species, and species of special concern were compared with locations of proposed developments and existing facilities. Known impacts caused by development and human-uses were also considered. The thresholds of change for the intensity of an impact are as follows:

Negligible: The action could result in a change to a population or individuals of a species or designated critical habitat, but the change would be so small that it would not adversely impact a given species.

Minor: The action could result in a change to a population or individual of a species or designated critical habitat. The change would be measurable but is not likely to adversely impact a given species.

Moderate: The action would result in some change to a population or individual of a species or designated critical habitat. The change would be measurable and could adversely impact a given species.

Major: The action would result in a noticeable change to a population or individuals of a species or resource or designated critical habitat. The change would be measurable and would adversely impact a given species.

For the purpose of this EA, the impact analysis will be focus on the bald eagle; the only state listed species that has been documented as occurring and is likely to occur within the project area.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under the No-action Alternative, conditions in the proximity of the existing bald eagle nest and along the shoreline within the study area would remain unchanged. Shoreline recession may result in the loss of candidate trees for eagle nesting and roosting, but this would not adversely impact the species because of the relative abundance of suitable trees along the shoreline. The overall impact on the species would be considered to be long-term, negligible and adverse.

Cumulative Impacts

No past, present, and reasonably foreseeable future actions have or continue to contribute to the cumulative impact on special status species in and around the study area.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

Under Alternative 2, stabilization of the shoreline in the study area would reduce the risk of upland habitat loss from erosion. As such, suitable nesting trees for the bald eagle may persist for longer periods of time relative to the No-action Alternative. The protection and enhancement of tidal marsh fringes using living shoreline approaches would enhance overall wildlife habitat and nursery areas for fish, with potential beneficial impacts for other special status species, including colonial waterbirds. This may also help sustain or improve the availability of food sources for the bald eagle and northern harrier. Wetland habitat enhancement and protection associated with Alternative 2 would have a beneficial impact on colonial waterbird habitat as well as feeding and perching habitat for migratory birds.

During construction, the proximity of heavy machinery and the noise emitted coupled with temporary human occupation of the shoreline area may impact the use of the existing nest at the Ringfield Picnic Area. No candidate roosting or nesting trees would be proposed for cutting under Alternative 2. The NPS would work with the DGIF and the CCB to determine if any mitigation is appropriate under the circumstances. Mitigation may include a time of year restriction on construction so as to minimize disturbance during periods of nest building and rearing of eaglets.

The study area does not represent suitable habitat for Atlantic sturgeon spawning though may provide some degree of feeding habitat. Alternative 2 would involve some degree of work in very shallow waters, especially where breakwaters and sills are proposed. This work may temporarily affect feeding areas during construction and the footprint of the structures would result in the permanent removal of a minor amount of river bottom suitable for use by this benthic feeder. As a free-swimming organism, the Atlantic sturgeon would be able to evacuate the construction zone in advance of disturbance. The risk of collisions with watercraft required for the construction phase would likely be minimal as they would generally consist of slow-moving barges.

In consideration of construction related issues, impacts to special status species would be short-term, minor and adverse. The potential for habitat preservation would represent a long-term beneficial impact.

Cumulative Impacts

No past, present, and reasonably foreseeable future actions have or continue to contribute to the cumulative impact on special status species in and around the study area.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

The impacts on special status species resulting from the implementation of Alternative 3 would be the same as for Alternative 2; short-term, minor and adverse.

Cumulative Impacts

No past, present, and reasonably foreseeable future actions have or continue to contribute to the cumulative impact on special status species in and around the study area.

CONCLUSION

Alternative 1: No Action

Alternative 1 would result in a long-term, negligible and adverse impact on special status species. Conditions along the shoreline would remain unchanged with respect to opportunities for bald eagle nesting and foraging. No cumulative impacts have been considered.

Alternative 2: NPS Preferred Alternative

Alternative 2 would result in a short-term, minor adverse impact on special status species as a result of potential noise disturbance and human occupancy in close proximity to a known bald eagle nest at Reach IA. Preservation of upland habitat would result in a long-term beneficial impact on special status species. No cumulative impacts have been considered.

Alternative 3

Alternative 3 would result in a short-term, minor adverse impact on special status species as a result of potential noise disturbance and human occupancy in close proximity to a known bald eagle nest at Reach IA. Preservation of upland habitat would result in a long-term beneficial impact on special status species. No cumulative impacts have been considered.

CULTURAL RESOURCES

METHODOLOGY

Cultural landscapes are the result of the long interaction between people and the land, and the influence of human beliefs and actions over time upon the natural landscape. Shaped through time by historical land-use and management practices, as well as politics and property laws, levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past, as well as a visual chronicle of its history. In order for a cultural landscape to be listed on or eligible for listing on the National Register, it must possess historic integrity of those features necessary to convey its significance, particularly with respect to location, setting, design, feeling, association, workmanship, and materials. The National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation (NPS 1990) provides a comprehensive discussion of these characteristics.

As noted in Chapter 3 "Affected Environment," the parkway cultural landscape is the only such landscape that intersects the study area and that may be impacted by the proposed project. For purposes of analyzing potential impacts to these resources, the threshold of change for the intensity of an impact is defined as follows:

Negligible: Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. An assessment of effect according to Section 106 of the NHPA would result in a determination of *no adverse effect*.

Minor: Alteration of a character-defining feature(s) would not diminish the overall integrity of the resource. An assessment of effect according to Section 106 of the NHPA would result in a determination of *no adverse effect*.

Moderate: Alteration of a character-defining feature(s) would diminish the overall integrity of the resource. An assessment of effect according to Section 106 of the NHPA would result in a determination of *adverse effect*.

Major: Loss of a character-defining feature(s) would diminish the overall integrity of the resource. An assessment of effect according to Section 106 of the NHPA would result in a determination of *adverse effect*.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under Alternative 1, no changes would be made to the parkway character-defining features (spatial organization/context, spatial character, topography, circulation, vegetation, shoreline, drainage features, structures, small scale features, cultural resources, and parkway uses) except potentially under those circumstances requiring preventative or emergency maintenance. These may include reparations to bridge structures and shoreline defense structures. Impacts associated with such reparations would affect what the cultural landscape report refers to as the "spatial

character" of the parkway, which remains largely unchanged since 1958 (NPS 1997). Specifically, the presence of construction equipment and personnel within the viewshed of the parkway and its surroundings might diminish the experience for park visitors. Such impacts would be short-term, minor and adverse.

However, long-term and adverse impacts on cultural landscapes can occur in two ways after construction. First, should a portion of the parkway itself be lost to erosion during an event and reconstruction efforts require design changes that differ from the original roadway plan, the cultural landscape would be impacted until such time that the road and the affected area could be reconstructed. Reconstruction efforts may not be able to replicate the pre-event conditions. Secondly, the cumulative effect of periodic installation of new structures may have a long-term effect on the cultural landscape of the parkway. In other words, while the effects of employing after-the-fact and localized approaches to address storm-induced or catastrophic erosion may be relatively minimal per event, the collective effect of multiple repairs may result in the overall impairment of the cultural landscape. Such a reactive approach may jeopardize parkway management objectives. Accordingly, impacts associated with the No-action Alternative would result in a long-term, minor to moderate adverse impact on the cultural landscape. The intensity of the impact would depend on the degree of damage caused by the erosion event and the approach to shoreline repair that was carried out.

Cumulative Impacts

The past, present, and reasonably foreseeable future actions that contribute to the cumulative impact on cultural landscapes in the study area include the emergency reparations at parkway stations kilometer 3 and kilometer 5. These actions were carried out to prevent the loss of the parkway to storm-induced shoreline erosion. By preventing the loss of the parkway to the imminent threat of erosion and reducing the risk of future erosion, these repairs have a long-term, beneficial impact on cultural landscapes. However, shoreline armoring and introduction of new stone materials into the cultural landscape can be considered to have a long-term, imperceptible adverse impact. These impacts, when combined with Alternative 1, would have long-term, minor to moderate adverse impact on the cultural landscape, Alternative 1 would contribute an imperceptible to appreciable adverse increment to this cumulative impact, depending on the number of repairs carried out and the approach used.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

Under Alternative 2, no changes would be made to the parkway's character-defining features (spatial organization/context, spatial character, topography, circulation, vegetation, shoreline, drainage features, structures, small scale features, cultural resources, and parkway uses) except for vegetation, shoreline, and cultural resources. The shoreline and bluff would be subjected to enhanced erosion control measures. These measures, while similar to ones used previously, are not necessarily identical; however, their function is the same and thus, no new elements would be introduced into the cultural landscape.

Where vegetation is disturbed during construction, it would be replaced in kind (i.e., stormwater gullies in Reach I along Bellfield Straight). Impacts to the woody vegetation that contributes to the spatial character of the cultural landscape are not anticipated, as areas of cut are restricted to the lower portions of previously engineered slopes which were originally devoid of woody vegetation.

Impacts on the spatial character of the parkway during construction would be caused by the presence of construction equipment within the viewshed, the noise this equipment may emit, and the possible use of select grassy areas for equipment staging. However, because such impacts would be temporary, they would be considered short-term, minor and adverse. Potential detractions are discussed in additional detail under the impacts analysis for Visitor Use and Experience. After construction is complete, Alternative 2 would result in a long-term, negligible impact on the cultural landscape since the impacts would be neither adverse nor beneficial and would be below the level of detection.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects have both a long-term, beneficial impact and a long-term, imperceptible adverse impact on cultural landscapes. These impacts, when combined with Alternative 2, would have long-term beneficial impact on cultural landscapes. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

The impact analysis for Alternative 3 is essentially identical to that provided for Alternative 2 above. However, the use of steel sheet piling, which would be visible from the river and to park visitors viewing the shoreline by foot, constitutes a new and potentially intrusive shoreline treatment approach. The sheet piling would be obscured to some degree by the repositioning of existing riprap along its toe, though the top would most likely remain visible. Accordingly, Alternative 3 would have a long-term, minor adverse impact on cultural landscapes. Impacts on the spatial character of the parkway during construction would be caused by the presence of construction equipment within the viewshed, the noise this equipment may emit (more pronounced than for Alternative 2 due to use of sheet piling), and the possible use of select grassy areas for equipment staging. However, because such impacts would be temporary, they would be considered short-term, minor and adverse. Potential detractions are discussed in additional detail under the impacts analysis for Visitor Use and Experience.

Cumulative Impacts

As discussed under Alternative 1, past, present, and reasonably foreseeable projects have both a long-term, beneficial impact and a long-term, imperceptible adverse impact on cultural landscapes. These impacts, when combined with Alternative 3, would have long-term beneficial impact on cultural landscapes. The degree of risk reduction to the parkway afforded by Alternative 3 would outweigh the potential visual detraction of the steel sheet pile component,

and thus Alternative 3 would contribute an appreciable beneficial increment to this cumulative impact.

CONCLUSION

Alternative 1

Overall, Alternative 1 would result in short-term, minor and adverse impacts (i.e., during construction for preventative or emergency maintenance) and long-term, minor to moderate adverse impacts on the cultural landscape, depending on the extent of storm damage, the number of reparations required, and the approach to reparation selected. Alternative 1 would contribute an imperceptible to appreciable adverse increment to long-term, minor to moderate adverse cumulative impacts.

Alternative 2

Overall, Alternative 2 would result in short-term, minor and adverse impacts (construction related) and long-term, negligible impact to the cultural landscape since the impacts would be neither adverse nor beneficial and would be below the level of detection. Alternative 2 would contribute an appreciable beneficial increment to long term, beneficial cumulative impacts.

Alternative 3

Overall, Alternative 3 would result in a short-term, minor and adverse impact (construction related) and a long-term, minor adverse impact (visual detraction of sheet piling) on cultural landscapes. Alternative 3 would contribute an appreciable beneficial increment to long-term beneficial cumulative impacts.

HISTORIC STRUCTURES

METHODOLOGY

A historic structure is defined by the NPS as “a constructed work, usually immovable by nature or design, consciously created to serve some act” (DO-28). In order for a structure or building to be listed on or eligible for listing on the National Register, it must possess historic integrity of those features necessary to convey its significance, particularly with respect to location, setting, design, feeling, association, workmanship, and materials. The National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation (NPS 1990) provides a comprehensive discussion of these characteristics.

For purposes of analyzing potential impacts to historic structures, the thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impact is at the lowest levels of detection with neither adverse nor beneficial consequences.

Minor: Alteration of a character-defining feature(s) would not diminish the overall integrity of the resource.

Moderate: Alteration of a character-defining feature(s) would diminish the overall integrity of the resource.

Major: Loss of a character-defining feature(s) would diminish the overall integrity of the resource.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under Alternative 1, no changes would be made to the parkway character-defining features (spatial organization/context, spatial character, topography, circulation, vegetation, shoreline, drainage features, structures, small scale features, cultural resources, and parkway uses) except for the shoreline. The shoreline and bluff would be subjected to maintenance on an as-needed basis to repair storm-induced or catastrophic damage. However, as shoreline recession can proceed in an unpredictable manner, the loss of historic structures may occur before such reparations can be arranged for and carried out. Historic structures that are most at risk include multiple sections of the parkway (primarily along Reach I) and Redoubt 1 (aka Fusiliers Redoubt) in Reach III. Redoubt 10 in Reach IV lies farther from the shoreline than do these structures, but is nevertheless at risk over the long term. Because the No-action Alternative amounts to a reactive strategy that would address shoreline erosion post-event, it may or may not be sufficient to mitigate the effects of such erosion. Accordingly, it would result in long-term, negligible to moderate adverse impacts on historic structures.

Cumulative Impacts

The past, present, and reasonably foreseeable future actions that contribute to the cumulative impact on historic resources in the study area include the emergency reparations at parkway stations kilometer 3 and kilometer 5. These actions were carried out to prevent the loss of the parkway to storm-induced shoreline erosion. By preventing the loss of the parkway to the imminent threat of erosion and reducing the risk of future erosion, these repairs have a long-term, beneficial impact on historic resources. These impacts, when combined with Alternative 1, would have long-term, moderate adverse impact on the cultural landscape, Alternative 1 would contribute an imperceptible to appreciable adverse increment to this cumulative impact, depending on whether post-storm reparations can successfully reduce the risk of the loss of the resource, or if the resource is partially lost during the event.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Under Alternative 2, no changes would be made to the parkway character-defining features (spatial organization/context, spatial character, topography, circulation, vegetation, shoreline, drainage features, structures, small scale features, cultural resources, and parkway uses) except for the shoreline. The shoreline and bluff would be subjected to preventive maintenance and

existing erosion-prevention measures would be stabilized and new measures installed. The park would continue to maintain all elements of the landscape as staff and funding are available.

Overall, Alternative 2 would result in a long-term, negligible impact on historic structures since the impacts would be neither adverse nor beneficial and would be below the level of detection.

Cumulative Impacts

The past, present, and reasonably foreseeable future actions that contribute to the cumulative impact on historic structures in the study area include the emergency reparations at parkway stations kilometer 3 and kilometer 5. These actions were carried out to prevent the loss of the parkway to storm-induced shoreline erosion. By preventing the loss of the parkway to the imminent threat of erosion and reducing the risk of future erosion, these repairs have a long-term, beneficial impact on historic structures. These impacts, when combined with Alternative 2, would have long-term beneficial impact on historic resources. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Under Alternative 3, no changes would be made to the parkway character-defining features (spatial organization/context, spatial character, topography, circulation, vegetation, shoreline, drainage features, structures, small scale features, cultural resources, and parkway uses) except for the shoreline. The shoreline and bluff would be subjected to preventive maintenance and existing erosion-prevention measures would be stabilized. The park would continue to maintain all elements of the landscape as staff and funding are available.

Overall, Alternative 3 would result in a long-term, negligible impact on historic structures since the impacts would be neither adverse nor beneficial and would be below the level of detection.

Cumulative Impacts

The analysis of cumulative impacts for Alternative 3 is identical to that for Alternative 2. The past, present, and reasonably foreseeable future actions contribute a long-term, beneficial impact on historic structures. These impacts, when combined with Alternative 3, would have long-term beneficial impact on historic resources. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact..

CONCLUSION

Alternative 1

Overall, Alternative 1 would result in long-term, negligible to moderate adverse impacts on historic structures. Alternative 1 would contribute an imperceptible to appreciable adverse increment to long-term, moderate adverse cumulative impacts.

Alternative 2

Overall, Alternative 2 would result in long-term, negligible impact to historic structures since the impacts would be neither adverse nor beneficial and would be below the level of detection. Alternative 2 would contribute an appreciable beneficial increment to long-term beneficial cumulative impacts.

Alternative 3

Overall, Alternative 3 would result in long-term, negligible impact to historic structures since the impacts would be neither adverse nor beneficial and would be below the level of detection. Alternative 3 would contribute an appreciable beneficial increment to long-term beneficial cumulative impacts.

ARCHEOLOGICAL RESOURCES

During the course of the project, a Programmatic Agreement (PA) was developed between the consulting parties (NPS and SHPO), the invited signatories, and the concurring parties. This 2010 PA supports an earlier PA (2008) which details the steps that will be taken in the event that significant resources are found to be present in direct or indirect impact areas within the Park. As is usual in a Section 106 evaluation, these steps involve the assessment of actions having an effect on cultural resources and the avoidance, minimization, or mitigation options that will be developed in response to adverse and no adverse effects determinations.

Terrestrial archeological investigations of portions of study area were reported by the William & Mary Center for Archaeological Research in 2009 (WMCAR 2009) and additional research was performed specific to this project in 2011 (WMCAR 2011a). Phase I and II-level field investigations are now complete and a draft report has been made available to the NPS for review. Based on this preliminary draft, the proposed project would not have an adverse effect on any resources potentially eligible for the National Register. This is because many of the proposed shoreline treatments do not involve any disturbance to upland areas of the riverbank where resources were identified. Rather, the proposed living shoreline approaches (e.g., rock sills, breakwaters) would build seaward from the existing shoreline. For those shoreline treatments where river bank disturbance may be necessary, such as for revetment rehabilitation, the degree of cut is limited to 5 to 10 feet in the horizontal (see Figure 11). Accordingly, areas of disturbance would be limited primarily to the previously engineered slope of the riverbank where no resources have been identified (WMCAR 2011b.). Slightly more extensive excavation would occur under Alternative 2 at Reach II, Sub-Reach “ab” for the installation of a rock sill (see Figure 7). The proposed location of the rock sill, on the downstream side of the mouth of Indian Field Creek, is actually an artificial landform created by hydraulic dredging during the construction of parkway to facilitate the bridge crossing of the creek. Though prehistoric artifacts were recovered from this area during past field investigations (WMCAR 2009) and the area was included as part of an archeological site deemed to be eligible for inclusion on the National Register, subsequent research has shown that the artifacts recovered from the area of Sub-Reach “ab” are likely materials that eroded into the York River and were redeposited during construction. Accordingly, this area does not contribute to the National Register eligibility of the

overall site (WMCAR 2011a). This impact assessment is subject to SHPO review of the completed reports and subsequent coordination with the NPS per the conditions of the PA.

As discussed in "Chapter 3: Affected Environment," an investigation of the study area for potential underwater archeological resources located a single resource; the remnants of a marine railway. Based on the positioning of this resource within the study area relative to the proposed shoreline treatment in the vicinity, it is very likely that final project design can avoid creating an adverse effect. This impact assessment is subject to NPS review and approval of a forthcoming report from Tidewater Atlantic Research, Inc. and subsequent coordination with the SHPO per the conditions of the PA.

VISITOR USE AND EXPERIENCE

METHODOLOGY

NPS *Management Policies 2006* (NPS 2006b) states that enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for the public to enjoy parks. Past planning documents, park statistics, and input from park staff provided background on changes to visitor use and experience over time. Anticipated impacts on visitor use and experience were analyzed using anecdotal information regarding shoreline repairs at kilometer 3 and kilometer 5 and understanding of the construction processes that would be required to implement Alternatives 2 and 3. Based on this evaluation, the following intensity levels were developed:

Past planning documents provided background on changes to visitor use and experience over time. Anticipated impacts on visitor use and experience were analyzed using information from previous studies. Based on these findings, the following intensity levels were developed:

Negligible: Changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the impacts associated with the alternative.

Minor: Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be slightly aware of the impacts associated with the alternative.

Moderate: Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the impacts associated with the alternative and would likely be able to express an opinion about the changes.

Major: Changes in visitor use and/or experience would be readily apparent and would be severely adverse or exceptionally beneficial. The visitor would be aware of the impacts associated with the alternative and would likely express a strong opinion about the changes.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under Alternative 1, the current opportunities for visitor use and experience recreation opportunities would continue. Access to and travel along the parkway would continue as normal, offering visitors connectivity between the Jamestown and Yorktown Units and Colonial Williamsburg. The viewshed of the York River from the parkway would remain unaltered.

Without any repair of existing structures and stabilization of eroding portions of the York River bank, visitor use and experience would be affected by shoreline recession. Unabated recession would continue to migrate towards the parkway surface. The Bellfield Straight area, where the parkway makes its closest approach to the river, would likely be affected first. With each coastal storm event, additional erosion would occur. Gully formation along the level grassy areas above the bank would continue to move landward. As they approach the parkway surface, temporary lane closures or wholesale road closure may be required while reparations are carried out. A major storm event may cause a rapid and extensive landward migration of the shoreline such that the road bed is undermined and the travel lane(s) collapse seaward, necessitating prolonged road closure.

Either scenario would result in the unpredictable cessation of travel along the parkway, disrupting visitor access and enjoyment of the facilities and resources along its route. This may pose a particular burden on visitors who have made long-standing plans to visit the area, only to find portions of it inaccessible. The unique experience of completing the journey from Yorktown to Jamestown, or vice versa, via the parkway would not be feasible. Recreational fishermen may not be able to access the waters at the mouths of around Felgates Creek and Indian Field Creek, further limiting visitor use and experience. The unavailability of park resources may prompt potential park visitors to explore other recreational or historic interpretation options in the vicinity.

Damage to the shoreline also may impact the viewshed as seen from the road. As the viewshed along the parkway was been carefully maintained over the years and has remained largely unaltered over the last 50 years, catastrophic shoreline damage may permanently alter the viewshed or necessitate a change in road alignment relative to the original road course.

Based on these scenarios, the No-action Alternative would have a short-term to long-term, minor to moderate adverse impact on visitor use and experience. This range of impact thresholds reflects the unpredictability of shoreline erosion and the variability in the degree of impact any one storm may have on the shoreline.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that may impact visitor use and experience include the emergency reparations performed at parkway stations kilometer 3 and kilometer 5. Though this action had a short-term impact on visitor use and experience while repairs were being carried out, in the end it represents a beneficial impact on visitor use and experience by reducing the risk to the parkway posed by the imminent threat of shoreline erosion

at two areas. This action, combined with Alternative 1 would result in a long-term, moderate adverse impact on visitor use and experience. Alternative 1 would contribute a noticeable to appreciable adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

Under Alternative 2, existing structures along the York River shoreline within the study area would be rehabilitated and new structures installed in order to provide a comprehensive reduction of the risk posed by shoreline erosion for the parkway and other upland resources. The likelihood of impacts on visitor use and experience would be accordingly diminished under Alternative 2, as the risk of parkway closure or damages to the parkway itself and upland habitat would be greatly diminished. However, short-term impacts would nevertheless occur during project construction. These would include construction equipment on the grassy shoulder of the parkway at Bellfield Straight where gully erosion would be repaired. Partial shoulder or lane closures may be required in this area depending on the type of equipment required to perform the work and convey the materials to the site.

The actual shoreline rehabilitation and repair effort would be conducted from the water. This would avoid interactions between parkway traffic and construction equipment. Nevertheless, the presence of construction equipment within the viewshed and the noise of this equipment may detract from the viewshed and visitor experience. This would occur where visitors have an unobstructed view of the shoreline. Because the project would likely proceed in a phased, reach-by-reach manner, construction equipment and barge approaches would be limited in deployment and hence visibility from the parkway. Some equipment, even though active in close proximity to the parkway, may not be fully visible to passing traffic. This is because the riverbank is very steep (greater than 20 ft) in many locations. This scenario would be especially true along Bellfield Straight. The placement of construction materials in staging areas at Poley Point and Sandy Point, if required, would also present another potential visual detraction and diminish slightly the use of the grassy area for the recreating public. The staging area would be cordoned off and signage posted to indicate that the active work zone is a restricted area. Signage would also inform visitors of the nature and importance of the project and provide information on how to learn more about the work being performed.

Based on the foregoing analysis, these adverse impacts occurring during construction would be offset by the beneficial impacts of the project. Therefore, Alternative 2 would have short-term, minor, and adverse impacts (construction related) and long-term beneficial impacts on visitor use and experience.

Cumulative Impacts

As discussed under Alternative 1, the reparations carried out at parkway stations kilometer 3 and kilometer 5 had a short-term impact on visitor use and experience (construction related) and a beneficial impact on visitor user and experience by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at these two areas. This impact, when combined with

Alternative 2, would have long-term, beneficial impacts on visitor use and experience due to the relative stability that would result for the parkway and other upland resources and habitat. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

The impacts to visitor use and experience arising from the implementation of Alternative 3 would be the same as those discussed for Alternative 2 with the following additions:

- The use of a pile driver would almost certainly result in greater construction related noise, though the sound pressure levels would depend on the type of equipment required; noise abatement measures employed; and the depth to which the piling would be driven. The sound levels generated by the pile driver may require restrictions on visitor access in areas where sheet piling would be installed, including popular fishing and sunbathing areas at Poley Point and Sandy Point.

- The greater height of the pile driver would make this equipment more visible than lower profile equipment that would be hidden in part or wholly behind steep sections of riverbank such as along Bellfield Straight.

Like Alternative 2, these additional construction phase and adverse impacts would be offset by the beneficial impacts of the project. Alternative 3 would have short-term adverse impacts on visitor use and experience during construction. These impacts would be minor overall but moderate in proximity to where sheet pile is being installed. Alternative 3 also would have long-term beneficial impacts on visitor use and experience.

Cumulative Impacts

As discussed under Alternative 1, the reparations carried out at parkway stations kilometer 3 and kilometer 5 had a short-term impact on visitor use and experience (construction related) and a beneficial impact on visitor user and experience by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at these two areas. This impact, when combined with Alternative 3, would have long-term, beneficial impacts on visitor use and experience due to the relative stability that would result for the parkway and other upland resources and habitat. Alternative 3 would contribute an appreciable beneficial increment to this cumulative impact.

CONCLUSION

Alternative 1: No Action

Alternative 1 would have a short-term to long-term, minor to moderate adverse impact on visitor use and experience. This range of impact thresholds reflects the unpredictability of shoreline erosion and the variability in the degree of impact any one storm may have on the shoreline and on parkway access and throughflow. Alternative 1 would contribute a noticeable to appreciable adverse increment to long-term, moderate adverse cumulative impacts.

Alternative 2: NPS Preferred Alternative

Alternative 2 would have short-term, minor, and adverse impacts on visitor use and experience during construction and long-term beneficial impacts due to the greatly diminished risk of parkway damage and loss of other upland resources. Alternative 2 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

Alternative 3

Alternative 3 would have short-term adverse impacts on visitor use and experience during construction. These impacts would be minor overall but moderate in proximity to where sheet piling would be installed. Alternative 3 would have long-term beneficial impacts on visitor use and experience due to the greatly diminished risk of parkway damage and loss of other upland resources. Alternative 3 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

PUBLIC SAFETY

METHODOLOGY

The NPS *Management Policies 2006* state that, "while recognizing that there are limitations on its capability to totally eliminate all hazards, the Service . . . will seek to provide a safe and healthful environment for visitors and employees." The policies also state, "the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education" (NPS 2006).

The purpose of this impact analysis is to identify the level of impact that implementing each of the proposed alternatives would have on the safety of users within the study area at Colonial National Historical Park. The impact thresholds for public safety are defined below.

Negligible: There would be no discernible impact on public safety. If adverse, slight injuries could occur, but none would be reportable.

Minor: The impact would be detectable but would be of a magnitude that would not have an appreciable impact on public safety. If adverse, any reported injury would require first aid that could be provided by park staff.

Moderate: The impacts would be readily apparent and would result in a substantial change in public safety in a manner noticeable to staff and the public. If adverse, any reported injury would require further medical attention beyond what is available by park staff.

Major: The impacts would be readily apparent. If adverse, an injury would result in permanent disability or death.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under Alternative 1, current public safety conditions within the study area would continue. In the context of the project, potential impacts to public safety would arise in response to appreciable shoreline erosion during coastal storm events or unpredictable riverbank slumping unrelated to a discrete storm event but nevertheless caused by storm damage that was sustained at some previous time. Such events would prompt emergency reparations of shoreline areas where the parkway and other upland resources are at imminent risk of loss. This may require temporary lane closures. Such closures may present enhanced risks for vehicular accidents via interaction with construction equipment and the presence of workers on or near the parkway surface. The parkway through the study area is unlit. Lane restrictions on unlit road surfaces many be more challenging to negotiate during the nighttime hours. Some means of automated or manned traffic control may be required to allow manage the two-way flow of traffic through the construction zone.

A catastrophic loss of the parkway road surface also would present a potentially dangerous situation for parkway users. Should passenger vehicles or bicyclists be traveling through the affected area at the time of such a failure, they may not have sufficient time to react to the changing conditions or damaged areas and suffer personal property damage and/or personal injury as a result. As the section of parkway with the project area is unlit, reaction time may be further diminished.

Based on the foregoing analysis, Alternative 1 would have a short-term, minor to moderate adverse impact on public safety as a result of the risks posed by the actual shoreline erosion event itself and the reparations conducted thereafter.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that may impact visitor use and experience include the emergency reparations performed at parkway stations kilometer 3 and kilometer 5. Though this action had a short-term impact on public safety while repairs were being carried out, in the end it represents a beneficial impact on public safety by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at two areas. This action, combined with Alternative 1 would result in a long-term, noticeable adverse impact on public safety. Alternative 1 would contribute a noticeable to appreciable adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

Under Alternative 2, existing structures along the York River shoreline within the study area would be rehabilitated and new structures installed in order to provide a comprehensive reduction of the risk posed by erosion for the parkway and other upland resources. Impacts on public safety would be accordingly improved under Alternative 2, as the risk of parkway close or

damages to the parkway itself and upland habitat would be greatly diminished. However, short-term impacts would nevertheless occur during project construction. These would include the presence and activities of construction equipment on the grassy shoulder of the parkway at Bellfield Straight where gully erosion would be repaired. Partial shoulder or lane closures may be required in this area depending on the type of equipment required to perform the work and convey the materials to the site. The potential for conflicts between construction equipment and recreational traffic may arise. However, traffic restrictions would likely be restricted to daytime hours and lifted at night, allowing traffic to move through the construction zone unimpeded after dark.

The placement of construction materials in staging areas at Poley Point and Sandy Point, if required, would present another potential risk to public safety. However, the staging area would be cordoned off and signage posted to indicate that the active work zone is a restricted area and to discourage visitors from walking upon over climbing over stone materials.

Because the construction equipment required for the shoreline rehabilitation and repair would access the study area from the water, there would be limited opportunity for visitor interaction. The construction site also would be cordoned off and proper signage erected to discourage visitors from accessing the area.

Based on the foregoing analysis, impacts to public safety arising from Alternative 2 would be short-term, minor and adverse (construction related) and long-term and beneficial (post construction).

Cumulative Impacts

As discussed under Alternative 1, the reparations carried out at parkway stations kilometer 3 and kilometer 5 had a short-term impact on public safety (construction related) and a beneficial impact on public safety by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at these two areas. This impact, when combined with Alternative 2, would have long-term, beneficial impacts on public safety due to the relative stability that would result for the parkway and other upland resources and habitat. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

The impacts to public safety arising from the implementation of Alternative 3 would be the same as those discussed for Alternative 2 with the following addition:

- The use of a pile driver would almost certainly result in greater construction related noise, though the sound pressure levels would depend on the type of equipment required; noise abatement measures employed; and the depth to which the piling would be driven. The sound levels generated by the pile driver may require restrictions on visitor access in

areas where sheet piling would be installed in order to prevent potential risks to hearing. Locations include popular fishing and sunbathing areas at Poley Point and Sandy Point.

Like Alternative 2, these additional construction phase and adverse impacts would be offset by the beneficial impacts of the project. Alternative 3 would have short-term adverse impacts on public safety during construction. These impacts would be minor providing that appropriate access restrictions and/or noise abatement measures are carried out where visitors would otherwise be in close proximity to pile driving machinery. Alternative 3 also would have long-term beneficial impacts on visitor use and experience.

Cumulative Impacts

As discussed under Alternative 1, the reparations carried out at parkway stations kilometer 3 and kilometer 5 had a short-term impact on public safety (construction related) and a beneficial impact on public safety by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at these two areas. This impact, when combined with Alternative 3, would have long-term, beneficial impacts on public safety due to the relative stability that would result for the parkway and other upland resources and habitat. Alternative 3 would contribute an appreciable beneficial increment to this cumulative impact.

CONCLUSION

Alternative 1: No Action

Alternative 1 would have a short-term, minor to moderate adverse impact on public safety as a result of the direct risks posed by shoreline erosion events and secondary risks posed by potential visitor interactions with construction zone equipment when reparations are conducted thereafter. Alternative 1 would contribute a noticeable to appreciable adverse increment to long-term, noticeable, adverse cumulative impacts.

Alternative 2: NPS Preferred Alternative

Alternative 2 would have short-term, minor and adverse (construction related) and long-term and beneficial (post construction) impacts on public safety due to the greatly diminished risk of parkway damage and loss of other upland resources. Alternative 2 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

Alternative 3

Alternative 3 would have short-term, minor and adverse (construction related) and long-term and beneficial (post construction) impacts on public safety due to the greatly diminished risk of parkway damage and loss of other upland resources. Alternative 2 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

INFRASTRUCTURE AND PARK OPERATIONS

METHODOLOGY

Operations, for the purpose of this analysis, refer to the quality of effectiveness of the infrastructure and the ability to maintain the infrastructure used in the operation of the park (including the parkway) in order to adequately protect and preserve vital resources and provide for an enhanced visitor experience. This includes an analysis of the condition and usefulness of the facilities and developed features used to support the operations of the park. The thresholds of change for the intensity of this impact are defined as follows:

Negligible: Operations and infrastructure would not be affected, or the impacts would be at low levels of detection and would not have a noticeable impact on operations and infrastructure.

Minor: The impact would be detectable but would be of a magnitude that would not have an appreciable impact on operations and infrastructure.

Moderate: The impacts would be readily apparent and would result in a substantial change in operations and infrastructure in a manner noticeable to staff and the public.

Major: The impacts would be readily apparent, would result in a substantial change in park infrastructure in a manner noticeable to staff and the public, and be markedly different from existing operations and infrastructure.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Impact Analysis

Under Alternative 1, the park would continue to maintain existing infrastructure within the study area. Access to the parkway and popular recreational areas at Felgates Creek and Indian Field Creek would be maintained and these areas managed per current procedures. Shoreline areas and upland portions of riverbanks would be periodically assessed to identify locations where erosion is migrating landward in particularly aggressive fashion and determine if an immediate threat is to park resources is evident. Reparations to such areas would be completed in a piecemeal fashion and on an as-needed basis in response to field observations and recommendations or in response to the catastrophic loss of upland resources, including the parkway roadbed or travel lanes themselves. This latter scenario would require the mobilization of park staff from both the Maintenance and Protection Division in an unpredictable fashion to perform activities such as restricting access to affected portion; assessing any private property damage (e.g., personal vehicles); and acting as a first responder, including administering first aid to injured parties.

Shoreline erosion and the translocation of upland resources into downgradient areas may impact and obstruct stormwater outfalls and result in inadequate drainage for the areas being served by the outfall. The park Maintenance Division staff may be required to carry out relatively minor reparations to the affected riverbank areas, including the clearing of such obstructions. However,

more extensive damage would likely require the use of outside consultants and specialists. Protection Division staff may be required to control traffic around damaged areas immediately after the failure event and monitor construction zones thereafter. In the event of lane restrictions or closures, park staff would inform the public through radio announcements and postings at the Yorktown Battlefield and Jamestown visitor centers. Access to the repaired site may be restricted to park visitors for some time after construction and may require monitoring by park staff on a routine basis to ensure the restored areas are stable. Responsibility for the maintenance of any new shoreline treatment structure that may have been installed as a result of the shoreline erosion event would be assumed by the NPS.

Reacting to unpredictable shoreline erosion events and addressing the resulting damages complicates operational planning and may draw park staff away from scheduled activities in other areas of the park. Overall, Alternative 1 would result in short-term to long-term, minor to moderate adverse impacts on infrastructure and park operations. The range of impact thresholds reflects the unpredictability of shoreline erosion and the variability in the degree of impact any one storm may have on the shoreline as well as the response required to correct the damage it causes.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that may impact infrastructure and park operations include the emergency reparations performed at parkway stations kilometer 3 and kilometer 5. This action had a short-term, adverse impact on infrastructure and park operations while repairs were being carried out. However, overall, it represents a beneficial impact on infrastructure and park operations by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at two areas. This action, combined with Alternative 1 would result in a long-term, noticeable adverse impact on infrastructure and park operations. Alternative 1 would contribute a noticeable to appreciable adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 2: NPS PREFERRED ALTERNATIVE

Impact Analysis

Under Alternative 2, existing structures along the York River shoreline within the study area would be rehabilitated and new structures installed in order to provide a comprehensive reduction in the risk of shoreline erosion for the parkway and other upland resources. Potential impacts on park infrastructure and operations would be improved accordingly under Alternative 2, as the threat of parkway damage, damage to stormwater systems, and the loss of the upland habitat so important to the historic viewshed would be diminished.

The rehabilitation of the NPS Breakwaters at Reach II, Sub-Reach “f” and the creation of a new breakwater system at Reach III, Sub-Reach “a” may present a challenge for park operations in that the beaches that would be developed behind these structures would represent desirable recreational areas. Though the park forbids boat launching and landing from waters along its boundaries, controlling such activities may prove to be difficult and require a change in current park operational procedures.

Short-term impacts on infrastructure and park operations would occur during project construction. These would include performing reparations to areas of gully erosion on the grassy shoulder of the parkway at Bellfield Straight. Partial shoulder or lane closures may be required in this area depending on the type of equipment required to perform the work and convey the materials to the site. Park staff may be called upon to manage traffic around the construction site and erect signage and temporary construction barriers. No changes in park operations would be expected during the construction effort that results in the actual shoreline improvements with the possible exception of monitoring visitor activity in the vicinity of staging areas (should they be required) in order to prevent trespass into restricted construction zones. Erection and maintenance of construction barriers would otherwise be the responsibility of the contractor responsible for performing the shoreline improvements.

Based on the foregoing analysis, Alternative 2 would have a short-term, minor adverse impact on infrastructure and park operations during the construction phase of the project; long-term, minor adverse impacts associated with potential changes in park operations at areas where new beaches would be developed; and long-term beneficial impacts from the project as a whole, which would diminish appreciably the risks of losses to upland infrastructure and the attendant operational challenges of addressing and managing such losses.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that may impact infrastructure and park operations include the emergency reparations performed at parkway stations kilometer 3 and kilometer 5. This action had a short-term, adverse impact on infrastructure and park operations while repairs were being carried out. However, overall, it represents a beneficial impact on infrastructure and park operations by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at two areas. This action, combined with Alternative 2 would result in a long-term, beneficial impact on infrastructure and park operations. Alternative 2 would contribute an appreciable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE 3

Impact Analysis

The impacts to infrastructure and park operations arising from the implementation of Alternative 3 would be the same as those discussed for Alternative 2 with the following exception:

- No breakwater rehabilitation at the NPS Breakwaters or new breakwater installation is proposed. Therefore, managing beach areas for potential recreational use such as boat launching and landing would not be required.

Alternative 3 would have a short-term, minor adverse impact on infrastructure and park operations during the construction phase of the project and long-term beneficial impacts from the project as a whole, which would diminish appreciably the risks of losses to upland infrastructure and the attendant operational challenges of addressing and managing such losses.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions that may impact infrastructure and park operations include the emergency reparations performed at parkway stations kilometer 3 and kilometer 5. This action had a short-term, adverse impact on infrastructure and park operations while repairs were being carried out. However, overall, it represents a beneficial impact on infrastructure and park operations by reducing the risk to the parkway posed by the imminent threat of shoreline erosion at two areas. This action, combined with Alternative 3 would result in a long-term, noticeable beneficial impact on infrastructure and park operations. Alternative 3 would contribute an appreciable beneficial increment to this cumulative impact.

CONCLUSION

Alternative 1: No Action

Alternative 1 would result in short-term to long-term, minor to moderate adverse impacts on infrastructure and park operations. The range of impact thresholds reflects the unpredictability of shoreline erosion and the variability in the degree of impact any one storm may have on the shoreline as well as the response required to correct the damage it causes. Alternative 1 would contribute a noticeable to appreciable adverse increment to long-term adverse cumulative impacts.

Alternative 2: NPS Preferred Alternative

Alternative 2 would have a short-term, minor adverse impact on infrastructure and park operations during the construction phase of the project; long-term, minor adverse impacts associated with potential changes in park operations at areas where new beaches would be developed; and long-term beneficial impacts from the project as a whole, which would diminish appreciably the risks of losses to upland infrastructure and the attendant operational challenges of addressing and managing such losses. Alternative 2 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

Alternative 3

Alternative 3 would have a short-term, minor adverse impact on infrastructure and park operations during the construction phase of the project and long-term beneficial impacts from the project as a whole, which would diminish appreciably the risks of losses to upland infrastructure and the attendant operational challenges of addressing and managing such losses. Alternative 3 would contribute an appreciable beneficial increment to long-term, beneficial cumulative impacts.

5
CONSULTATION AND COORDINATION

NPS DO-12 requires the NPS to make "diligent" efforts to involve the interested and affected public in the NEPA process. This process, known as scoping, helps to determine the important issues and eliminate those that are not; allocate assignments among the interdisciplinary team members and/or other participating agencies; identify related projects and associated documents; identify other permits, surveys, consultations, etc. required by other agencies; and create a schedule that allows adequate time to prepare and distribute the environmental document for public review and comment before a final decision is made. This chapter documents the scoping process for the proposed action, identifies future compliance needs and permits, and includes the list of preparers for the document.

THE SCOPING PROCESS

The scoping process is initiated at the beginning of the NEPA process to identify the range of issues, resources, and alternatives to address in the EA. Typically, both internal and public scoping is conducted to address these elements. State and federal agencies also were contacted in order to uncover any additional planning issues and to fulfill statutory requirements. The planning process for the proposed action was initiated during the internal, agency, and public scoping in the spring of 2010. This process introduced the purpose and need of the project.

INTERNAL SCOPING

Internal scoping for the proposed action was initiated as part of the NEPA process. An internal scoping meeting was held at the park on March 16, 2010. Park staff and other NPS personnel met with their consultants to conduct a site visit, review the purpose and need for the project and potential project constraints, and discuss potential impact topics and cumulative impacts to consider within the EA. During the development of this EA, park and other NPS staff provided planning documents, technical reports, natural resource inventories, and other information to the consultants.

AGENCY CONSULTATION

Various agencies and neighboring property owners were contacted via letter and invited to a scoping meeting at the park held on March 17, 2010. These included the Commander of NWS Yorktown, VIMS, the DEQ Office of Environmental Impact Review, the Commanding Office of

the USCG, the DCR, the USFWS, the SHPO, the USACE, the CCB, the VMRC, and York County Department of Environmental and Developmental Services. Agencies and neighboring landowners not able to attend the meeting were encouraged to provide written comments to the NPS. The correspondence that was received is included in "Appendix A: Relevant Correspondence." At the meeting, VIMS presented a summary of the findings and recommendations of the SMP and answered questions from meeting participants.

The agency consultation is discussed by statutory category below.

Section 7 of the Endangered Species Act

The USFWS did not respond to the invitation to the scoping meeting. A review of the Information, Planning and Conservation (IPaC) database was carried out to determine if federally listed species may occur within the study area. The small whorled pogonia (*Isotria medeoloides*), a federally listed plant, was the only resource identified. As discussed in the section describing Special Status Species in "Chapter 3: Affected Environment," under there is no suitable habitat for this plant within the study area.

Section 106 of the National Historic Preservation Act

During the scoping phase of the project, the NPS determined that the project constitutes an undertaking subject to review under Section 106 of the NHPA and that it may affect properties listed in or eligible for listing in the National Register of Historic Places (NRHP) and what at the time were unidentified archeological resources that may contribute to the significance of the Park, or may be eligible for listing on an individual basis. Accordingly, the NPS consulted with the SHPO pursuant to the 2008 *Programmatic Agreement among the National Park Service (U.S. Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officer* and 36 CFR Part 800.14(b)(1)(ii). A Programmatic Agreement (PA) was developed between the NPS and the SHPO, who jointly agreed on the Area of Potential Effect (APE). This PA details the steps that will be taken in the event that significant resources are found to be present in direct or indirect impact areas. As is usual in a Section 106 evaluation, these steps involve the assessment of actions having an effect on cultural resources and the avoidance, minimization, or mitigation options that will be developed in response to adverse and no adverse effects determinations.

The USACE and FHWA were invited to participate in consultation and both designated the NPS as the lead federal agency to fulfill the responsibilities under Section 106. Other concurring parties to the PA include the Catawba Indian Nation, York County, and the Virginia Council on Indians. A copy of the PA is included in Appendix A.

Other Consultation

In a letter dated March 17, 2010, the DCR noted that the Poley Point Conservation Site and Ballard Creek Ravines Conservation Site intersect the study area. The natural heritage of concern for both sites is the bald eagle. Due to the legal status of the bald eagle, the DCR recommended coordination with the DGIF to ensure compliance with protected species legislation. The DCR

noted that their files do not indicate the presence of any State Natural Area Preserves that are under the DCR's jurisdiction within the project vicinity.

In a letter dated March 17, 2010, the DEQ noted that the Office of Environmental Impact Review is responsible for coordinating Virginia's review of any environmental documents prepared pursuant to NEPA and will comment to the NPS on behalf of the Commonwealth. A similar review process will pertain to the Federal Consistency Determination (FCD) that must be provided pursuant to the Coastal Zone Management Act (CZMA, see section entitled Coastal Zone Management Consistency, below). The DEQ will require 18 copies of this EA and the FCD (Appendix B) when it is finalized.

Both the DCR and DEQ letters are contained within "Appendix A: Relevant Correspondence."

TRIBAL CONSULTATION

The Catawba Indian Nation and the Virginia Council on Indians were consulted for this project per compliance with Section 106 of the NHPA. Both are concurring parties to the PA.

Table 11: Consistency with Applicable Federal Laws, Regulations, and Programs

Law, Regulation, or Program	Brief Description of Compliance
Executive Order 11988 – Floodplain Management	The project would result in long-term, negligible adverse impacts on floodplains. Statements of Finding will be prepared on a phase-by-phase basis in accordance with Executive Order 11988 and NPS DO-77-2 as design plans are advanced. No significant effect on floodplain resources would occur from the proposed action.
Executive Order 11990 – Protection of Wetlands	The project would result in short-term, minor adverse impacts on wetland resources during project construction. The proposed actions would be implemented and managed to comply with Director's Order 77-1: *Wetland Protection* and the related Procedural Manual 77-1 (NPS 2012), including the applicable best management practices and conditions listed in Appendix 2 of the procedural manual. Statements of Finding will be prepared on a phase-by-phase basis in accordance with Executive Order 11988 and NPS DO-77-1 as design plans are advanced.
Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972), Sections 401, 402, and 404 (b)(1). Established to protect the state's water resources.	To the greatest extent practicable, the project would include avoidance and minimization of impacts on wetlands subject to jurisdiction under Section 404 of the Clean Water Act. Unavoidable impacts on Section 404 jurisdictional resources would be permitted through the USACE. A joint Federal/State/Local permit application would be submitted for review and approval once the erosion control design has reached a level sufficient for application. Mitigation is generally not required by the USACE for living shoreline projects since there would be a net increase in wetland resources.

Table 11: Consistency with Applicable Federal Laws, Regulations, and Programs (Cont'd)	
Rivers and Harbors Act of 1899 establishes USACE regulatory authority over U.S. navigable waters. Establishes permit requirements for construction of bridges, causeways, dams, or dikes within or over navigable waters of U.S. Section 10 requires a USACE permit for construction of any "obstruction of navigable waters" of the U.S., and for any excavation, fill, or other modification to various types of navigable waters.	A Section 10 permit would be required from the USACE. A joint Federal/State/Local permit application would be submitted for review and approval once the erosion control design has reached a level sufficient for application.
National Historic Preservation Act of 1966 as amended (16 USC 470 et seq.)	The project would result in no adverse effect to historic properties or cultural landscapes. A Programmatic Agreement has been signed between the NPS and the SHPO and Section 106 coordination is ongoing.
Endangered Species Act of 1973, as amended (16 USC 1531 et seq.)	This EA has determined that no habitat for federally listed species is present within the study area. No adverse impacts on listed species or its habitat are anticipated.
Migratory Bird Treaty Act (16 U.S.C. 703-712)	The study area is owned and protected by the federal government. Short-term, minor adverse impacts on the bald eagle species may occur during the construction phase of the project. The NPS would coordinate with the DGIF to ascertain whether mitigation is appropriate.
Executive Order 12898 – Environmental Justice	The proposed activities would protect upland and aquatic resources from shoreline erosion. Environmental justice has not been identified as a relevant issue.

Table 12: Consistency with Applicable State Laws, Regulations, and Programs	
Law, Regulation, or Program	**Brief Description of Compliance**
DCR is responsible for the issuance, denial, revocation, termination and enforcement of individual and general Virginia Stormwater Management Permits (VSMP) for the control of stormwater discharges from construction activities through the Virginia Stormwater Management Program and as authorized by the Virginia Stormwater Act, Article 1.1 (§ 10.1-603.1 et seq.) of Chapter 6 of Title 10.1 of the Code of Virginia. The Construction General Permit requires the construction site operator to develop and implement a site specific Stormwater Pollution Prevention Plan (SWPPP). Those seeking the permit must thoroughly read and understand its requirements. The SWPPP must be prepared prior to submitting a registration statement for permit coverage to DCR.	The project would disturb between 1.0 to 5.0 acres of land and therefore a Construction General /Stormwater Management - Phase II Land Clearing Permit would be required. The project would comply with the Virginia stormwater regulations through best management design considerations and the implementation of a sedimentation and erosion control program during construction. The project would not be anticipated to result in an exceedance of any surface water quality standard.

Table 12: Consistency with Applicable State Laws, Regulations, and Programs (Cont'd)

Law, Regulation, or Program	Brief Description of Compliance
The Virginia Endangered Species Act (§29.1-563 - §29.1-570) provides that DGIF is the state regulatory authority over federally or state listed endangered or threatened fish and wildlife in the Commonwealth of Virginia.	Correspondence from DGIF indicates state protected species may be present within or in the vicinity of the project. No adverse impacts on listed species are anticipated.
Virginia Endangered Plant and Insect Act (§3.1-1020-1030), Authorizes Virginia Department of Agriculture and Consumer Services to regulate and protect Virginia's endangered plants and insects.	No state listed threatened or endangered plants or insects have been identified as likely to occur within the project area.
Coastal Zone Management Act (CZMA) of 1972, reauthorized 1990 directs state programs to provide for the protection of natural resources within the coastal zone. The Virginia Department of Environmental Quality's (DEQ) Virginia Coastal Zone Management Program (CZMP) is a networked program of state agencies and local governments responsible for administering the enforceable laws and regulations that protect wetlands, dunes, subaqueous lands, fisheries, and air and water quality. The DEQ is the lead agency for coordinating the Commonwealth's review of federal consistency determinations and certifications with cooperating agencies and responding to the appropriate federal agency. The federal consistency regulations implement the CZMA requirement that federal actions that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone must be consistent with the enforceable policies of a coastal state's federally approved coastal management program, before they can occur.	The project is anticipated to be consistent with the enforceable policies of Virginia's CZMP. A Federal Coastal Zone Consistency Determination is included in Appendix B.
Chesapeake Bay Preservation Act (CBPA) and CBPA Designation and Management Regulations (Section 10.1-2100 of the Code of Virginia) is administered at the local level by York County, Section 23.2-1 of the County Code. The purpose of the CPBA is to protect and improve water quality of the Chesapeake Bay, its tributaries, and other state waters by minimizing the effects of human activity within certain lands called Chesapeake Bay Preservation Areas. Removal of existing vegetation within the preservation area may be authorized by the County upon submittal of a Water Quality Impact Assessment (WQIA) documenting that the vegetative buffer functions would be maintained and vegetation replaced.	Upon review of the regulations, the project is anticipated to be consistent with the CBPA. Under Section 23.2-9 of the County Code, shoreline erosion control practices are defined as permitted modifications of the CBA buffer area. However, any clearing deemed necessary in order to gain access to the shoreline would be required to be revegetated in accordance with the Riparian Buffers Modification & Mitigation Guidance Manual.

Table 12: Consistency with Applicable State Laws, Regulations, and Programs (Cont'd)

Law, Regulation, or Program	Brief Description of Compliance
Tidal Wetlands Act (Code of Virginia: 28.2-1300), establishes procedures and law by which localities regulate development within tidal wetlands. York County has adopted the Act under Section 23.1 of County Code.	A local wetlands permit would be required from the York County Wetlands Board. A joint Federal/State/Local permit application would be submitted for review and approval once the erosion control design has reached a level sufficient for application. Living shoreline projects are typically considered self-mitigating and, therefore, no mitigation is anticipated for this project.
Virginia Submerged Lands (Code of Virginia 28.2-1200, sets forth regulations to maintain ungranted beds of bays, rivers, creeks, and shores of the sea to remain in common to be used by all the people of the Commonwealth.	A submerged lands permit would be required from the Virginia Marine Resources Commission. A joint Federal/State/Local permit application would be submitted for review and approval once the erosion control design has reached a level sufficient for application. Mitigation is not typically required for submerged lands impacts, provided there are no affects to shellfish grounds. VMRC would waive any royalty charges associated with sandy fill since the project is a federal activity.
Virginia Water Protection Act (Code of Virginia: 62.1-44.3, 62.1-44.5, 62.1-44.15:5, and 62.1-44.29), establishes the regulation to protect and enhance the Commonwealth's wetland resources and is designed to achieve a no net loss of existing wetland acreage and function.	Under current policy, a VWP permit is not required from the Virginia Department of Environmental Quality (DEQ) for tidal projects as long as permits are received from the issuing agencies, USACE, Virginia Marine Resources Commission, and the acting local wetlands board.

REQUIRED PERMITS AND APPROVALS

In the Commonwealth of Virginia, development in wetland habitats is regulated by statutes at the local, state, and federal levels. Permits would be required under and in accordance with the following regulations.

Clean Water Act Section 404

The proposed action impacts waters of the United States as defined by the Clean Water Act and is therefore subject to review by the USACE. The Clean Water Act Section 404 regulates the discharge of dredged or fill material into waters of the United States, and under Section 404, impacts to wetlands or aquatic habitats may be considered in compliance if the project is water dependent.

Rivers and Harbors Act Section 10

Section 10 of the Rivers and Harbors Act is also administered by the COE and regulates construction, filling, dredging, or excavation in navigable waters of the United States.

Submerged Lands Act (Section 28.2-1200 Code of Virginia)

The Submerged Lands Act is administered by the Virginia Marine Resources Commission and applies to activities that encroach upon or over the beds of the bays and ocean, rivers, streams, and creeks in the state.

Virginia Water Protection Permit

The Virginia Department of Environmental Quality is responsible for review of projects that result in a significant discharge into state waters, which include wetlands. Before the COE can grant a 404 permit, the state must certify that the activity does not violate state water quality standards.

Virginia Stormwater Management Program (VSMP) Permit

The Virginia Department of Conservation and Recreation authorizes stormwater discharge from construction sites that disturb more than 2,500 square feet of land. Regulations require that a Stormwater Pollution Prevention Plan (SWPPP) must be prepared prior to submitting a registration statement for permit coverage under the VSMP.

York County Tidal Wetlands Board (Section 28.2-1300 Code of Virginia)

The York County Tidal Wetlands Board would also review the project since tidal shorelines and wetlands are to be disturbed.

It is anticipated that joint local/state/federal permit process would require a minimum 90 to 120 day process in order to receive all necessary reviews and approvals. The project would be placed before the York County Wetlands Board during one of their monthly scheduled public hearings, followed by the Virginia Marine Resources Commission, which also meets on a monthly basis. The USACE would provide a 30-day public notice period during which agency and public comment is received. The DEQ would likely waive their permit requirements for a VWP permit provide local, state, and federal permits are issued.

Additional agency consultations would be required in the following areas:

- Section 106 of the National Historic Preservation Act requires consultation with the Virginia SHPO
- Section 7 of the Endangered Species Act of 1973 may require additional coordination with the USFWS
- The Virginia Endangered Species Act may require additional coordination with the DGIF

COASTAL ZONE MANAGEMENT CONSISTENCY

Coastal Zone Management (CZM) for the proposed action is federally authorized by the Coastal Zone Management Act, as amended. The coastal zone management program (CZMP) federal consistency review process is described in federal regulation 15 CFR 930: Federal Consistency with Approved Coastal Management Programs. The Coastal Programs Division within the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean and Coastal

Resource Management is in charge of the program. The Coastal Programs Division is responsible for advancing national coastal management objectives and maintaining and strengthening state and territorial coastal management capabilities. It supports states through financial assistance, mediation, technical service and information, and participation in priority state, regional, and local forums. The CZMP leaves day-to-day management decisions at the state level in the 34 states and territories with federally approved coastal management programs, including Virginia.

Pursuant to the CZMA, in 1986, the NOAA approved the Virginia Coastal Zone Management Program (VCP). Accordingly, federal activities which are reasonably likely to affect any land or water use or natural resources of Virginia's designated coastal resources management area must be consistent with the enforceable policies of the VCP. The VCP is a networked program with several agencies administering the enforceable policies. Virginia also has several advisory policies which were established to serve as a discretionary guide during project planning. As the lead agency for the VCP, the Department of Environmental Quality (DEQ) is responsible for coordinating the Commonwealth's review of federal consistency determinations and certifications with cooperating agencies and responding to the appropriate federal agency or applicant.

The VCP is comprised of nine enforceable policies: Fisheries Management; Subaqueous Lands Management; Wetlands Management; Dunes Management; Non-point Source Pollution Control; Point Source Pollution Control; Shoreline Sanitation; Air Pollution Control; and Coastal Lands Management. All federal development projects inside the coastal zone are automatically subject to the consistency regulations and require a federal consistency determination. This determination is included in Appendix B.

LIST OF PREPARERS AND CONTRIBUTORS

This document was prepared by Vanasse Hangen Brustlin, Inc. with assistance from the Virginia Institute for Marine Science and input from staff at Colonial National Historical Park, the NPS Denver Service Center, and the NPS Northeast Region Office.

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Margaret Beavers	Environmental Scientist	Graphics and GIS analysis
Doug DeBerry	Senior Environmental Scientist	Task Manager for wetland delineation. Author of statement of findings for wetlands and floodplains. Natural resource review and analysis
Tracy Hamm	Environmental Planner	Document preparation and analysis.
Timothy Hogan	Senior Engineer	Value analysis specialist.
Brad Ketterling	Project Manager	Guidance of NEPA process; document preparation and review, project management.
Matt Lajoie	Environmental Scientist	Wetland delineation and survey.
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NPS Denver Service Center	
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Northeast Region Office	
Jacki Katzmire	Environmental Protection Specialist
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LIST OF RECIPIENTS

Copies of the EA (either hard copy or CD version) will be distributed to the following government officials and agencies, and nongovernmental organizations. Copies also will be provided to individuals upon request. The names of individuals are not included below.

FEDERAL AGENCIES

Federal Highways Administration, Eastern Federal Lands Highway Division
U.S. Army Corps of Engineers, Norfolk District
U.S. Coast Guard, Training Center Yorktown
U.S. Fish and Wildlife Service, Gloucester Field Office
U.S. Naval Weapons Station Yorktown

TRIBAL NATIONS

Catawba Indian Nation

STATE AGENCIES

Jamestown-Yorktown Foundation
Virginia Council on Indians
Virginia Department of Conservation and Recreation, Natural Heritage Program

Virginia Department of Environmental Quality, Office of Environmental Impact Review
Virginia Department of Historic Resources (State Historic Preservation Officer)
Virginia Marine Resources Commission

LOCAL GOVERNMENTS

York County, Environmental and Development Services
York County, Planning Division

UNIVERSITIES

College of William & Mary, Keck Environmental Field Laboratory
College of William & Mary, Virginia Institute of Marine Sciences

REFERENCES

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APPENDIX A: RELEVANT CORRESPONDENCE

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COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Division of Natural Heritage

217 Governor Street

Richmond, Virginia 23219-2010

(804) 786-7951 FAX (804) 371-2674

March 17, 2010

Dorothy Geyer
National Park Service, Colonial National Historic Park
P.O. Box 210
Yorktown, VA 23690

Re: York River Shoreline Repair and Stabilization, Colonial National Historical Park

Dear Ms. Geyer:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Poley Point Conservation Site and the Ballard Creek Ravines Conservation Site are within the project area. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. They are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. The Poley Point Conservation Site has been given a biodiversity significance ranking of B5, which represents a site of general significance, and the Ballard Creek Ravines Conservation Site has been given a biodiversity significance ranking of B1 which represents a site of outstanding significance. The natural heritage resource of concern associated with both Conservation Sites is:

Bald eagle	*Haliaeetus leucocephalus*	G5/S2S3B,S3N/NL/LT

Bald eagle nest sites are often found in the midst of large wooded areas near marshes or other bodies of water (Byrd, 1991). Bald eagles feed on fish, waterfowl, seabirds (Campbell et. al., 1990), various mammals and carrion (Terres, 1980). Threats to this species include human disturbance of nest sites (Byrd, 1991), habitat loss, biocide contamination, decreasing food supply and illegal shooting (Herkert, 1992). Please note that this species is currently classified as threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Due to the legal status of the Bald eagle, DCR also recommends coordination with the VDGIF to ensure compliance with protected species legislation

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

Our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Shirl Dressler at (804) 367-6913.

Should you have any questions or concerns, feel free to contact me at 804-692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

CC: Amy Ewing, VDGIF

Literature Cited

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Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
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March 17, 2010

Ms. Dorothy Geyer
National Park Service
Colonial National Historical Park
Post Office Box 210
Yorktown, Virginia 23690

RE: Request for Scoping Comments for the Preparation of an Environmental Assessment for the Proposed Shoreline Repair and Stabilization: York River Shoreline, Colonial National Historical Park, York County.

Dear Ms. Geyer:

This is in response to the March 11, 2010 letter from Mr. P. Daniel Smith announcing the preparation of an Environmental Assessment (EA) for the proposed Shoreline Repair and Stabilization: York River Shoreline, at Colonial National Historical Park in York County, Virginia, and soliciting comments on the scope of the document.

PROJECT DESCRIPTION

According to the letter, the shoreline of the York River is subject to wind-driven wave action that has caused moderate to severe erosion within the boundaries of Colonial National Historical Park. Though stone revetments and other means of shore defense have been installed in some locations, unprotected shorelines continue to erode. Under extreme storm conditions such as during Hurricane Isabel in September, 2003, even protected reaches were impacted. Based on the findings and recommendations of the Shoreline Management Plan prepared by the Virginia Institute of Marine Science in 2006, the National Park Service (NPS) will be considering shoreline repairs and stabilization in select locations from Felgates Creek near Cheatham Annex to just west of the U.S. Coast Guard Training Center Yorktown.

ENVIRONMENTAL REVIEW

The roles of the Virginia Department of Environmental Quality (DEQ) in relation to the project under consideration are as follows. First, DEQ's Office of Environmental Impact Review will coordinate Virginia's review of any environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and comment to NPS on behalf of the Commonwealth. A similar review process will pertain to the Federal Consistency Determination (FCD) that must be provided pursuant to the Coastal Zone Management Act (CZMA). If the FCD is included as part of the EA, there can be a single review.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act of 1972, as amended, federal activities affecting Virginia's coastal resources or coastal uses must be consistent with the Virginia Coastal Zone Management Program (VCP) (previously called the Virginia Coastal Resources Management Program) (see section 307(c)(1) of the Act and the *Federal Consistency Regulations*, 15 CFR Part 930, sub-part C). The National Park Service must provide a consistency determination which involves an analysis of the activities in light of the enforceable policies of the VCP (first enclosure), and a commitment to comply with the enforceable policies. In addition, we invite your attention to the advisory policies of the VCP (second enclosure). The Federal Consistency Determination may be provided as part of the NEPA document or independently, depending on your agency's preference; we recommend, in the interests of efficiency for all concerned, that it be provided together with the NEPA document and that 60 days be allowed for review in keeping with the *Federal Consistency Regulations* (see section 930.41(a)). Section 930.39 of the *Federal Consistency Regulations* and Virginia's *Federal Consistency Information Package* at http://www.deq.virginia.gov/eir/federal.html give content requirements for the consistency determination.

PROJECT SCOPING

While this Office does not participate in scoping efforts beyond the advice given herein, other agencies are free to provide scoping comments concerning the preparation of the NEPA document for the proposed project. Therefore, we are sharing your letter (attached) with selected state and local Virginia agencies, which are likely to include the following (note: starred (*) agencies administer one or more of the enforceable policies of the Virginia Coastal Zone Management Program):

- Department of Environmental Quality:
  - Office of Environmental Impact Review
  - Tidewater Regional Office*
  - Air Division*
  - Waste Division
- Department of Game and Inland Fisheries*
- Department of Conservation and Recreation:

  - Division of Soil and Water Conservation*
  - Division of Chesapeake Bay Local Assistance*
  - Division of Planning and Recreation Resources
- Marine Resources Commission*
- Department of Agriculture and Consumer Services
- Department of Health*
- Department of Mines, Minerals, and Energy
- Department of Historic Resources
- Virginia Institute of Marine Science
- Hampton Roads Planning District Commission
- York County.

In order to ensure an effective coordinated review of the EA and FCD, we will require 18 copies of the document when it is published. The submission may include 4 hard copies and 14 CDs or 4 hard copies and an electronic copy available for download at a National Park Service web or ftp site. The document should include a U.S. Geological Survey topographic map as part of its information. We recommend, as well, that project details unfamiliar to people outside the NPS be adequately described.

If you have questions about the environmental review process or the federal consistency review process, please feel free to call me at (804) 698-4325 or John Fisher of this Office at (804) 698-4339.

I hope this information is helpful to you.

Sincerely,

Ellie L. Irons, Manager
Office of Environmental Impact Review

Attachments

Ec: Cindy Keltner, DEQ-TRO
Kotur S. Narasimhan, DEQ-Air
Paul Kohler, DEQ-Waste
Amy Ewing, DGIF
Robbie Rhur, DCR
Pam Mason, VIMS
Tony Watkinson, MRC
Barry Matthews, VDH
Scott Johnson, DMME
Keith Tignor, VDACS

Cc: Roger Kirchen, DHR
Dwight Farmer, Hampton Roads PDC
Albert Maddalena, York County

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
TDD (804) 698-4021
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Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

Attachment 1

Enforceable Regulatory Programs comprising Virginia's Coastal Resources Management Program (VCP)

a. Fisheries Management - The program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities. This program is administered by the Marine Resources Commission (VMRC); Virginia Code 28.2-200 to 28.2-713 and the Department of Game and Inland Fisheries (DGIF); Virginia Code 29.1-100 to 29.1-570.

The State Tributyltin (TBT) Regulatory Program has been added to the Fisheries Management program. The General Assembly amended the Virginia Pesticide Use and Application Act as it related to the possession, sale, or use of marine antifoulant paints containing TBT. The use of TBT in boat paint constitutes a serious threat to important marine animal species. The TBT program monitors boating activities and boat painting activities to ensure compliance with TBT regulations promulgated pursuant to the amendment. The VMRC, DGIF, and Virginia Department of Agriculture Consumer Services (VDACS) share enforcement responsibilities; Virginia Code 3.1-249.59 to 3.1-249.62.

b. Subaqueous Lands Management - The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, tidal wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the Department of Environmental Quality (DEQ). The program is administered by the Marine Resources Commission; Virginia Code 28.2-1200 to 28.2-1213.

c. Wetlands Management - The purpose of the wetlands management program is to preserve wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation.

(1) The tidal wetlands program is administered by the Marine Resources Commission; Virginia Code 28.2-1301 through 28.2-1320.

(2) The Virginia Water Protection Permit program administered by DEQ includes protection of wetlands --both tidal and non-tidal; Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

d. Dunes Management - Dune protection is carried out pursuant to The Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission; Virginia Code 28.2-1400 through 28.2-1420.

e. Non-point Source Pollution Control – (1) Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by the Department of Conservation and Recreation; Virginia Code 10.1-560 et.seq.).

(2) Coastal Lands Management is a state-local cooperative program administered by the DCR's Division of Chesapeake Bay Local Assistance and 84 localities in Tidewater (see i) Virginia; Virginia Code §10.1-2100 –10.1-2114 and 9 VAC10-20 et seq.

f. Point Source Pollution Control - The point source program is administered by the State Water Control Board (DEQ) pursuant to Virginia Code 62.1-44.15. Point source pollution control is accomplished through the implementation of:

(1) the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to Section 402 of the federal Clean Water Act and administered in Virginia as the Virginia Pollutant Discharge Elimination System (VPDES) permit program.

(2) The Virginia Water Protection Permit (VWPP) program administered by DEQ; Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

g. Shoreline Sanitation - The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth. This program is administered by the Department of Health (Virginia Code 32.1-164 through 32.1-165).

h. Air Pollution Control - The program implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (Virginia Code 10-1.1300 through §10.1-1320).

(i) Coastal Lands Management is a state-local cooperative program administered by the DCR's Division of Chesapeake Bay Local Assistance and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act; Virginia Code §10.1-2100 –10.1-2114 and Chesapeake Bay Preservation Area Designation and Management Regulations; Virginia Administrative Code 9 VAC10-20 et seq.

Attachment 2

Advisory Policies for Geographic Areas of Particular Concern

a. Coastal Natural Resource Areas - These areas are vital to estuarine and marine ecosystems and/or are of great importance to areas immediately inland of the shoreline. Such areas receive special attention from the Commonwealth because of their conservation, recreational, ecological, and aesthetic values. These areas are worthy of special consideration in any planning or resources management process and include the following resources:

a) Wetlands
b) Aquatic Spawning, Nursery, and Feeding Grounds
c) Coastal Primary Sand Dunes
d) Barrier Islands
e) Significant Wildlife Habitat Areas
f) Public Recreation Areas
g) Sand and Gravel Resources
h) Underwater Historic Sites.

b. Coastal Natural Hazard Areas - This policy covers areas vulnerable to continuing and severe erosion and areas susceptible to potential damage from wind, tidal, and storm related events including flooding. New buildings and other structures should be designed and sited to minimize the potential for property damage due to storms or shoreline erosion. The areas of concern are as follows:

i) Highly Erodible Areas
ii) Coastal High Hazard Areas, including flood plains.

c. Waterfront Development Areas - These areas are vital to the Commonwealth because of the limited number of areas suitable for waterfront activities. The areas of concern are as follows:

i) Commercial Ports
ii) Commercial Fishing Piers
iii) Community Waterfronts

Although the management of such areas is the responsibility of local government and some regional authorities, designation of these areas as Waterfront Development Areas of Particular Concern (APC) under the VCRMP is encouraged. Designation will allow the use of federal CZMA funds to be used to assist planning for such areas and the implementation of such plans. The VCRMP recognizes two broad classes of priority uses for waterfront development APC:

i) water access dependent activities;
ii) activities significantly enhanced by the waterfront location and complementary to other existing and/or planned activities in a given waterfront area.

County Administration

County Administrator
James O. McReynolds

York County
VIRGINIA
America's Future Since 1781

Administrative/Legislative Services
Economic Development
Real Estate Assessment
Public Information
Planning

November 30, 2010

P. Daniel Smith
Superintendent
Colonial National Historical Park
P.O. Box 210
Yorktown, VA 23690

Dear Dan:

Thank you for your November 18th letter inviting York County to participate in the consultation process concerning the Section 106 review for the York River Shoreline Stabilization Project being planned by the Park Service. York County does wish to participate and the Programmatic Agreement signature page executed by Mr. McReynolds, County Administrator, is enclosed.

Should additional information or documentation be needed at this time, please let us know.

Sincerely,

Mark

J. Mark Carter
Assistant County Administrator

Enclosure

224 Ballard Street • P.O. Box 532 • Yorktown, Virginia 23690-0532 • (757) 890-3320
Fax: (757) 890-4000 •TDD (757) 890-3300 • Email: ctyadm@yorkcounty.gov
A Hampton Roads Community

Preserving America's Heritage

January 4, 2011

Mr. P. Daniel Smith
Superintendent
Colonial National Historical Park
National Park Service
P.O. Box 210
Yorktown, VA 23690

Ref: Proposed York River Shoreline Stabilization Project
York County, Virginia

Dear Mr. Smith:

The Advisory Council on Historic Preservation (ACHP) recently received your notification and supporting documentation regarding the development of a Programmatic Agreement (PA) for the referenced undertaking. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to develop this agreement is needed. However, if we receive a request for participation from the State Historic Preservation Officer (SHPO), a Tribal Historic Preservation Officer, an affected Indian tribe, a consulting party or other party, we may reconsider this decision. Additionally, should circumstances change and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final PA, developed in consultation with the Virginia SHPO and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act. Please ensure the consulting parties receive a copy of this letter.

Thank you for providing us with your notification of adverse effect. If you have any questions or need additional assistance, please contact Katry Harris at 202-606-8520, or via email at kharris@achp.gov.

Sincerely,

Raymond V. Wallace

Raymond Wallace
Historic Preservation Technician
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION
1100 Pennsylvania Avenue NW, Suite 803 □ Washington, DC 20004
Phone: 202-606-8503 □ Fax: 202-606-8647 □ achp@achp.gov □ www.achp.gov

COMMONWEALTH of VIRGINIA

Department of Historic Resources

Douglas W. Domenech
Secretary of Natural Resources

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Kathleen S. Kilpatrick
Director

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January 19, 2011

P. Daniel Smith, Superintendent
United States Department of the Interior
National Park Service
Colonial National Historical Park
P.O. Box 210
Yorktown, VA 23690

RE: York River Shoreline Stabilization Project
Colonial National Historical Park
York County, Virginia
DHR File No. 2010 - 0376

Dear Mr. Smith:

Thank you for offering us the opportunity to participate in the Programmatic f Agreement for the referenced project. Our director's signature on the document evidences our concurrence.

We appreciate the efforts of you and your staff, in particular Mr. Jonathan Connolly to bring the Section 106 process to a successful resolution.

We look forward to working with you on this project. If you have any questions, or if we may provide any further assistance, please do not hesitate to contact me at (804) 367-2323, ext. 112; fax (804) 367-2391; e-mail ethel.eaton@dhr.virginia.gov.

Sincerely,

Ethel R Eaton

Ethel R. Eaton, Ph.D., Senior Policy Analyst
Division of Resource Services and Review

PROGRAMMATIC AGREEMENT
Between
THE NATIONAL PARK SERVICE
and
THE VIRGINIA STATE HISTORIC PRESERVATION OFFICE
CONCERNING
THE YORK RIVER SHORELINE STABILIZATION PROJECT
in
YORK COUNTY, VIRGINIA

WHEREAS, Colonial National Historical Park (Park) is a unit of the National Park Service (NPS) and is charged to meet the directives of the NPS Organic Act of 1916 (P.L. 64-235, 39 Stat. 535) to "conserve the scenery and the natural and historic objects and the wildlife 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", as it applies to the Colonial Parkway and Yorktown Battlefield; and

WHEREAS, the NPS intends to stabilize the York River Shoreline, bordering the Park, between Felgates Creek and the Park boundary with the U.S. Coast Guard Training Center, to protect the Colonial Parkway, Yorktown Battlefield, and other significant historic properties within the Park (Project); and

WHEREAS, the Project is proposed along four reaches along the York River and the reaches have been delineated as follows: Reach I- from the point of land known as the Ringfield Picnic Area, at the mouth of Felgates Creek, downstream to the mouth of Indian Field Creek; Reach II- from the mouth of Indian Field Creek downstream to the northern end of the Naval Weapons Station Piers; Reach III- from the southern end of the Naval Weapons Station Enclosure Piers to the mouth of Yorktown Creek; Reach IV- from Cornwallis Cave to the common boundary of the Park and the U.S Coast Guard Training Center in the vicinity of the Moore House, as shown on the attached maps and aerial images (Figures 1a-2b); and

WHEREAS, the NPS has determined that this Project constitutes an undertaking subject to review under Section 106 of the National Historic Preservation Act (NHPA), 16 USC § 470f, and *Protection of Historic Properties*, its implementing regulations, 36 CFR Part 800, herein referred to as Section 106; and

WHEREAS, the NPS has determined that implementation of this Project may affect properties listed in or eligible for listing in the National Register of Historic Places (NRHP) and as yet unidentified archeological resources that may contribute to the significance of the Park, or may be eligible for listing on an individual basis, and the NPS has consulted with the Virginia State Historic Preservation Officer (SHPO) pursuant to the 2008 *Programmatic Agreement among the National Park Service (U.S. Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officer* (2008 PA) and 36 CFR Part 800.14(b)(1)(ii); and

WHEREAS, the NPS proposes to phase implementation of the Project by identified reaches and the NPS proposes to phase identification and evaluation of historic properties accordingly, pursuant to 36 CFR Part 800.4(b)(2); and

WHEREAS, the NPS in consultation with the SHPO has determined the area of potential effects (APE) for this Project, and the APE is depicted on the attached maps and aerial images (Figures 1a-2b); and

WHEREAS, the NPS has notified the Advisory Council on Historic Preservation (ACHP) of the potential adverse effect pursuant, to 36 CFR Part 800.6(a)(1) and 36 CFR Part 800.14(b)(3) and has invited the ACHP to participate in consultation and the ACHP has declined to participate; and

WHEREAS, the U.S. Army Corps of Engineers (USACE) will be designing a portion of the stabilization structures and pursuant to Section 404 of the Clean Water Act, a Department of the Army permit will likely be required for this Project, and the USACE has designated the NPS as the lead federal agency to fulfill federal responsibilities under Section 106; and

WHEREAS, the NPS may at some future time apply to the Federal Highway Administration (FHWA) for funding for road improvements and/or construction associated with the Colonial Parkway and the FHWA has been invited to participate in consultation and the FHWA has designated the NPS as the lead federal agency to fulfill responsibilities under Section 106; and

WHEREAS, pursuant to 36 CFR 800.2, the NPS has invited the Catawba Indian Nation (CIN-THPO) to participate in government-to-government consultation in accordance with 36 CFR 800.2(c) (2) (ii) (C) and to sign this Agreement as a concurring party and the CIN-THPO has elected to concur in this Agreement; and

WHEREAS, pursuant to 36 CFR Part 800.2(c)(3)the NPS has invited York County to participate in consultation and sign this Agreement as a concurring party and York County has elected to participate; and

WHEREAS, pursuant to 36 CFR 800.2 (5) the NPS has invited the Virginia Council on Indians (VCI) to participate in consultation and sign this Agreement as a concurring party and the VCI has elected to participate; and

WHEREAS, the NPS has solicited and considered the views of the public using its National Environmental Policy Act public involvement procedures pursuant to 40 CFR Part 1500.2(d) and 40 CFR Part 1506.6;

NOW THEREFORE, the NPS and the SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

The NPS shall ensure that the following measures are carried out.

I. CONSULTATION

The NPS shall consult with the SHPO in carrying out the terms of this agreement. Such consultation may include but not be limited to:

Written correspondence

Conference calls

Face-to-face meetings

Field visits

II. PLANNING AND COMPLIANCE PREPARATION

A. Consistent with the provisions of the 2008 PA, the NPS shall prepare documentation for the actions using the "Assessment of Actions Having an Effect on Cultural Resources" form (also called the Assessment of Effect form). Any forms will be reviewed by cultural resource advisors who meet the professional qualifications set forth in the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* in the fields of archeology, history, historic landscape architecture, and historic architecture.

B. Actions that meet the criteria for streamlined review, found in Stipulation III.C of the 2008 PA, will require no further review. The NPS shall submit Assessment of Effect forms to the SHPO to document actions that the NPS considers to meet the criteria for streamlined review, found in Stipulation III.C of the 2008 PA. If the criteria for streamlined review are not met, the NPS shall submit the assessment forms to the SHPO for review and comment.

C. The NPS shall develop plans and specifications for implementing the actions on land compatible with the historic structures, contributing landscapes and landscape features of the Colonial Parkway and Yorktown Battlefield and consistent with the recommended approaches to preserving its historic setting; and will provide the SHPO with a set of design plans for review.

D. If the NPS determines that the proposed shoreline stabilization may alter the qualities that make a contributing structure, landscape or landscape feature significant, the NPS will prepare design alternatives and/or landscape treatment plans to avoid, minimize, or mitigate the Project's adverse effects for submission to the SHPO for review and approval prior to implementation.

III. REVIEW REQUIREMENTS

A. The NPS shall submit all construction drawings and documents in draft form to the SHPO and other consulting parties for their/its review and comment with a 30 day response time. This includes all required plans, such as detailed construction plans for the various types of stabilization structures proposed for the different reaches. The plans will include types of equipment used, staging areas, equipment access, all ground disturbing activity, including tree and vegetation removal and use of trails and roadways.

B. All final drawings will be provided to the SHPO and other consulting parties prior to the commencement of construction.

IV. IDENTIFICATION, EVALUATION, AND TREATMENT OF HISTORIC PROPERTIES

A. For each reach of the proposed shoreline stabilization project, the NPS shall ensure that an archeological survey program, for identification of terrestrial and submerged archeological sites within the Project APE, is developed in consultation with the SHPO and other consulting parties. Prior to affecting any potentially eligible archeological site, the NPS shall develop a testing program of sufficient intensity to provide an evaluation of eligibility for the (NRHP) in consultation with SHPO and other consulting parties, following the regulations outlined in 36 CFR Part 800.4(c).

B. If, as a result of the testing program, archeological sites are identified within the Project APE that are eligible for the NRHP, the NPS shall develop a plan for their avoidance, protection, or recovery of information in consultation with the SHPO and other consulting parties. The plan shall be submitted to the SHPO and other consulting parties for review and comment prior to implementation.

C. All data recovery plans prepared under the terms of this Agreement shall include the following elements:

1. Information on the archeological property or properties where data recovery is to be carried out, and the context in which such properties are eligible for the National Register;

2. Information on any property, properties, or portions of properties that will be destroyed without data recovery;

3. Discussion of the research questions to be addressed through the data recovery with an explanation/ justification of their relevance and importance;

4. Description of the recovery methods to be used, with an explanation of their pertinence to the research questions; and

5. Information on arrangements for any regular progress reports or meetings to keep the SHPO and other consulting parties up to date on the course of the work. The plan should contain the expected timetable for excavation, analysis and preparation of the final report.

D. If the NPS determines that the proposed Project may alter the qualities that make a contributing structure, landscape or landscape feature significant, the NPS shall prepare design alternatives and/or landscape treatment plans to avoid, minimize, or mitigate the project's adverse effects and submit the design alternatives to the SHPO and other consulting parties for review and comment prior to implementation.

V. REPORTING REQUIREMENTS

A. For each phase of the proposed upgrade, the NPS shall provide to the SHPO and other consulting parties a draft summary or letter report briefly describing the findings of the work, required in Stipulation IV of this document, for review and comment. The summary/letter report shall include, as appropriate, recommendations on NRHP eligibility or potential eligibility of all identified archaeological sites, cultural landscapes and landscape features, recommendations for further archaeological or cultural landscape surveys, the potential effects of the Project on historic properties, and suggested measures to resolve adverse effects through avoidance, minimization or mitigation.

B. The SHPO and other consulting parties shall provide their comments to the NPS within thirty (30) calendar days from receipt of the draft summary/letter report. If no comments are received within the thirty (30) day comment period, the NPS may assume that the non-

responding party has no comments. If the consulting parties concur with the recommendations for that phase, the NPS may proceed with the next step in the process for that phase. If the consulting parties do not concur with the NPS' recommendations for that phase, the parties shall consult further to resolve the issues following the provisions for dispute resolution in Stipulation IX of this document.

C. The NPS shall ensure that the draft summaries/letter reports for all phases of the Project are incorporated into one final technical report. The SHPO and other consulting parties shall provide their comments on the draft technical report to the NPS within thirty (30) calendar days from receipt of the draft report. If no comments are received within the thirty (30) day comment period, the NPS may assume that the non-responding party has no comments. The NPS shall ensure that all comments on the draft technical report received in a timely manner are considered in preparation of the final report. Once the NPS has approved the final report, the NPS shall submit two (2) archivally-bound hardcopies and one electronic copy in Adobe® Portable Document Format (.pdf) to the SHPO and one (1) copy of that document to each of the consulting parties in a format mutually agreed to.

D. All cultural resource work performed under the terms of this Agreement shall be carried out by or under the direct supervision of a professional who meets the *Secretary of the Interior's Professional Qualifications Standards* (48 FR 44739) in the appropriate discipline.

    1. All archaeological studies conducted on submerged sites will be carried out by an archeologist trained in underwater archeology using current methods and equipment.

    2. Archeologists working on submerged sites within the Project APE will secure all necessary permits from the Virginia Marine Resources Commission and the Corps prior to conducting field work.

E. All archaeological studies conducted pursuant to this Agreement shall be consistent with the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716-44742, September 1983), the ACHP's *Section 106 Archeology Guidance* (June 2007) and the SHPO's *Guidelines for Archaeological Investigations in Virginia* (July 2009), and subsequent revisions or replacements.

F. All historical, architectural and landscape studies resulting from this Agreement shall be consistent with pertinent standards and guidelines of the Secretary of the Interior, including, as applicable, the Secretary of the Interior's *Standards and Guidelines for Historical Documentation* (48 FR 44728-30) and for *Architectural and Engineering Documentation* (48 FR 44730-34), the SHPO's *Guidelines for Conducting Cultural Resource Survey in Virginia* (rev. 2003), and "Photographic Documentation for National Park Service (NPS) Register Nominations and Virginia Department of Historic Resources (DHR) Basic Survey" (Updated Sept. 13, 2006), and subsequent revisions or replacements.

G. Upon the completion of all stipulations to this Agreement, the NPS shall circulate to the SHPO and the other consulting parties a signed memorandum documenting that the NPS has fulfilled all its responsibilities under this Agreement.

VI. CURATION

Within thirty (30) days of the NPS' approval of the final technical report, the NPS shall deposit all archeological materials and appropriate field and research notes, maps, drawing and photographic records collected as a result of archeological investigations arising from this Agreement (with the exception of human skeletal remains and associated funerary objects) for permanent curation with the NPS repository at Yorktown, a repository which meets the requirements in 36 CFR 79, *Curation of Federally Owned and Administered Archeological Collections*. All such items shall be made available to educational institutions and individual scholars for appropriate exhibit and/or research under the operating policies of the NPS.

VII. POST REVIEW DISCOVERIES

A. The NPS shall ensure that all construction documents include the following provisions:

1. If previously unidentified historic properties or unanticipated effects to historic properties are discovered during construction, the construction contractor shall immediately halt all activity within a one hundred (100) foot radius of the discovery, notify NPS of the discovery and implement interim measures to protect the discovery from looting and vandalism.

2. Immediately upon receipt of the notification required in Stipulation VII.A.1 of this document, the NPS shall

   (a) inspect the construction site to determine the extent of the discovery and ensure that construction activities have halted;

   (b) clearly mark the area of the discovery;

   (c) implement additional measures, as appropriate, to protect the discovery from looting and vandalism; and

   (d) have a professional archeologist inspect the construction site to determine the extent of the discovery and provide recommendations regarding its NRHP eligibility and treatment; and

   (e) notify the SHPO and other consulting parties of the discovery describing the measures that have been implemented to comply with Stipulations VII.A.1 and A.2 of this document.

3. Within forty-eight (48) hours of receipt of the notification described in Stipulation VII.A.2 (e) of this document, the NPS shall provide the SHPO and other consulting parties with its assessment of the NRHP eligibility of the discovery and the measures it proposes to take to resolve adverse effects. In making its official evaluation, the NPS, in consultation with the SHPO and other consulting parties may assume the discovery to be NRHP eligible for the purposes of Section 106 pursuant to 36 CFR Part 800.13(c). The SHPO and other consulting parties shall respond within forty-eight (48) hours of receipt.

4. The NPS, which shall take into account the consulting parties' recommendations on eligibility and treatment of the discovery, shall ensure that appropriate actions are carried out and provide the SHPO and the other consulting parties with a report on these actions when they have been implemented.

5. Construction activities may proceed in the area of the discovery when the NPS has determined that implementation of the actions undertaken to address the discovery pursuant to Stipulation VII.A are complete.

VIII. HUMAN REMAINS

A. The NPS shall make all reasonable efforts to avoid disturbing gravesites, including those containing Native American human remains and associated funerary artifacts. The NPS shall treat all human remains in a manner consistent with the ACHP's "Policy Statement Regarding Treatment of Burial Sites, Human Remains and Funerary Objects" (February 23, 2007; http://www.achp.gov/docs/hrpolicy0207.pdf) or ACHP policy in effect at the time remains and funerary artifacts are handled.

1. If the remains found on federal lands are determined to be of Native American origin, the NPS shall comply with the provisions of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. Sec 3001 et seq.). If the remains are found on private lands or are determined not to be of Native American origin, the NPS shall comply with the Virginia Antiquities Act, Section 10.1-2305 of the Code of Virginia, final regulations adopted by the Virginia Board of Historic Resources and published in the Virginia Register on July 15, 1991, or subsequent revisions.

2. The NPS shall use reasonable efforts to ensure that the general public is excluded from viewing any burial site or associated funerary artifacts. The consulting parties to this Agreement shall release no photographs of any burial site or associated funerary artifacts to the press or general public. The NPS shall notify the CIN-THPO, the VCI, or individual Virginia tribes when burials, human skeletal remains, or funerary artifacts are encountered on the project.

IX. DISPUTE RESOLUTION

A. Should any consulting party object in writing to the NPS regarding any action carried out or proposed with respect to this Agreement or the implementation of its terms, the NPS shall consult with the objecting party in an effort to resolve the objection. If, after initiating such consultation, the NPS determines that the objection cannot be resolved, the NPS shall:

1. Forward all documentation relevant to the dispute, including the NPS' proposed resolution, to the ACHP. The ACHP shall provide the NPS with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the NPS shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the

ACHP, consulting parties to this Agreement, and provide them with a copy of this written response. The NPS will then proceed according to its final decision.

2. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, the NPS may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the NPS shall prepare a written response that takes into account any timely comments regarding the dispute from the consulting parties to this Agreement, and provide them and the ACHP with a copy of such written response.

B. The NPS' responsibility to carry out all actions under this Agreement that is not the subject of the objection remains unchanged.

C. At any time during implementation of the measures stipulated in this Agreement, should an objection pertaining to this Agreement or the effect of the Project on historic properties be raised by a member of the public, the NPS shall notify the other consulting parties, and attempt to resolve the objection. If the NPS determines that the objection cannot be resolved, the NPS shall comply with Stipulations IX.A and IX.B of this document.

X. AMENDMENT

Any signatory to this Agreement may propose to the NPS that it be amended or modified, whereupon NPS shall consult with the consulting parties to consider such an amendment. This Agreement may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date it is signed by all of the signatories and filed with the ACHP.

XI. TERMINATION

A. If any signatory determines that the terms of this Agreement will not or cannot be carried out, that party shall immediately consult with the other signatories and concurring parties to seek an amendment in accordance with Stipulation X of this document. If within thirty (30) days an amendment cannot be reached, any signatory may terminate the Agreement upon written notification to the other signatories and concurring parties.

B. Once the Agreement is terminated, and prior to work continuing on the Project, the NPS must either (a) execute another Programmatic Agreement or a Memorandum of Agreement pursuant to 36 CFR Part 800.14(b) or 36 CFR Part 800.6, respectively, or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR Part 800.7. The NPS shall notify the signatories as to the course of action it will pursue.

C. In the event that this Agreement is terminated, the NPS shall submit to the SHPO and the other consulting parties a technical report with the results of any surveys or treatment measures that have been implemented to date, up to and including the date of termination.

XII. DURATION OF AGREEMENT

This Agreement shall continue in full force and effect until five (5) years after the date of the last signature of a signatory party. At any time in the six (6)-month period prior to such date, the NPS may request the SHPO to consider an extension or modification of this agreement. No extension or modification shall be effective unless all signatory parties to this Agreement have agreed with it in writing.

Execution of this Agreement by the NPS, the SHPO, and its submission to the ACHP in accordance with 36 CFR Part 800.6(b) (1) (iv), shall, pursuant to 36 CFR Part 800.6(c), be considered to be an agreement with the ACHP for the purposes of Section 110(l) of the NHPA. Execution and submission of this Agreement and implementation of its terms evidence that the NPS has afforded the ACHP an opportunity to comment on the Project and its effects on historic properties, and that the NPS has taken into account the effects of the Project on historic properties.

Signatories:

National Park Service

By: _____ Date: 01/ /11

P. Daniel Smith
Superintendent
Colonial National Historical Park

Virginia Department of Historic Resources

By: _____ Date: 1/19/11

Kathleen S. Kilpatrick
Director
Virginia State Historic Preservation Officer

RCVD 7 DEC

Concurring parties:

Catawba Indian Nation

By: Wenonah G. Haire, DNP Date: 11/29/10

Dr. ~~Ms.~~ Wenonah G. Haire
Tribal Historic Preservation Officer

* Note: Any reference to SHPO should also include CIN-THPO. We wish to be consulted on all these issues the same as SHPO.

Army Corps of Engineers

[redacted]

By: _____ Date: _____

Keith Lockwood, Acting Chief, Regulatory Branch, Department of the Army

Virginia Council on Indians

By: _____ Date: _____

Deanna Beacham, Program Specialist

York County

By: _____ Date: _____

James O. McReynolds, County Administrator

Federal Highways Administration

By: _____ Date: _____

John Simkins, Senior Environmental Specialist

Concurring parties:

Catawba Indian Nation

By: _____ Date: _____
Dr. Wenonah G. Haire
Tribal Historic Preservation Officer

Army Corps of Engineers

By: _____ Date: 9 MAR 11

Andrew W. Backus, P.E., PMP
Colonel, U.S. Army
Commanding

Virginia Council on Indians

By: _____ Date: _____

Deanna Beacham, Program Specialist

York County

By: _____ Date: _____

James O. McReynolds, County Administrator

Federal Highways Administration

By: _____ Date: _____

John Simkins, Senior Environmental Specialist

Concurring parties:

Catawba Indian Nation

By: _____ Date: _____
Ms. Wenonah G. Haire
Tribal Historic Preservation Officer

Army Corps of Engineers

By: _____ Date: _____

Keith Lockwood, Acting Chief, Regulatory Branch, Department of the Army

Virginia Council on Indians

By: Deanna Beacham Date: 11/23/2010

Deanna Beacham, Program Specialist

York County

By: _____ Date: _____

James O. McReynolds, County Administrator

Federal Highways Administration

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John Simkins, Senior Environmental Specialist

Concurring parties:

Catawba Indian Nation

By: _____ Date: _____
Ms. Wenonah G. Haire
Tribal Historic Preservation Officer

Army Corps of Engineers

By: _____ Date: _____

Keith Lockwood, Acting Chief, Regulatory Branch, Department of the Army

Virginia Council on Indians

By: _____ Date: _____

Deanna Beacham, Program Specialist

York County

Approved as to form:
County Attorney

By: _____ Date: 11/29/10

James O. McReynolds, County Administrator

Federal Highways Administration

By: _____ Date:

John Simkins, Senior Environmental Specialist

Concurring parties:

Catawba Indian Nation

By: _____ Date: _____
Dr. Wenonah G. Haire
Tribal Historic Preservation Officer

Army Corps of Engineers

By: _____ Date: _____

Andrew W. Backus, P.E., PMP
Colonel, U.S. Army
Commanding

Virginia Council on Indians

By: _____ Date: _____

Deanna Beacham, Program Specialist

York County

By: _____ Date: _____

James O. McReynolds, County Administrator

Federal Highway Administration

By: John Dunkins Date: 4/8/11

for: Irene Rico, Division Administrator

APPENDIX B: FEDERAL CONSISTENCY DETERMINATION

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INTRODUCTION

This document provides the National Park Service's Consistency Determination as required by the Coastal Zone Management Act of 1972, section 307(c)(1) and 15 CFR Part 930, subpart C. Based upon the information, data, and analysis provided below and in the EA, the National Park Service (NPS) finds that the proposed action is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Resources Management Program.

PROPOSED ACTION

The proposed action is described in "Chapter 2: Alternatives" under "Elements Common to All Action Alternatives" and "Alternative 2: NPS Preferred Alternative." The project area has been divided into five (5) separate shoreline segments, or reaches. Major elements of the proposed actions within all the reaches include:

- Installation of shoreline stabilization measures consisting of rock sills, sandy marsh terrace and plantings, rock breakwaters and beach nourishment, and rock spurs.
- Rehabilitation of existing revetment, sill, and breakwater structures.
- Minor bank slope repair.

ASSESSMENT OF EFFECT

FISHERIES MANAGEMENT

The NPS Preferred Alternative calls for the construction of rock breakwaters, sills, and installation of sandy beach fill and sandy material for establishment of marsh planting zones. Placement of rock and sand during the construction process will cause temporary impacts to adjacent fisheries habitat, while permanent impacts will occur in shallow water habitat occupied by the proposed structures. Noise during construction could also contribute to secondary impacts to the fisheries resource. Once construction was completed, however, the rock structures will provide additional structural habitat for fish and other animals in locations where structure is presently absent, or located in much shallower water.

There are currently no known studies indicating these types of shoreline stabilization structures result in detrimental impacts upon fisheries. Conversely, living shoreline treatment methods are most often described as being the most beneficial shoreline erosion treatment method given the increased habitat value associated with the restored/created tidal marshes and improved nursery shelter.

In "Chapter 3: Affected Environment" under "Wildlife and Wildlife Habitat" there is a more detailed description of the existing conditions related to fisheries. In "Chapter 4: Environmental Consequences," there is a discussion of subsequent impacts of the proposed action on fisheries management.

SUBAQUEOUS LANDS MANAGEMENT

As noted above, construction of shoreline stabilization measures along the York River shoreline and nearshore zone is proposed under the NPS Preferred Alternative. Upland habitats will be protected from erosion and tidal wetlands will be expanded, while subaqueous lands potentially occupied by macroinvertebrates and used by free-swimming organisms will be impacted. Overall, impacts on subaqueous lands will be short-term, negligible adverse impacts (construction related), and long-term beneficial impacts on wildlife and wildlife habitat.

WETLANDS MANAGEMENT

A large component of the NPS Preferred Alternative incorporates the use of living shoreline stabilization techniques, which are designed to restore or enhance existing wetland systems. Temporary impacts to wetlands will occur during construction operations, but the proposed action will have long-term, beneficial impacts to wetland resources via the restoration and creation of wetland areas behind (landward of) living shoreline treatments (e.g., rock sills) that are designed with regard for projected sea-level rise.

A more detailed description of the existing conditions related to wetlands can be found in "Chapter 3: Affected Environment" under "Wetland Resources" and the subsequent impacts of the alternatives on wetland habitats can be found in "Chapter 4: Environmental Consequences" under "Wetland Resources."

DUNES MANAGEMENT

No dunes exist within the study area that will be impacted by the proposed action.

NON-POINT SOURCE POLLUTION CONTROL

The proposed NPS Preferred Alternative does not result in an increase in impervious cover within the project limits. On the contrary, a large portion of the project area benefits from the restoration and enhancement of tidal, fringe wetlands. These wetland areas will provide improved filtration of runoff originating from the hillside and adjacent parkway.

During the shoreline stabilization design phase, the NPS will prepare and implement Erosion and Sediment Control Plans that comply with the Virginia Erosion and Sediment Control Law. The NPS will be responsible for overseeing on-site contractors, conducting regular field inspections, and taking prompt action against non-compliance, if necessary.

POINT SOURCE POLLUTION CONTROL

There are no regulated point sources within the project area. However, because land disturbance in this project will exceed one acre, the project will require a VSMP general permit for stormwater discharges from construction activities.

SHORELINE SANITATION

No wells and no new drain fields will be required for the project.

AIR POLLUTION CONTROL

The NPS Preferred Alternative does not have the ability to increase future pollution levels of CO, volatile organic compounds (VOCs), and nitrous oxide (NOx), since improvements are limited to inert rock and sand, and plantings. Only minor short-term impacts will occur due to temporary construction activities, consisting of diesel exhaust from heavy equipment.

COASTAL LANDS MANAGEMENT

Direct impacts to the 100-foot Resource Protection Area (RPA) buffer will only occur in locations were temporary construction access is needed. These impacts will be minor and will be mitigated for in accordance with Department of Conservation and Recreation's (DCR) Riparian Buffers Modification & Mitigation Guidance Manual.

The NPS will coordinate directly with the York County Environmental Division and Chesapeake Bay Local Assistance Department (CBLAD), who will review site plans as prepared, to ensure maximum compliance with Chesapeake Bay Preservation Regulations.

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

U.S. Government Printing Office
June 2012

Document No. 333/100800
PMIS No. 145520

United States Department of the Interior – National Park Service