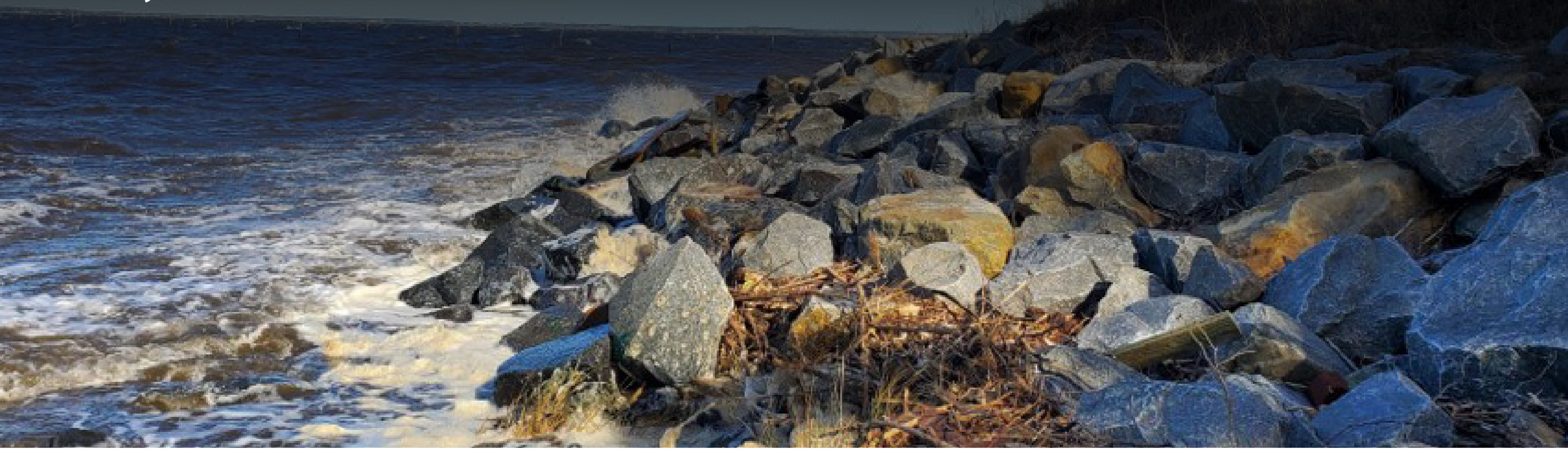
National Park Service
U.S. Department of the Interior

Fort Raleigh
National Historic Site

Shoreline Stabilization for Erosion Control

Environmental Assessment
July 2025



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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 wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic 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. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting 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.

FORA #113027

United States Department of the Interior - National Park Service

U.S DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE
FORT RALEIGH NATIONAL HISTORIC SITE

Shoreline Stabilization for Erosion Control Environmental Assessment
July 2025

The National Park Service (NPS) proposes to stabilize approximately 1.1 mile of unprotected shoreline at Fort Raleigh National Historic Site (FORA) for the protection of cultural resources, natural resources and park infrastructure.

The 355-acre site was established on April 5, 1941, to preserve land declared to be of national significance as a portion of the colonial settlement or settlements established in America by Sir Walter Raleigh between 1584 and 1590 and the history of the Native Americans, European Americans, and African Americans who lived on Roanoke Island (NPS 2017).

Combating erosion along FORA's shoreline has been a management issue since its establishment. The shoreline is estimated to have eroded a quarter mile or more since the late 16th century, resulting in loss of resources and land (NPS 2017). Wind, wave action, and currents have caused substantial erosion of the shoreline over time, which has resulted in archeological resources washing away, the loss of upland forested areas, and threats to the long-term stability of park facilities and infrastructure.

Shoreline erosion control measures are needed within the boundaries of FORA to address shoreline erosion accelerated by segmented stabilization structures, more frequent and intense hurricane activity, winter nor'easters, rising sea levels, currents, and littoral drift. Action is necessary to address this erosion, protect significant archaeological sites, and restore the shoreline to safeguard both cultural heritage and natural ecosystems and park infrastructure within FORA.

Under the No-Action Alternative, current management practices would continue without changes, focusing on mitigating the impacts of shoreline erosion. The rock revetment alternative proposes the design and construction of a continuous revetment, constructed of rock or other materials, along unarmored shoreline sections, utilizing geotextile fabric and fill to stabilize areas between the natural shoreline and bluff, topped with riprap, human placed rock or other hardened materials. The rock berm alternative involves constructing a continuous rock berm in a trapezoidal shape near the toe of the existing bluff to protect the shoreline. The combined rock revetment and rock berm alternative would be tailored to the specific conditions and recreational uses of each shoreline section. The rock revetment, rock berm, and the combination alternatives would all be preceded by the placement of sand fill material in advance to rock placement creating access for recreation.

This environmental assessment analyzes the potential impacts these alternatives would have on the natural, historic, and human environment. This environmental assessment has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code [USC] 4332[2] [C]); the Department of the Interior NEPA regulations (43 CFR Part 46); and NPS Director's Order #12 and Handbook: *Conservation Planning, Environmental Impact Analysis, and Decision-Making (NPS 2015)* and Section 106 of the National Historic Preservation Act

(NHPA) of 1966 as amended, including implementing regulations (36 Code of Federal Regulations {CFR} Part 800).

How to Comment:

We invite you to comment on this environmental assessment during the 30-day public review period. The preferred method of providing comments is through the NPS's Planning, Environment, and Public Comment (PEPC) website for the park at: https://parkplanning.nps.gov/FORA_shoreline. Or you may mail comments to the address below:

Superintendent
Fort Raleigh National Historic Site
1401 National Park Drive
Manteo, NC 27954

Only written comments will be accepted. Please be aware that your entire comment will become part of the public record. If you wish to remain anonymous, please clearly state that within your correspondence; however, NPS cannot guarantee that personal information, such as email address and phone number, will be withheld.

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Chapter 1: PURPOSE AND NEED

INTRODUCTION

The National Park Service (NPS) proposes to stabilize the eroding Fort Raleigh National Historic Site (FORA) shoreline to protect park resources and critical infrastructure. FORA is in Dare County, North Carolina, northwest of the town of Manteo on the northern end of Roanoke Island, an island within the Albemarle Sound (Figure 1). Residential developments are located east, west, and south of FORA with US Highway 64 running through the southern portion of the site.

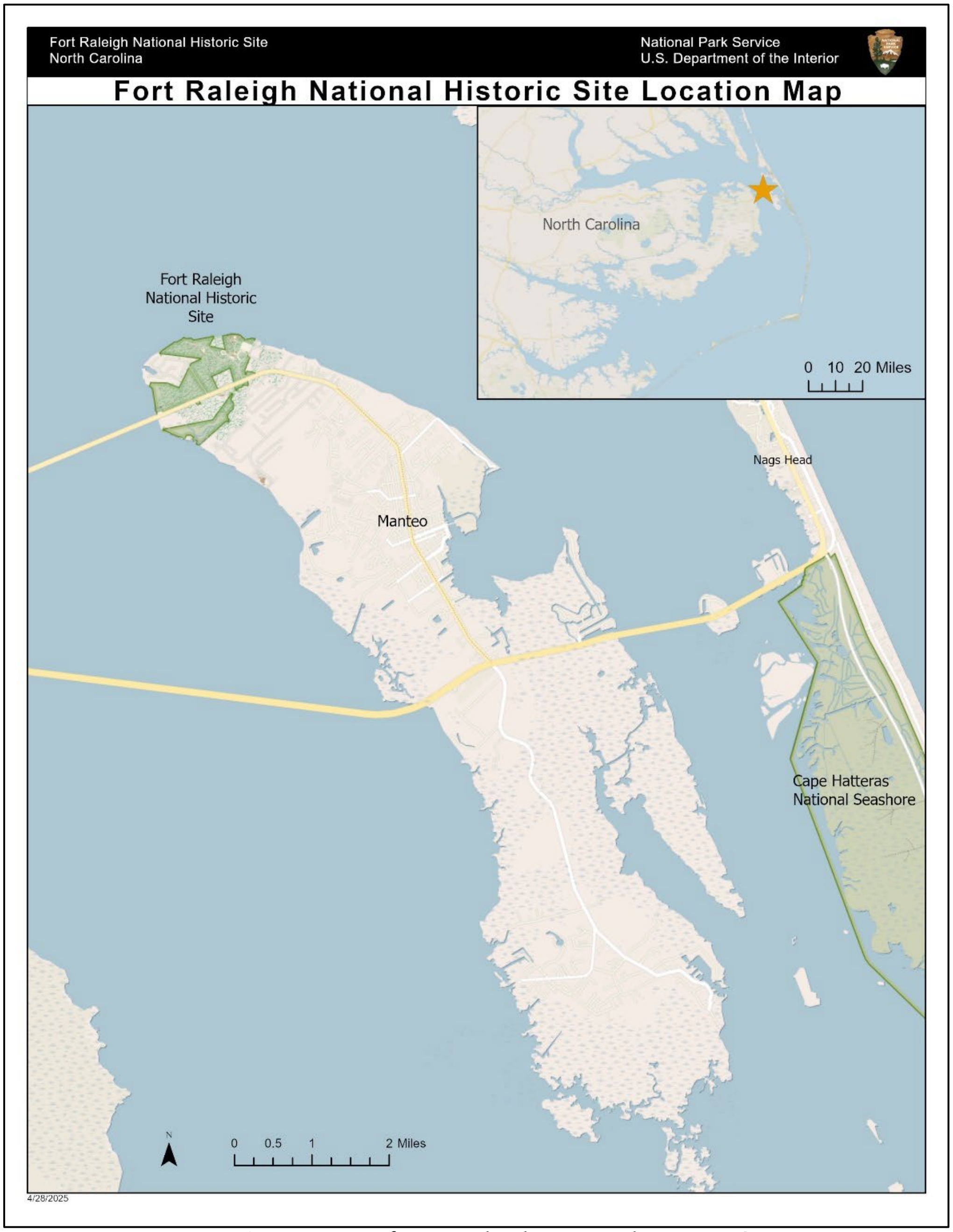

Figure 1. Location of Fort Raleigh National Historic Site.

In 1935, the site area became Fort Raleigh State Park under the North Carolina Historical Commission. On July 14, 1939, the State of North Carolina deeded Fort Raleigh State Park to the United States government (NPS 2013). Fort Raleigh National Historic Site (FORA, or the park) was established by Secretarial Order on April 5, 1941, to preserve land declared to be of national significance as a portion of the colonial settlement or settlements established in America by Sir Walter Raleigh between 1584 and 1590. The national historic site contains 355 acres that are unique in the NPS system because of the preservation and interpretation of the history of the first English attempts at colonization in the New World and the history of Native Americans, European Americans and African Americans on Roanoke Island. The site was listed on the National Register of Historic Places in 1966. Today approximately 300,000 visitors come to the national historic site each year.

Roanoke Island is part of a system with distinct ecological communities of plants and animals and geologic processes characterized by shoreline change and forces of nature. The site contains a mixed maritime evergreen forests and deciduous forest which has been identified by the state of North Carolina Natural Heritage Program as a Significant Natural Heritage Area. Significant Natural Heritage Areas contain one or more natural heritage elements-high quality or rare natural communities, rare species, and special animal habitats.

The Lost Colony play was first performed at the Waterside Theatre in 1937. It is the nation's first and longest running outdoor symphonic drama and is produced by the Roanoke Island Historical Association (RIHA) on the very site of the first English colony in the New World. The Waterside Theatre is protected by a shoreline hardened with riprap; however, unprotected sections of shoreline adjacent to the theatre have the potential to threaten and compromise the overall stability of the protected area. The NPS parking lot for visitors and patrons is located 100 feet from the shoreline and is also at risk from shoreline erosion. Another cultural resource the Dough Cemetery, has been protected by the installation of rock revetment, the shoreline east and west of the rock revetment has eroded significantly, and the cemetery is at risk from the land becoming undercut.

Identified by the North Carolina Department of Environment and Natural Resources as a Significant Natural Heritage Area (SNHA) the areas located within Fort Raleigh National Historic Site are defined by the North Carolina Natural Heritage Program (NHP) as areas that "possess natural values justifying recognition by the state as an outstanding part of the natural heritage of North Carolina" (NPS 2016). The Fort Raleigh Maritime Forest Significant Natural Heritage Area is an evergreen maritime forest which is important for conservation of the state's biodiversity. Over time, shoreline erosion has caused large trees and shrubs within this SNHA to become undercut and slough off into the sound all along the shoreline within the project area.

The Elizabethan Gardens, designed to entertain Queen Elizabeth I during her reign (1558 to 1603), are a lush tapestry of color, fragrance, and texture, reflecting the cultural heritage of England. These gardens while private land are bordered by FORA on three sides and accessible by driving through the park. The founders created the gardens as a living memorial to the colonists of the Roanoke Voyages, utilizing property leased from Roanoke Island Historical Association (RIHA). The gardens' boundaries extend to the Roanoke Sound and their shoreline is contiguous with the FORA shoreline, an area that has also been affected by erosion. Consequently, RIHA is planning to construct a shoreline stabilization structure to protect and preserve the shoreline in front of the Elizabethan Gardens.

PROJECT BACKGROUND

Shoreline erosion, a combination of waves, currents, and winds, intensified by extreme weather events, is causing the increased exposure of in situ archaeological resources. This has resulted in some archaeological resources becoming submerged offshore within the Albemarle Sound resulting in a loss of context for that artifact (Caffrey 2013).

Where shoreline processes are “natural” (that is, not altered by human activities or structures), the NPS policy is to allow those unaltered processes to continue. However, where shoreline processes have been altered by human activities or structures, the NPS policy is to investigate alternatives for mitigating the effects of those activities or structures; and restoring natural conditions (NPS *Management Policies 2006* § 4.8.1.1).

Combating erosion along FORA’s shoreline has been a management issue since FORA’s creation. The shoreline is estimated to have eroded a quarter mile or more since the late 16th century, resulting in loss of resources and site land (NPS 2017). FORA’s shoreline orientation allows for littoral drift in both easterly and westerly directions, depending on the dominant wind and wave direction. Erosion of sediment bank sections provides the primary source of sediment to the littoral system. Changes in the shoreline sediment supply, orientation, or rate of migration at one location can have impacts that reach far outside of the area where the actions are implemented (Eshleman and York 2011). Consequently, the natural conditions in one area can lead to substantial effects elsewhere.

The following actions have been taken by the NPS to address shoreline erosion (Binkley 2003).

- 1941 and 1945 – two jetties with pilings were placed to address the erosion behind the stage and dressing rooms.
- 1949 – four jetties and sandbags sills were installed at the beach on Roanoke Sound and the park property line.
- 1966 – two wood groins and a sandbag sill (breakwater) were planned but never installed.
- 1979-1980 – rock riprap revetments were placed in two areas, Dough Cemetery And Waterside Theatre.

In the past fifteen years a baseline condition assessment and three site analyses were conducted. The first analysis was conducted in 2011 (Eshleman and York 2011) provided recommendations for future shoreline protection planning efforts. In 2014 and 2018 two additional studies expanded on the previous efforts by performing a more thorough site analysis that incorporated an armor stone component along with the beach fill and marsh plantings suggested in 2011. In 2022 a more recent on-site consultation occurred with staff from the North Carolina Coastal Federation. This consult provided recommendations of using a variety of options, including the application of armor stone, due to the varying escarpment heights along the shoreline.


Figure 2. Wooden Groins along the shoreline at Fort Raleigh National Historic Site, Manteo, N.C. (12/15/2021)


Figure 3. Rock berm near waterside theatre at Fort Raleigh National Historic Site, Manteo, N.C. (12/15/2021)

Despite previous erosion control efforts, the shoreline continues to erode at a rate of 4 to 10 feet per year (Kirk 2018), leading to the loss of land and cultural resources. Collapse of portions of the cliff would continue to cause loss of cultural and natural resources and FORA property.

This environmental assessment (EA) analyzes the potential effects of implementing four alternatives for minimizing erosion, the No-Action Alternative and three action alternatives. This EA analyzes the potential impacts these alternatives would have on the natural, historic, and human environment and has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code [U.S.C] 4332[2] [C]); the Department of the Interior NEPA regulations (43 C.F.R Part 46)[1]; and NPS Director's Order #12 and Handbook, *Conservation Planning, Environmental Impact Analysis and Decision-Making* (NPS 2015), and Section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended, including implementing regulations (36 Code of Federal Regulations {CFR} Part 800).

[1] Executive Order 14154, *Unleashing American Energy* (Jan. 20, 2025), and a Presidential Memorandum, *Ending Illegal Discrimination and Restoring Merit-Based Opportunity* (Jan. 21, 2025), require the Department to strictly adhere to the National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321 et seq. Further, such Order and Memorandum repeal Executive Orders 12898 (Feb. 11, 1994) and 14096 (Apr. 21, 2023). Because Executive Orders 12898 and 14096 have been repealed, complying with such Orders is a legal impossibility. The NPS verifies that it has complied with the requirements of NEPA, including the Department's regulations and procedures implementing NEPA at 43 C.F.R. Part 46 and Part 516 of the Departmental Manual, consistent with the President's January 2025 Order and Memorandum. The NPS has also voluntarily considered the Council on Environmental Quality's rescinded regulations implementing NEPA, previously found at 40 C.F.R. Parts 1500–1508, as guidance to the extent appropriate and consistent with the requirements of NEPA and Executive Order 14154.

PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed action is to mitigate park lands from shoreline erosion for the protection of cultural and natural resources and the park's associated property and infrastructure.

Shoreline erosion control measures are needed within the boundaries of FORA to address shoreline erosion accelerated by segmented stabilization structures, more frequent and intense hurricane activity, winter nor'easters, rising sea levels, currents, and littoral drift. Immediate action is necessary to address this erosion, protect significant archaeological sites, and restore the shoreline to safeguard both cultural heritage and natural ecosystems within FORA for the long-term. Figure 4 provides a comparison of active erosion areas since 1993 and depicts the general locations of shoreline erosion within FORA's limits, which are identified as the project area. The project area is further divided into four sections (Section A, B, C, and D).

The boundaries of the project are defined by the mean high water (MHW) line mark, which delineates the shoreline boundary of FORA. MHW is defined as the height of all high waters at a particular point or station over a considerable period. For tidal water, the cycle of change covers a period of 19 years, and the mean high water is the mean of all high waters for that period. NPS is typically legislated through appropriations and funding guidelines to utilize federal funding solely for projects within federally authorized boundaries, necessitating that any shoreline stabilization measures at FORA be constructed above the MHW line and not extend into submerged lands outside of the park's boundary (NPS Organic Act and 54 USC § 100101 et seq.). The submerged lands adjacent to FORA's boundary are North Carolina state property. However, it is anticipated, based on a solicitor's opinion for beach nourishment projects at Cape Hatteras National Seashore, that if the beaches are built back out, then the FORA MHW boundary is adjusted to accommodate the new sediment.

ISSUES, CONCERNS, AND IMPACT TOPICS

Issues are "problems, concerns, conflicts, obstacles, or benefits that would result" if either the No Action Alternative or the proposed action is implemented (NPS 2015).

Impact topics are resources of concern within the project area that could be affected, either beneficially or adversely, by implementing any of the four alternatives presented in this EA. Impact topics considered in this document were identified based on scoping, site conditions, federal laws, regulations, Executive Orders, NPS Management Policies, Director's Orders, and staff knowledge of the site's resources. During the scoping process, impact topics were either retained for further analysis in this EA or dismissed from further consideration. A topic was retained for analysis if it met one or more of the following conditions:

- The environmental impacts associated with the issue are central to the proposal or of critical importance.
- A detailed analysis of environmental impacts related to the issue is necessary to make a reasoned choice between alternatives.
- The environmental impacts associated with the issue are a big point of contention among the public or other agencies.
- There are potentially significant impacts to resources associated with the issue.

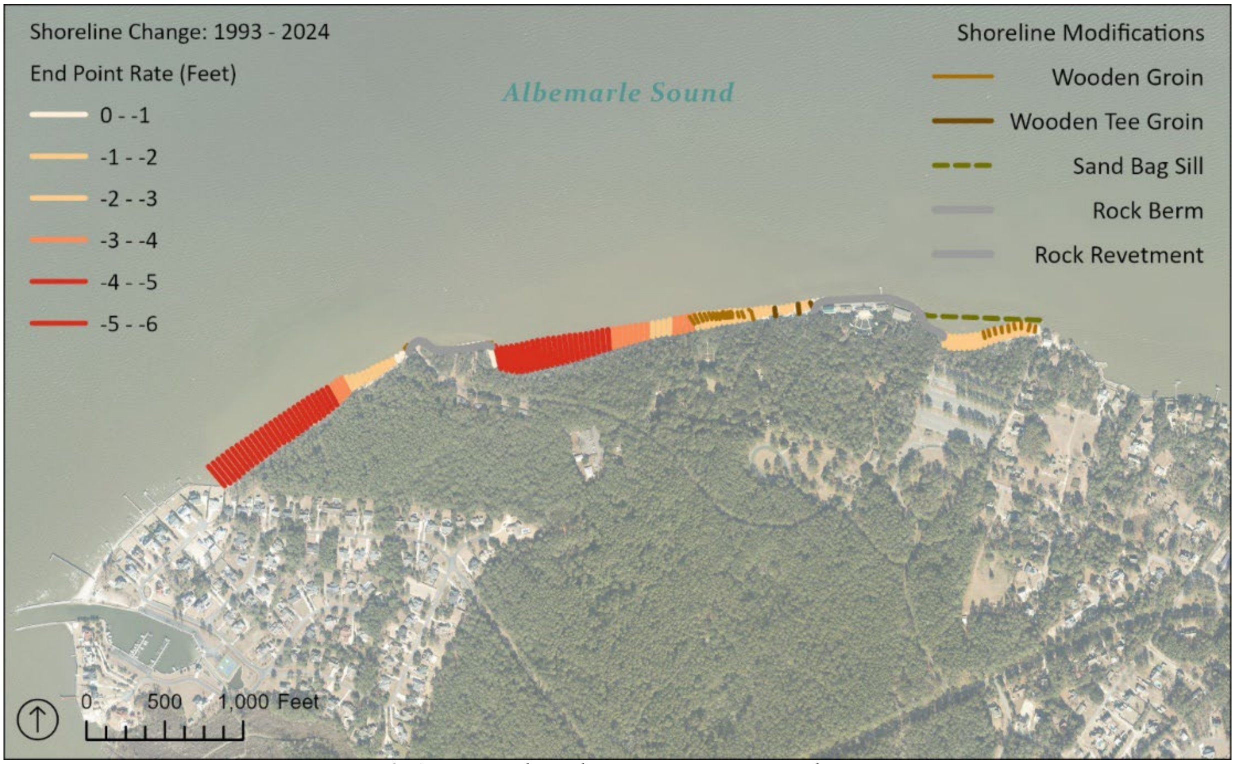

Figure 4. Average shoreline erosion rate and structures.

During the scoping process, specific considerations and concerns were identified as critical to this project. Along with the purpose of and need for the proposed action, these issues guided the development of alternatives and contributed to the selection of impact topics analyzed in detail in this EA. Some issues and concerns raised during scoping were dismissed from detailed analysis because it was determined they were not central to the proposed action, the resource does not occur in the area, or there would be no measurable change to the resource. The following issues and concerns were identified for this project:

- There is a high potential to find subsurface cultural resources during construction.
- The potential for adverse impacts if these resources are not documented.
- The recovery or documentation of submerged archeological resources within the project area.
- Construction of a temporary road(s) to haul project material through a mature forested area has the potential to impact sensitive vegetation and water resources within a Significant Natural Heritage Area.
- Project actions would modify the shoreline bluffs and open sand beaches when a combination of actions are incorporated.
- Certain areas would be closed to visitors during project activities. How visitors recreate along the shoreline would change during and after construction.
- There is potential for impacts on marine and terrestrial wildlife within the project area.
- The use of heavy equipment would temporarily create noise and alter the beach profile during project activities.
- Constructing a hardened shoreline would modify the viewshed, recreational use, and access of the shoreline.

- Construction could temporarily affect Roanoke Sound water quality parameters.

Figure 5. Rock revetment in front of Dough Cemetery
at Fort Raleigh National Historic Site, Manteo, N.C.
(12/15/2021)

IMPACT TOPICS RETAINED FOR ANALYIS

Based on the issues and concerns, six impact topics have been carried forward for analysis, and subtopics are embedded within each topic. The impact topics retained for analysis are biological resources, cultural resources, geological resources, visitor use and experience, soundscape, and land use. Additional information about each resource can be found in their respective "Existing Environment and Expected Future Conditions" sections in Chapter 3.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

The topics of air quality; commercial fishing, ethnographic resources, museum collections, prehistoric and historic structures, and human health and safety; have been dismissed from further impact analysis based on the rationale provided for each within Appendix A.

Chapter 2: ALTERNATIVES

INTRODUCTION

This chapter describes the alternatives considered in this EA to address shoreline stabilization. The implementation of the NEPA process calls for the alternatives considered to include a No-Action Alternative. The description and evaluation of this alternative provides a baseline to which the action alternatives can be compared. Four alternatives are evaluated: the No-Action Alternative, Rock Revetment, Rock Berm, and a combination rock revetment and rock berm (preferred alternative). The placement of beach fill to re-establish land previously lost to erosion is considered on all three action alternatives. Mitigation measures are presented for the combination rock revetment and rock berm alternative, which is the preferred alternative. Several other potential alternatives were considered but dismissed from detailed analysis in the EA and are presented at the end of this chapter.

ACTIONS COMMON TO ALL ACTION ALTERNATIVES

The placement of beach fill would consist of placing sand as fill material along the shoreline to restore land previously lost to erosion and is being considered as both an interim measure and supplemental measure common to all action alternatives. At present neither wave modeling nor sediment transportation studies have been conducted to evaluate performance of proposed alternatives.

The timeline for implementation of the action alternatives for any of the project sections is variable and may be extended for several years based on funding availability. Within that timeframe, opportunities may arise for beach fill (sometimes referred to as "nourishment") to be placed within sections to provide temporary benefits to the site until the action alternative may be implemented or would be implemented in conjunction with an action alternative, (Figure 6). These benefits include providing a sediment source to the beaches within the park to decrease hazard exposure and account for the time associated with tasks that precede the implementation of the selected alternative, such as the development of an engineered design and procurement of project funding. This action would temporarily continue to provide beach areas for public use.

Beach fill material, if sourced from outside of the park, would be required to have similar sediment characteristics such as grain size, color, texture, and geologic characteristics of the material, as the native beach or shore conditions found at the project site. Grain characteristic criteria for sediment compatibility would follow the NPS management policies and the standards outlined in the North Carolina Administrative Code (NCAC), at 15A NCAC 07H.031, Technical Standards for Beach Fill Projects and NPS Beach Nourishment Guidance (NPS 2023).

Additionally, the beach fill should generally be designed such that it will be sloped comparable to pre-project conditions following natural adjustment of the profile under wave and wind conditions. The "constructed" slope immediately following project completion may be steeper than the pre-project slope, but the "design" slope would be similar to pre-project conditions (or represent a "restoration" to some previous or desired state). Waves and currents would then redistribute the sand to create a natural profile that is more gently sloping than the construction template. This natural equilibration process would decrease the beach width over time. Beach erosion would continue after beach fill is completed, unless the shoreline stabilization alternatives are implemented. The beach may be planted with riparian vegetation typically found on periodically inundated beaches and shorelines along Albemarle-Pamlico estuary system.

Depending on the location of the sand source, the sand could be transported with articulated and/or rigid dump trucks (Figure 7), offloaded from barges within Roanoke Sound, or pumped onto the beach as a sediment slurry through a pipe from ongoing permitted navigation (channel) maintenance actions in the vicinity. Sand would be distributed with track and/or wheeled bulldozers and/or skid loaders. General volume estimates of 48,000 to 96,000 cubic yards of beach fill material were determined when 1-cubic yard and 2-cubic yards are applied to a template of 800 yards of linear shoreline and 60-yard width. The shoreline change analysis from 1993-2024 (Figure 4) was used to identify the dimensions that would restore the shoreline in Sections A, B, and D to a geometry that more closely resembles the curvature around the north end of FORA in 1993 compared to the offsets that presently exist between stabilized and non-stabilized sections of the shoreline. The range of volume is used to provide a general reference frame for the volume of material that may be required to develop an engineered design that is responsive to the varied topography that exists along the shoreline.

For Alternatives 1 through 3 land-based construction equipment would access the shoreline through four potential access corridors (Figure 9). If a dredge was used and the need for shoreline equipment simultaneously, these same access corridors would be used.

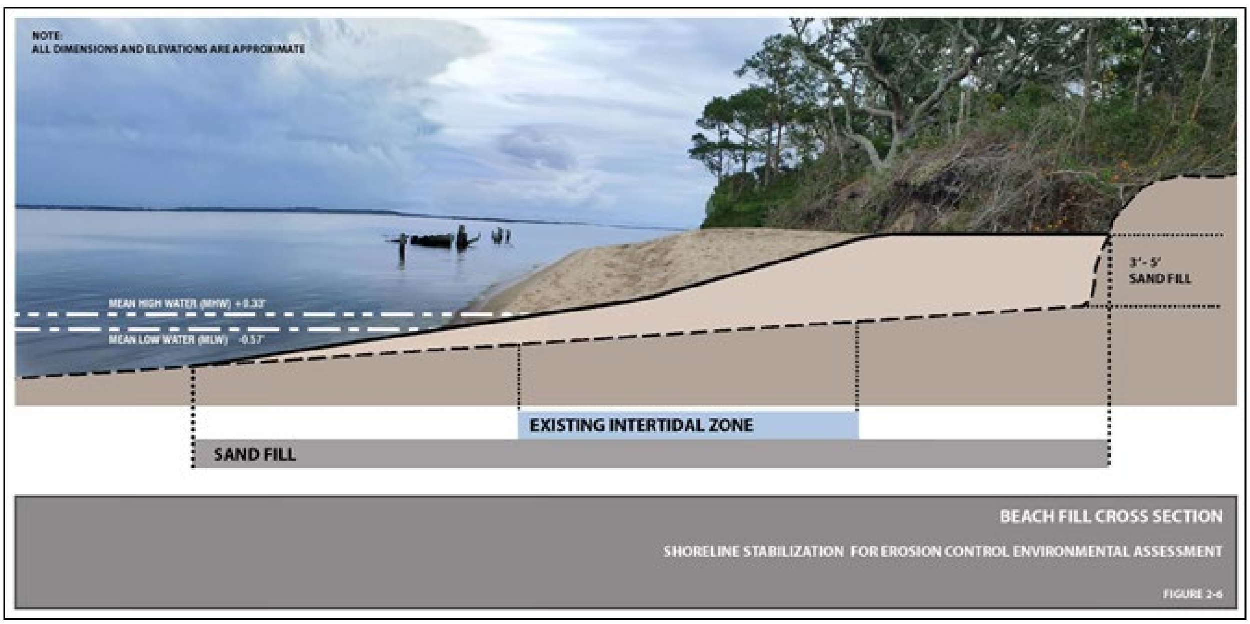

Figure 6. Conceptual drawing of Beach fill cross section.

Figure 7. Example of beach fill using mechanical methods (Date and location unknown)

NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the NPS would not implement any additional shoreline stabilization measures. The National Park Service would leave the existing shoreline as is with no protection from shoreline erosion, and the shoreline would continue to experience erosion where no protection exists. As the shoreline continues to erode over time, the NPS would either relocate or remove any threatened infrastructure when impacted by erosion including, but not limited to the Lost Colony parking lot, ticket booth and septic system; the Costume Shop, park housing and potentially trails. Under this alternative the NPS would essentially retreat from the unprotected shoreline over time. Routine archeological pedestrian surveys of the shoreline would continue, and salvage archeology may be implemented. Although the No-Action Alternative would not meet the project purpose and need, it serves as a baseline to compare the impacts of the action alternatives.

ALTERNATIVE 1 – ROCK REVETMENT

A Rock Revetment (Alternative 1) is proposed to reduce shoreline erosion through the placement of appropriately sized rock or other hardened materials directly onto the shoreline to protect it from wave action (Figure 8). This alternative would be comparable to the existing rock revetment along the Dough Cemetery (Figure 10). This alternative may include adding fill soil between the existing slope and/or bluff and the layer of rock placed to protect the archaeologically sensitive area. There would be minimal to no soil grading activities in the existing soil along the bluffs by hand tools or mechanical equipment due to the sensitive nature of the area. To obtain a 2:1 or 3:1 graded slope for this area fill soil would be transported to the construction site to assist in the protection of buried cultural resources. This fill soil would be used only in the area behind the rock material placement area not the proposed beach fill area. Once this off-site fill soil is placed and graded to a 2:1 or 3:1 slope, the placement of geotextile fabric and large rock riprap would then be placed on top of the introduced soil layer.

Depending on soil conditions, the slope would likely range from an approximately 2-foot run and 1-foot rise (2H:1V, 50% slope, or 26.6-degree slope angle) to a 3-foot run and 1-foot rise

(3H:1V, 30% slope, or 18-degree slope angle), which are typical slopes for revetment projects (USACE 2003. NCDEQ 2014). The geotextile fabric followed by a layer of rock would be placed on the fill slope to an elevation high enough to prevent wave runup from eroding soil above the crest of the revetment. Any unarmored soil above the revetment subject to erosion may be stabilized using geotextiles or seeding of native grass species. These secondary measures would help prevent erosion from rainfall events and surface water runoff. The toe of the revetment would need to be keyed (buried) several feet into the ground to prevent undermining from scour. This would require some shoreline sediment excavation; however, no sediment would be moved off-site, and on-site sediment would be trenched and graded to secure the revetment toe. This alternative would be similar to the existing rock revetment at the Dough Cemetery (Figure 10) which has stabilized the shoreline for over forty years.

The implementation of this alternative may occur in phases if the project is sub-divided into four smaller project areas, see Figure 9 for the general alignment and access routes. The revetment for this alternative may have two sections, Section A and Section C, that require less fill material and would be a shallow, lower elevation revetment. On average, Sections A and C would have a run between 10 and 20 feet and a rise of between 5 and 10 feet. The two other sections, Section B and Section D, would have larger amounts of fill and rock as the bluff height is substantially higher. These sections would have a run between 12 and 30 feet and a rise between 6 and 15 feet in height. The revetment lengths are approximate, for Section A is 1,600 feet, Section B is 1,400 feet, Section C is 700 feet, and Section D is 1,500 feet for a total project length of roughly 5,200.

Alternative 1 would be designed to blend into the existing rock revetment at Dough Cemetery and the existing rock berm at the Waterside Theatre as well as adjoin private property bulkhead/rock revetment in Section A and rock revetment in Section D.

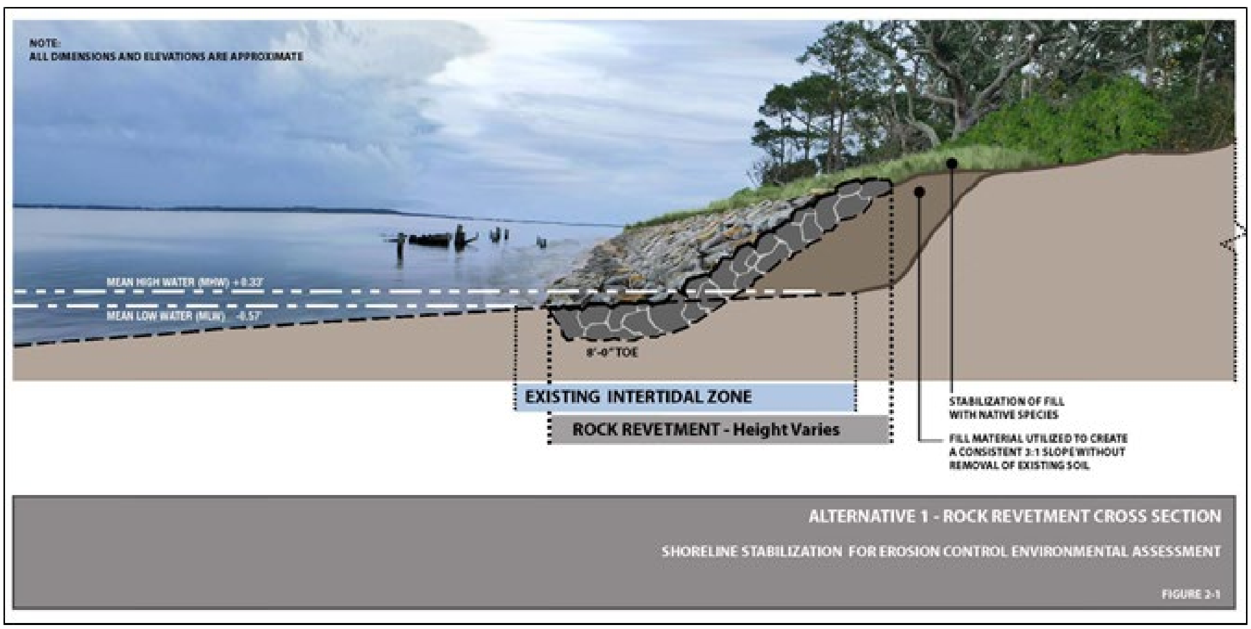

Figure 8. Conceptual drawing of Rock Revetment cross section.

Construction access and staging for this alternative would be accomplished by land access from the site property, but water access would be possible if required. Material and equipment delivery would be provided through four construction access routes. One permanent access route could be on the park’s west boundary line with the Elizabethan Gardens, 720 feet in length supporting both Sections B and C. This access route could also be maintained as a future firebreak, non-native species barrier, and a maintenance access route to the shoreline rock revetment. Three additional access routes are anticipated as temporary. The widths of the access routes would typically be 20-25 feet wide. Approximate lengths of the access routes are: 1,610 feet for the route supporting Section A; 2,840 feet for the route supporting Sections B and C: and 900 feet for the route supporting Section D, refer to Figure 9 for access route locations. All access routes would be cleared of vegetation, graded, stabilized, and matting placed for heavy equipment ingress and egress. Once construction is completed the temporary access routes would be de-compacted through tillage and revegetated with site specific native species. Cleared vegetation may be hauled off site or cut up and chipped and scattered onsite.

Temporary staging areas would be located on cleared, paved, or open areas along existing access routes or parking lots. Ground protection, such as steel plates, polyethylene mats, or timber mats, would be installed ahead of stockpiling rock and fill dirt and before storing heavy equipment. Ground protection would be based on the type of equipment being used in the area. Anticipated construction equipment would likely include, but not be limited to, articulated and/or rigid dump trucks, barges, skiffs, track and/or wheel bulldozers, track and/or wheeled backhoes, front-end loaders, compactors, and track and/or wheeled skid loaders. Prior to project start up, all construction equipment would be inspected by park resource staff for potential non-native species or other park concerns.

The removal of dead and downed vegetation along the shoreline and beach areas would need to occur prior to any placement of rock. Cleared vegetation may be hauled off site or cut up and chipped and scattered onsite or could be used as part of the stabilization structure. Additionally, any man-made structure such as the wooden groins or exposed structural debris below the mean high water (MHW) would remain in place and not be removed from the project area.

Construction could occur year-round. Construction phasing may occur based on funding availability. Phasing of the project areas would be determined by funding availability and prioritized by vulnerability to erosion that threatens park resources and infrastructure. If construction phasing is needed, the following would be the likely priority of construction: Phase I would take place the first year in Section D, Phase II would follow taking place in Section B, Phase III would take place in Section C, and lastly Phase IV would take place in Section A, refer to Figure 9 for locations. Construction duration is anticipated to be approximately 1 year per phase.

Currently RIHA is planning a shoreline stabilization project (2026) along the 500 feet of the Elizabethan Gardens northern property boundary. The NPS would work with RIHA for access, and, ideally, a coordinated effort on design and construction to allow for the NPS and RIHA shoreline stabilization projects to work successfully together. Access to RIHA’s section would be along the existing access route (720 foot) that would be used to access Section B and C. Currently the route is 12 feet wide and needs several trees removed to accommodate wider equipment, 20 feet width. This route would be graded down to approximately three foot above the MHW in the last 80 to 40 feet prior to the embankment.

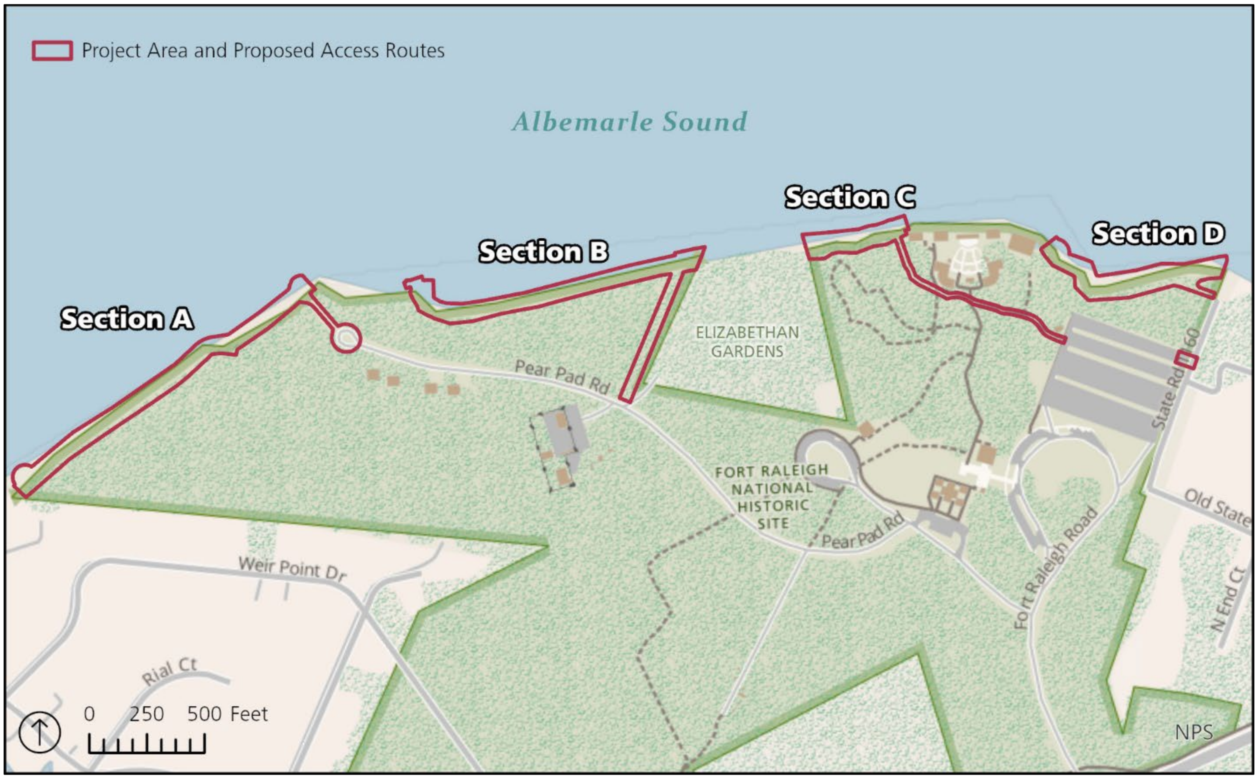

Figure 9. Project area and proposed access routes at Fort Raleigh N.H.S.


Figure 10. Rock revetment at Dough Cemetery at Fort Raleigh National Historic Site, Manteo, N.C. (12/15/2021)

ALTERNATIVE 2 – ROCK BERM

Rock Berm (Alternative 2) is proposed to reduce shoreline erosion through the construction of a rock or other hardened structural barrier (or berm) beginning at or near the base of the shoreline to protect the shoreline from wave action (Figure 11). The strip of land between high and low tide lines is called the foreshore. The foreshore lands at FORA fluctuate with the movement of shorelines due to erosion or accretion of beach sediment. Where erosion has obliterated this line, the NPS owns the land down to the mean low tide line. Where accretion takes place and the MLW moves farther out into the sound as does the NPS boundary.

This alternative would be comparable to the existing rock berm along the Waterside Theatre (Figure 12) which has stabilized the shoreline for over forty years. Beach fill or the placement of sediment (see *Actions Common to All Alternatives*), may also be implemented to build the shoreline out approximately 25 – 100 feet prior to installation of the berm at the water's edge, back to the projected 1993 shoreline location. Marsh plantings would then be installed in low elevation areas of the sandy beach. When paired with beach fill/nourishment, the berm, would protect the low-elevation sandy beach area from wave action and the marsh plantings would help maintain marsh/beach elevation over time; however, during certain high tides and as sea level rises, water would percolate through the berm and provide marsh habitat between the berm and edge of the bluff. Additionally, the berm would be constructed with one or more overlapping gaps, where aquatic organisms could freely move into marsh areas during high tides. These gaps in the berm would allow habitat connectivity, greater tidal exchange, and better shoreline access to visitors and watercraft recreationalists to and from the sound and beach. Over time, Alternative 2 eventually becomes a living shoreline.

Alternative 2 may have a trapezoidal cross section and minor excavation and grading would be performed within the berm footprint to create a relatively uniform foundation. The intent of this design is to have minimal bluff excavation. The rock would be placed on geotextile fabric and not directly on native soil nor in the water. Cleared vegetation may be hauled off site or cut up and chipped and scattered onsite or could be used as part of the stabilization structure. The berm's crest elevation would be approximately 4–10 feet above the normal water surface elevation (North American Vertical Datum) depending on site conditions and amount of beach fill used.

The project area has been split into four smaller zones, see Figure 9 for the general alignment and access routes. The revetment for this alternative would connect to existing revetments and berms.

Section A would tie-in to the western FORA property shoreline/bluff and terminate at the approximate location of Camp Wirth's remaining in-water structures. No hardened structures are proposed for the Etheridge Point beach area in Section A. The entire length of Section B is proposed to have a rock berm and would tie-in to the existing Dough Cemetery rock revetment on the west side and terminate on the eastern side at the FORA property line with the Elizabethan Gardens. Section C is also proposed to have a rock berm and would begin at the western edge of the FORA property line and tie into the existing rock berm at the Waterside Theatre's westside. Section D would tie-in to the existing rock berm at the Waterside Theatres eastern side and continue to the edge of the FORA property line where it would tie-in with the residential rock revetment on the eastern limits. All lengths are approximate, Section A is 1,100 feet, section B is 1,400 feet, section C is 800 feet, and section D is 1,900 feet. For a total projected length of 5,200.

Vegetation and structural debris removal, construction methods and phasing, and use of beach fill for Alternative 2 would be like those for Alternative 1.

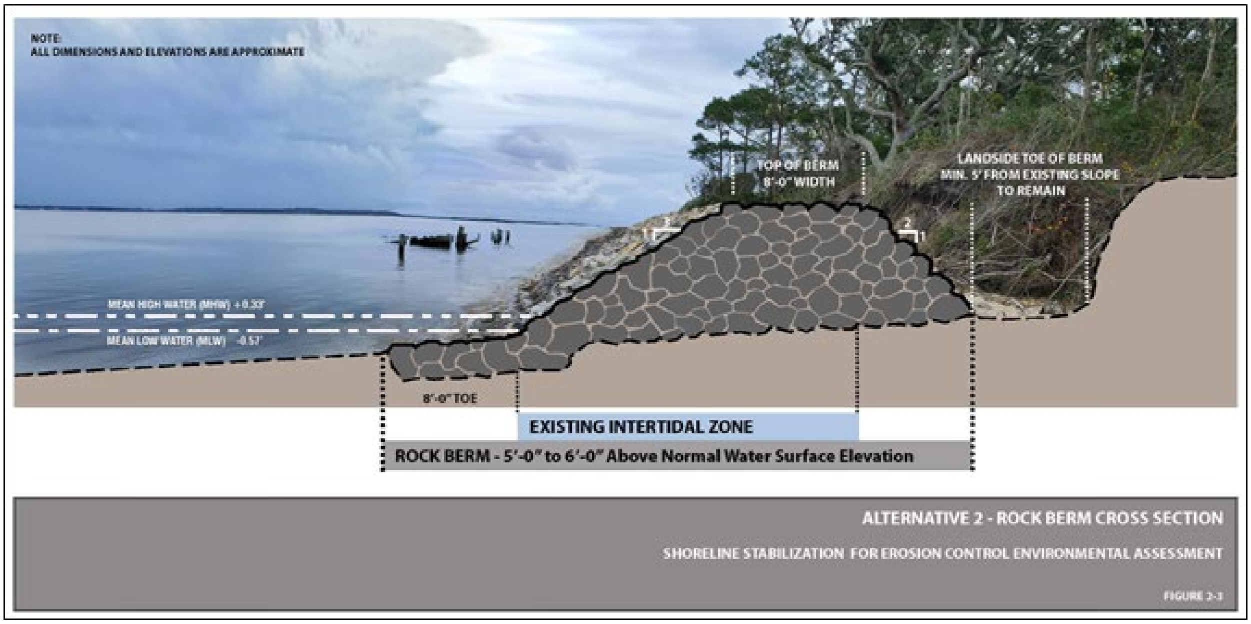

Figure 9. Conceptual drawing of Rock berm cross section.

Figure 10. Rock berm at waterside theatre at Fort Raleigh
National Historic Site, Manteo, N.C. (12/15/2021)

ALTERNATIVE 3 – ROCK REVETMENT/BERM COMBINATION (PROPOSED/PREFERRED)

Combination (Alternative 3) is a combination of Alternative 1 and Alternative 2 and is the NPS's preferred alternative. This alternative is proposed to reduce shoreline erosion through the construction of a combination of rock revetment and rock berm in areas of the shoreline that are the best fit due to existing topography, land use, and constructability. During design, the specific rock revetment and rock berm areas would be identified based on these factors. Generally, the typical cross-sections and design elements described for Alternatives 1 and 2 would be applied to this alternative. See Figure 9 for the general alignment and location of the access routes.

Vegetation and structural debris removal, construction methods and phasing, and use of beach fill for this alternative would be the same as those for Alternatives 1 and 2, respectively.

GUIDELINES & MITIGATION MEASURES FOR (PREFERRED)

Congress has charged the National Park Service with managing the lands under its stewardship "in such manner and by such means as would leave them unimpaired for the enjoyment of future generations "(NPS Organic Act, 54 U.S.C § 100101(b) et seq.).

Under its Organic Act, the National Park Service has the authority to develop and direct mitigation for impacts to resources under its jurisdiction. This is in addition to the requirements that may be created through the need to comply with laws and regulations managing resource impacts that are overseen by other agencies. To meet these obligations, the NPS has developed Management Policies and Director's Orders that identify the authorities (laws, regulations, and executive orders) directing how impacts and mitigation to resources shall be managed as well as the policies and procedures by which the NPS shall comply with these authorities. A full listing of the NPS policies is available from the NPS Office of Policy website at https://npspolicy.nps.gov/index.cfm. Table 1 details project design criteria (PDC) and best management practices (BMP) incorporated into Alternative 3 to minimize potential adverse impacts from implementation and construction of the NPS-preferred alternative. Most of the project design criteria and best management practices provided are considered common practices for shoreline stabilization projects to prevent or decrease potential resource impacts. They are highly effective methods that can be planned and adapted to site conditions as needed. The potential effects of implementing the preferred alternative (described in Chapter 3) are presented under the assumption that these project design criteria and best management practices are applied.

TABLE 1 - PROJECT DESIGN CRITERIA AND BEST MANAGEMENT PRACTICES FOR THE PREFERRED ALTERNATIVE

Project Phase	Project Criteria and Best Management Practices
Design	• The actual design of the stabilization structure would consider historical water level, wave height, and wave period data plus site specific topographic and bathymetric conditions to develop a design along each segment that will provide sufficient shoreline and scour protection from a design storm and future sea level scenario. • The actual design would incorporate the park's MHW level boundary to ensure no subsurface lands would be impacted. • A combined Wetland and Floodplain Statement of Findings would be completed and approved during the design process to minimize wetland, and floodplain impacts and determine exact wetland impact quantities for compensatory mitigation. • A Federal Consistency Determination would be completed and submitted to NC Division of Coastal Management to ensure the design would be consistent with the states coastal management policies • The NPS would consider the design criteria identified within the USACE Nation Wide Permit 13 - Bank Stabilization and 15A NCAC 07H .1100 -

	NC GENERAL PERMIT FOR CONSTRUCTION OF BULKHEADS AND RIPRAP REVETMENTS FOR SHORELINE PROTECTION IN ESTUARINE AND PUBLIC TRUST WATERS AND OCEAN HAZARD AREAS as a reference for the purposes of federal consistency. Federal consistency requires that federal actions, within and outside the coastal zone, which have reasonably foreseeable effects on any coastal use (land or water) or natural resource of the coastal zone be consistent with the enforceable policies of a state's federally approved coastal management program

Pre-Construction	• State and federal permits would be obtained to support the proposed action/preferred alternative as needed:
	    • United States Army Corps of Engineers Section 404/Section 10 Permits
	    • North Carolina Department of Environmental Quality (NCDEQ) Division of Water Resources (NCDWR) 401 Water Quality Certification
	    • NCDEQ Division of Energy, Mineral, and Land Resources (DEMLR) Soil Erosion and Sedimentation Control (SESC) Permit (for disturbances greater than one acre)
	
	• A public information program to notify users of temporary closures, delays, and road hazards during construction shall be implemented. This program would help convey appropriate messages to the public and aid in mitigating potential impacts on visitors' expectations and experiences.
	• A project schedule would be provided to the public as soon as it is known.
	• All utilities (power, fiber, water, sewer, etc.) would be marked properly prior to construction activities by utility companies. If any utility shutdowns are expected due to project activities, notification to the National Park Service is required.
	NPS will remove any invasive plants that may have entered construction areas using approaches prescribed in the NPS Integrated Pest Management Program.
	• The project administrator shall inspect all off-road equipment prior to entering NPS lands to ensure that they are free of soil, seeds, vegetative matter, or other debris that could contain or hold noxious weed seeds. "Off-road equipment" includes all construction machinery except for pickup trucks, service vehicles, cars, or similar vehicles.
	• Measures must be identified to prevent or control spills and /or leaks of fuels, lubricants, or other contaminants from entering the park and any water body.
	• Clearing limits shall be adequately buffered and marked in the design and marked with silt fencing within the project area.
	• To minimize the amount of ground disturbance, staging and stockpiling areas shall be in pre-identified, NPS approved sites.
	• Construction sites would be marked as appropriate and limited to the smallest feasible area.
	• Protective fencing and barricades would be provided for safety and to preserve natural and cultural resources.
	• Vegetation would be cleared only as necessary to construct the access routes for truck and equipment passage.

	• Tree clearing efforts would take place outside of the avian spring and summer nesting seasons (April 1– August 31). Additionally, surveys are required to determine if the project area contains nests for the American bald eagle during fall/winter seasons. • Tree clearing would take place outside the federally listed bat pup seasons (May 1–July 15) per United States Fish and Wildlife Service (USFWS) guidelines for the endangered northern long-eared bat and the proposed listed tricolored bat. • Effective stormwater management measures specific to the site would be implemented, and appropriate erosion and sedimentation control measures would be in place during construction and removed upon project completion, when appropriate.
During Construction	• NPS policies and procedures for protecting and preserving cultural resources, including guidance addressing unplanned discoveries of cultural resources, would be followed. If undocumented historic or archeological resources are located during ground-disturbing activities, all construction in the immediate vicinity must cease and properties shall be treated as specified in 36 CFR Part 800, Protection of Historic Properties. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed. • An archeologist with the Secretary of Interior qualifications shall be on-site to monitor construction, including excavation and grading activities. Should any archeological resources be uncovered during construction, construction would be halted until a discovery plan is enacted. • A biologist qualified with the identification of the parks species and the ecosystem would conduct daily species surveys to avoid project work interaction with federal listed species. Encountered species would be allowed to move out of the project area before work commenced. • Per 2017 USFWS Guidelines for Avoiding Impacts to the West Indian Manatee: If a manatee is seen within 100 yards of the active construction and/or dredging operation or vessel movement, all appropriate precautions would be implemented to ensure protection of the manatee. These precautions include the immediate shutdown of moving equipment if a manatee comes within 50 feet of the operational area of the equipment. Activities would not resume until the manatee has departed the project area of its own volition (i.e., it may not be herded or harassed from the area). • All USFWS and National Marine Fisheries Service (NMFS) recommendations would be followed by the contractors. • Any collision with and/or injury to a listed aquatic species would be reported immediately to NMFS's Protection Resources Division at 727-824-5312 and to Cape Hatteras National Seashore biologists at 252-216-6892. • Construction workers would be responsible for following recommended safety procedures. An active construction site would be off limits to park visitors. Temporary barriers would be used to prevent visitor access to the site, and signs would be installed along access routes and at access points to warn visitors of construction activities. Construction materials would be in a secure area. • All fill material must be clean material and weed free.

	• All contractor equipment and vehicles shall be washed off-site prior to operating on NPS lands. • The NPS would ensure that the contractors implement measures to prevent invasive plants from entering construction areas, such as ensuring that construction-related equipment arrives at the site free of mud or seed-bearing materials and certifying that all seeds and straw material are weed-free. • Equipment must be free of any fluid (fuel, oil hydraulic fluid, etc.) leaks upon arrival to the work site and would be inspected at the beginning of each shift for leaks. Leaking equipment would be removed off site for necessary repairs before the commencement of work. • Runoff from stockpiled material must be controlled with silt fencing, filter cloth, coir wattles, or other appropriate means to prevent reentry into waterways. • All hazardous materials and hazardous waste materials (petroleum products, used oil filters, etc.) would be stored in structurally sound and sealed containers in the hazardous materials storage area and segregated from the other non-hazardous materials. All hazardous materials would be disposed of in accordance with federal, tribal, and state regulations. • All waste generated would be properly disposed of in a contractor-provided trash bin located in an approved site and hauled off promptly at project completion. • Construction equipment and maintenance materials would be stored at NPS-approved staging areas. • All major equipment fueling, and maintenance would be performed offsite or on impervious surfaces such as concrete or asphalt or deploy a spill containment pad. Absorbent, spill cleanup materials and spill kits would be located at the staging area. All equipment receiving maintenance and vehicles, and equipment parked overnight would have drip pans placed beneath them. • To reduce noise and pollution emissions, construction equipment would not idle any longer than is necessary for safety and/or mechanical reasons. • No amplified artificial music (stereos, smartphones, etc.) would be allowed. • To the extent practicable, work shall be scheduled to avoid construction activity and construction-related delays during peak visitation times. No holiday or nighttime work shall be allowed. Weekend work (Friday through Sunday) shall not be allowed unless authorized in writing by the NPS. • No work would occur outside the limits of disturbance without NPS approval.
Post-Construction	• All construction access routes, staging, and site fencing would be removed upon completion of construction. • Disturbed areas would be returned to pre-existing contours (where applicable) and seeded and planted with NPS-approved vegetation per NPS standards. Restoration efforts would be the responsibility of the contractor. • The NPS would monitor and treat invasive and exotic plant species. Herbicides must be approved through the Pesticide Use Proposal System

	(PUPS). Application of herbicides shall be by licensed applicators and certificates must be issued to the NPS. At completion of annual work, a pesticide use log must be submitted to the NPS and entered into PUPs prior to the next years' herbicide treatments. • Annual summaries of restoration efforts, lessons learned, and plans for the subsequent year would be prepared near the end of the calendar year to document restoration success and inform adaptive management decision-making.

ALTERNATIVES CONSIDERED BUT DISMISSED

During the development of the proposed action and refinement of the project's purpose and need statement, the NPS considered a range of alternatives. The range of alternatives includes those evaluated in a Value Analysis Study performed in 2018 (Kirk 2018). A summary of some of these alternatives and reasons for their dismissal from further consideration are provided below. The NPS dismissed alternatives determined to be problematic and as such would not accomplish the purpose and need of the project, which is to substantially stabilize the unprotected 1.1 miles of shoreline from eroding and impacting further NPS resources and facilities. Therefore, the following alternatives were considered but dismissed from further consideration.

Offshore Breakwater

A living shoreline is a natural approach to shoreline stabilization that incorporates the use of native vegetation, natural materials, and ecological processes to protect coastal areas from erosion while enhancing habitat and water quality. Living shorelines typically include features such as marshes, a breakwater, and other natural elements that work together to absorb wave energy and reduce erosion. A breakwater is a man-made structure, typically constructed of rock or concrete, designed to protect the shoreline from wave action and erosion. Breakwaters are often placed offshore and act as barriers to incoming waves, reducing their energy before they reach the shore. This can help to create calmer waters behind the structure, which can promote sediment deposition and potentially lead to beach accretion.

During the Value Analysis Study, a living shoreline with an offshore breakwater was identified as a preferred alternative since it was identified, at the time, as having the best value score when comparing the total importance of the advantages against the life cycle costs. However, the breakwater would need to be placed outside of FORA boundaries and the NPS cannot use federal funding for projects outside of NPS property. Appropriations and funding guidelines often specify that federal funds allocated to the NPS are to be used for projects and activities that occur within the boundaries of federally designated park lands.
A review of the effectiveness of a living shoreline was revisited as part of this planning effort. Several local and state examples were also reviewed. The following elements were considered:

As a result of this concern, the Offshore Breakwater Alternative was determined to not be a reasonable alternative for consideration as a single Action Alternative. However, when included as a potential component in each of the proposed Action Alternatives and completed prior to any rock embankment or berm construction, it was decided to include an “Actions Common to all Action Alternatives” in the EA.

Beach Fill (Nourishment) and Dune Creation

This alternative consists entirely of natural protection by constructing a large beach fill area with a vegetated dune. A 100-foot-wide nourished beach with a vegetated dune would be created along the unarmored shore. To help stabilize the dune under storm surge and high wave energy events, the landward portion of the beach fill near the toe of the dune would be covered by planted vegetation.

Because the beach would be expected to erode over time, this alternative was determined to not be a reasonable, stand-alone alternative for long-term stabilization. However, beach nourishment/fill was considered as a measure in “common to all alternatives” for use in building the beach out prior to the placement of hardening measures. The timeline for implementation of these other alternatives is variable and may extend for several years. Within that timeframe, opportunities may arise for a portion of this alternative that would provide temporary benefits to the site by implementing the beach fill aspect.

Bulkhead

This alternative consists of a retaining wall used along a shoreline to protect against erosion and shoreline retreat caused by waves and flooding. Bulkheads are most often constructed of wood, concrete, or sheet pile. While bulkheads may serve their purpose to slow erosion at a bluff, the increased wave reflection caused by their presence can result in increased re-suspension of sand in the water in front of the structure. Any sand that remains in front of the structure is typically lost due to currents and littoral drift.

Additionally, the tiebacks required for this stabilization structure would need to be exceptionally long, which would be difficult to install effectively due to the need to excavate into the existing soil of the bluff that is covered with mature vegetation and trees and unknown archeological resources. In addition, the longevity of the bulkhead would not be as long as the alternatives proposed, even with the placement of armor stone in front of the bulkhead (Kirk 2018).

Due to the potentially extensive impacts to the maritime forest vegetation and wildlife habitat and unknown archeological resources along with the high life cycle costs, this alternative would not be carried forward for analysis in the EA.

Chapter 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the affected environment (the existing conditions of resources, including trends, ongoing and planned actions) and the environmental consequences associated with the No-Action Alternative, Alternative 1 – Rock Revetment, Alternative 2 – Rock Berm, and Alternative 3 – Combination on each resource topic as presented in Chapter 1. The "Environmental Consequences" section evaluates direct and indirect impacts and overall effects from the implementation of each alternative. A factual description of the direct and indirect effects provides the reader with an understanding of how the current and expected future condition of the resource would likely change because of implementing the alternatives. A comparative conclusion of the alternatives is included for each impact topic.

GENERAL METHODS FOR ASSESSING IMPACTS

In accordance with NEPA implementation, impacts of the alternatives are described under each impact topic. Where appropriate, mitigation measures for adverse impacts are also described and incorporated into the evaluation of impacts. The methods used to assess potential impacts are based on a review of pertinent literature and NPS studies; information provided by on-site experts and other agencies; professional judgment; recent field site assessment; and NPS staff knowledge and insight. The specific methods used to assess impacts for each resource may vary. While Chapter 2 provides descriptions of the No-Action and Alternatives 1, 2, and 3, and Appendix B provides a review of past park actions as related to each impact topic describing the affected environment and resource trends. Chapter 3 provides information on each impact topic and how it relates to each proposed alternative. In 2024 the NPS conducted a biological and site condition assessment for the project area (Biological Resources and Site Condition Assessment Report, HDR 2024). This assessment utilizes a combination of desktop materials and in-field reconnaissance to evaluate the projects estimated acreage and assess the maximum extent of environmental consequences prior to finalizing the project design.

Relative to general environmental trends, anticipated changes in sea level and the resultant increases in tide and storm surge levels will influence the rate of shoreline erosion at FORA. There are many projections for anticipated sea level rise based on both environmental and social factors. In addition, uncertainties exist relative to the processes that affect sea level rise, including global and regional changes in emissions and natural variability.

For the purposes of analysis in this EA, near-term (2020–2050) sea level change is expected to range from approximately 1.2 foot to 1.8 feet for the Atlantic/NC coast Region (NOAA 2022). Long-term (2050–2100) ranges from approximately 2.07 feet to 7.12 feet for the Atlantic/NC coast Region (NOAA 2022). A 1-meter (3.3-foot) rise is considered a good estimate for planning purposes because that rate requires only that the linear relationship between temperature and sea level noted in the 20th century remains valid for the 21st century and because it is not located at the upper or lower extreme of valid projections (NCCRC 2010).

Extreme water levels are also predicted to change. Weather trends are expected to increase the extent and frequency of coastal flooding (Loehman 2009) from storm surges and sea level rise.

Frequencies of NOAA defined high tide flooding for minor, moderate, and major flooding is expected to nearly double by 2050 (NOAA 2022). Storm surge at FORA for a category 3 storm has been predicted for mean and high tides to be 8.8 feet and 9.7 feet, respectively (Caffrey 2013). Changes in the frequency of severe storms and increased rainfall intensity could further aggravate flooding and storm damage (Loehman 2009).

Due to changes in sea level and storm frequency and magnitude, the rate of shoreline erosion is also anticipated to increase compared to historical trends. From 1851–1970, shoreline loss ranged between 4 feet and 8 feet per year (ft/yr) for North Roanoke Island (Riggs and Ames 2003). While stabilization with hardened structures on North Roanoke Island began in the 1970s, shoreline recession along nonhardened sections of the shore has continued, averaging approximately 4 to 10 ft/yr (Riggs and Ames 2003).

AQUATIC AND TERRESTRIAL WILDLIFE AND HABITAT

Existing and Expected Future Conditions of the Environment

Aquatic and terrestrial wildlife resources include living, native, or naturalized fish and animals and their habitats. Species protected under the Endangered Species Act (ESA) and state-equivalent requirements, Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and Magnuson-Stevens Fishery Conservation and Management Act are also evaluated in this resource subtopic. The 9.88-acre project area includes four shoreline sections and three access routes.

The project area lies in the EPA Level III Middle Atlantic Coastal Plain Ecoregion and within the Nonriverine Swamps and Peatlands Level IV Ecoregion (Griffith 2002). The habitats identified within the project area are of common distribution within the Coastal Plain and provide various ecological functions, including nesting and foraging habitat for numerous species of birds, mammals, reptiles, amphibians, fish, and macroinvertebrates. The project area also includes the potential presence of threatened and endangered species, discussed in (Species of Special Concern).

Incidental wildlife observations were recorded during the biological and site condition assessment field surveys conducted on February 15 and 16, 2022 (HDR, *2024*). Common birds and mammals, or indications of their presence (e.g., tracks, scat), observed during field surveys include American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), brown-headed nuthatch (*Sitta pusilla*), cedar waxwing (*Bombycilla cedrorum*), Carolina chickadee (*Poecile carolinensis*), Carolina wren (*Thryothorus ludovicianus*), chipping sparrow (*Spizella passerina*), laughing gull (*Leucophaeus atricilla*), northern cardinal (*Cardinalis cardinalis*), red-bellied woodpecker (*Melanerpes carolinus*), red fox (*Vulpes vulpes*), scarlet tanager (*Piranga olivacea*), yellow-bellied sapsucker (*Sphyrapicus varius*), swallows (Hirundinidae), terns (Laridae), eastern gray squirrel (*Sciurus carolinensis*), and raccoon (*Procyon lotor*). Common birds seen along the shore of the Albemarle Sound system include willet (*Tringa semipalmata*), sanderling (*Calidris alba*), American oystercatcher (*Haematopus palliatus*), brown pelican (*Pelecanus occidentalis*), American white ibis (*Eudocimus albus*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucophalus*), and several species of gulls (family: Laridae).

Three terrestrial vegetation communities exist within the project area and include coastal fringe evergreen forest (Typic subtype), maritime evergreen forest (Mid-Atlantic subtype), and maritime dry grassland (Typic subtype), which are further explained in (Vegetation). The wildlife observations recorded during the 2024 biological site assessment were mainly species located within the maritime evergreen forest, which supports a variety of terrestrial species. All three terrestrial vegetative communities could provide suitable habitat for the following reptiles and amphibians: Carolina anole (*Anole carolinensis*), southeastern five-lined skink (*Eumeces inexpectatus*), broadhead skink (*Plestiodon laticeps*), eastern box turtle (*Terrapene Carolina*), American toad (*Anaxyrus americanus*), Fowler's toad (*Anaxyrus fowleri*), black racer (*Coluber constrictor*), corn snake (*Elaphe guttata*), rainbow snake (*Farancia eryrogramma*), milksnake (*Lampropeltis Triangulum*), rough green snake (*Opheodrys aestivus*), eastern hognose snake (*Heterodon platirhinos*), cottonmouth (*Agkistrodon piscivorus*), timber rattlesnake (*Crotalus horridus*), and copperhead (*Agkistrodon contortrix*). Many more species of reptiles, amphibians, insects, and birds not listed here are supported by the terrestrial vegetation communities.

Common aquatic wildlife of the Albemarle Sound system supported in the project area include freshwater, estuarine, and anadromous fish species, such as striped bass (*Morone saxatilis*), speckled trout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), spot (*Leiostomus xanthurus*), flounder (*Paralichthys* spp.), croaker (*Micropogonias* spp.), crappie (*Pomoxis* spp.), sunfish (*Lepomis* spp.), perch (Perca spp.), catfish (family Ictaluridae), and shad (*Alosa* spp.). Common shellfish found in the Albemarle Sound system include blue crab (*Callinectes sapidus*) and other portunids (swimming crabs), brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*F. duorarum*), white shrimp (*Litopenaeus setiferus*), ribbed mussel (*Geukensia demissa*), and the eastern oyster (*Crassostrea virginica*).

Anticipated environmental trends, including the continued loss of shoreline due to erosion, are expected to change terrestrial habitats into aquatic habitats.

Essential Fish Habitat

In conformance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (as amended 1996), an assessment was conducted to evaluate Essential Fish Habitat (EFH) and describe potential adverse effects on essential fish habitat. Essential fish habitat is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growing to maturity (16 USC 1802, 50 CFR § 600.10). The Magnuson-Stevens Act requires that the National Marine Fisheries Service (NMFS) work with federal and state agencies, regional fishery management councils, and the fishing community to protect, conserve, and enhance essential fish habitat.

A desktop analysis using the NMFS EFH mapper (NOAA 2022) and subsequent field verification identified approximately 8.28 acres of essential fish habitat within the project area, consisting of 2.78 acres of unconsolidated shoreline associated primarily with the intertidal zone of the Albemarle Sound and 5.5 acres of unconsolidated bottom habitat types. Essential fish habitat in the project area appears to be moderate to high quality with minor impacts from adjacent development and FORA's current rock berms and revetment installations. Moderate to high quality essential fish habitat refers to areas that provide optimal conditions for survival, growth, and reproduction of fish species that help maintain sustainable fish populations. This is crucial for the conservation and management of fish populations and sustainable fisheries practices. The stewardship of fisheries and habitat within the Albemarle Sound is not within the scope of FORA; rather it falls under the responsibility and management of the North Carolina Division of Water Quality (NCDEQ) and NOAA. These organizations release annual Coastal Habitat Protection Plans to ensure that the there is a foundation for healthy and sustainable fisheries (CHPP 2021). The shoreline near FORA contains past coastal structures that included hardened structures that contribute to the goals outlined in the plan (CHPP 2021).

Unconsolidated shores are characterized by substrates lacking vegetation, except for pioneer plants. Erosion and deposition by waves and currents produce significant landforms, such as beaches, bars, and flats, all of which typify unconsolidated shores. Unconsolidated bottoms are defined as all wetland and deepwater habitat with at least 25 percent cover of particles smaller than stone and less than 30 percent vegetative cover as they lack large, stable surfaces for plants or animals to attach. These environments can be subtidal; permanently, intermittently, or semi permanently flooded; or flooded-tidal. Unconsolidated shores are found adjacent to unconsolidated bottoms in the landward position of an intertidal zone. NMFS requires both these types of EFH habitats to be analyzed as they differ in ecological niches, vulnerabilities, and regulatory requirements. The combination of the impacts would obscure the impacts on the individual ecosystems. An EFH Memorandum that further describes EFH types, habitat areas of particular concern (HAPC), and federally managed fisheries is included in (*Biological Resources and Site Condition Assessment Report, HDR 2024*).

Federally managed fisheries were also evaluated using the NMFS EFH Mapper (NOAA 2022). Federally managed fisheries with habitat within the project area or in the immediate vicinity (i.e., Croatan, Roanoke, and Albemarle Sounds) include the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*), smoothhound shark complex (*Mustelus* spp.), spiny lobster (*Panularis* sp.), penaeid shrimp management unit, and the snapper-grouper management unit. These fisheries are described in greater detail in the EFH Memorandum in (*Biological Resources and Site Condition Assessment Report, HDR 2024*).

Section 7 of the Endangered Species Act requires federal agencies to ensure actions they authorize do not jeopardize the existence of any federally listed species. Under Section 7(a)(2), federal agencies must consult with the NOAA Habitat Conservation Division when any project or action they take might affect any ESA listed marine species of designated critical habitat. During the permitting process, informal consultation will occur with the NOAA Southeast Regional Office for EFH resources and with the NOAA Fisheries Protected Resources Division for fish species.

As a result of anticipated environmental trends (see General Methods for Assessing Impacts), continued loss of shoreline due to erosion is expected. Rising sea levels could have consequences for the two EFH habitat types, potentially leading to a decline in habitat quality and the variety of associated aquatic species (NPS 2021c). These environmental trends increase sedimentation and degrade the water quality and benthic communities that support fish habitat (NPS Management Policies 2006).

Environmental Consequences

Impacts of the No-Action Alternative

The No-Action Alternative would not impede the FORA shoreline's existing natural erosion processes and would not result in any direct impacts to aquatic and terrestrial wildlife and their habitats.

The No-Action Alternative would cause permanent, indirect, adverse impacts on aquatic and terrestrial wildlife and their corridors. These impacts stem from sustained erosion, potentially contributing to habitat deterioration. Recent scientific research and modeling have indicated that coastal erosion precipitates the degradation and loss of vital habitat components, including intertidal mud flats and tidal marshes (NPS 2021c). These habitats play pivotal roles in the reproductive cycles, shelter provision, and food availability for various fish species. Furthermore, the process of coastal erosion increases water quality deterioration through heightened sedimentation and runoff. This influx of sediment and pollutants not only disrupts the ecological balance but also impacts the health and sustainability of aquatic ecosystems, affecting the overall resilience of fish populations and the integrity of marine biodiversity (NPS 2021c).

Impacts on the terrestrial wildlife and habitats within the project area result in direct land loss and loss of related forested habitat, which is vital to biodiversity. The current rate of erosion can induce habitat fragmentation, which disrupts species dispersal and genetic connectivity. This can diminish biodiversity by eliminating the distinct plant communities or potential nesting habitats of terrestrial species. Additionally, these habitats become increasingly susceptible to storm surges and flooding, exacerbating coastal instability and habitat degradation as the shoreline erodes an estimated rate of one to five feet per year.

Impacts of Alternative 1 – Rock Revetment

Under Alternative 1, permanent, direct, adverse impacts on aquatic life due to the loss of approximately 3.15 acres of EFH (1.42 acres of unconsolidated bottoms and 1.73 acres of unconsolidated shore) would be attributable to the placement of riprap fill along approximately 5,146 feet of shoreline in Sections A–D (*Biological Resources and Site Condition Assessment Report, HDR 2024*). However, the incorporation of hard substrate provides ecological benefits to fish and oyster habitats through the provision of structural support for colonization, shelter, and foraging, (Seitz, et al., 2006, Chee et al., 2020, and Naylor et al., 2017).

Implementation of Alternative 1 would result in long-term beneficial impacts on localized aquatic habitat through reduced aquatic habitat deterioration adjacent to the shoreline as a result of reduced coastal erosion. Permanent shoreline erosion protection would reduce the effects that coastal erosion has on aquatic habitats and water quality by reducing eroding soils from sloughing off into the water. Rock revetment installation would result in temporary, direct, adverse impacts on aquatic wildlife, including a disruption to approximately 2.11 acres of EFH (1.31 acres of unconsolidated bottom and 0.80 acres of unconsolidated shore) due to the construction of temporary shoreline access routes to support construction actions (*Biological Resources and Site Condition Assessment Report, HDR 2024*).

Permanent, direct, adverse impacts on terrestrial wildlife involve minimal loss of maritime forested habitat. A total of 0.05 acre out of 0.38 acre of maritime forest in the project area would be lost due to the placement of fill and revetment.

Similarly, Alternative 1 would result in long-term, beneficial impacts on localized terrestrial habitat due to permanent shoreline stabilization measures. Reducing shoreline erosion would result in reduced terrestrial habitat loss for maritime forest habitat and maritime dry grasslands. Shoreline erosion results in the permanent loss of localized terrestrial habitats. Current shoreline erosion rates at FORA, given current trends, are anticipated to be between 1 to 5 ft/yr (Riggs and Ames 2003). The loss of this terrestrial habitat can be reduced through the implementation of shoreline protection measures.

Temporary, direct, adverse impacts on localized terrestrial habitat and wildlife would occur due to disturbance or displacement of wildlife due to temporary construction actions. Alternative 1 would result in a total of 0.18 acre of temporary impacts to forested areas (*Biological Resources and Site Condition Assessment Report, HDR 2024*). Construction-related impacts would be minimized to the extent practicable during final design and permitting. FORA will not plan to remove forested cover along bluffs/shorelines, unless a tree is compromised or falling into the sound. Construction access routes in terrestrial landscapes (20–25 feet wide and approximately 400 feet long) may be re-vegetated with appropriate NPS approved species postconstruction.

Should the opportunity arise, beach fill may be used in advance of all alternative's construction phases (see Chapter 2) to provide short-term benefits to aquatic and terrestrial wildlife and habitat by supplying a temporary sediment source to reduce erosional impacts and protect aquatic and terrestrial wildlife and habitats. Beach fill offers a temporary benefit, lasting 3–5 years, contingent on the quantity deposited within the project area. Beach fill would contribute to shoreline stabilization and foster temporary habitat for various benthic aquatic organisms and build wildlife and foraging corridors for terrestrial species. However, temporary, short- to long-term, direct, adverse impacts may arise during and post-sediment placement. These impacts may entail the burial of benthic communities at the project site, with repercussions expected to persist for periods ranging from 6 months to several years (Corbett and Walsh 2017). Additionally, beach fill could result in temporary, short-term, direct, adverse impacts related to elevated turbidity levels in the water column, potentially impacting essential fish habitat.

Implementation of Alternative 1 would result in long-term beneficial impacts on localized aquatic habitat through reduced aquatic habitat deterioration adjacent to the shoreline as a result of reduced coastal erosion. Permanent shoreline erosion protection would reduce the effects that coastal erosion has on aquatic habitats and water quality by reducing eroding soils from sloughing off into the water. Rock revetment installation would result in temporary, direct, and adverse impacts on aquatic wildlife, including a disruption to approximately 2.11 acres of EFH (1.31 acres of unconsolidated bottom and 0.80 acres of unconsolidated shore) due to the construction of temporary shoreline access routes to support construction actions (*Biological Resources and Site Condition Assessment Report, HDR 2024*).

Impacts on localized terrestrial habitat and wildlife would occur due to disturbance or displacement of wildlife due to temporary construction actions. Alternative 1 would result in a total of 0.18 acre of temporary impacts to forested areas (*Biological Resources and Site Condition Assessment Report, HDR 2024*). Construction-related impacts would be minimized to the extent practicable during final design and permitting. FORA will not plan to remove forested cover along bluffs/shorelines, unless a tree is compromised or falling into the sound. Construction access routes in terrestrial landscapes (20–25 feet wide and approximately 300 feet long) would be re-vegetated with appropriate NPS approved species postconstruction.

Impacts of Alternative 2 – Rock Berm

Permanent, beneficial impacts on aquatic and terrestrial habitat are similar to those for Alternative 1. Permanent, direct, adverse impacts on aquatic life include a loss of approximately 3.46 acres of EFH (2.22 acres of unconsolidated bottoms and 1.24 acres of unconsolidated shores) attributable to the placement of riprap fill along 5,244 feet of shoreline in Sections A–D (*Biological Resources and Site Condition Assessment Report, HDR 2024*).

Temporary, direct, adverse impacts on localized impacts of Alternative 1 – Rock Revetment include a temporary disruption to aquatic life of approximately 1.72 acres of EFH (0.92 acre of unconsolidated bottoms and 0.81 acre of unconsolidated shore) due to the temporary construction limits on the seaward side of existing rock revetment and rock berm and the proposed rock berm (see Table 2).

The anticipated permanent, direct, adverse impacts on terrestrial wildlife are similar to Alternative 1. Permanent (0.03 acre) and temporary impacts (0.23 acre) to forested areas from Alternative 2 are provided in Table 2 and would be minimized further during design and permitting. FORA will not plan to remove forested cover along bluffs/shorelines unless a tree is compromised or falling into the sound. Similar to the other alternatives, construction access routes (20-25 feet wide and approximately 400 feet long) would be re-planted with appropriate, NPS-approved species post-construction.

Impacts on aquatic and terrestrial habitat and wildlife as a result of beach fill are identical to those described for Alternative 1.

Impacts of Alternative 3 – Rock Berm/Rock Revetment Combination (Proposed/Preferred)

The impacts on aquatic wildlife exhibit similarities to Alternative 1 and Alternative 2, as Alternative 3 combines both alternatives. Permanent, adverse impacts on approximately 4.74 acres of EFH (2.29 acres of unconsolidated shore and 2.45 acres of unconsolidated bottoms) (*Biological Resources and Site Condition Assessment Report, HDR 2024*), would be attributed to the revetment riprap fill along 5,146 feet of shoreline and the rock berm footprint along 5,244 feet of shoreline in Sections A–D. Consistent with Alternative 1 and Alternative 2, comparable long-term ecological benefits are anticipated. Temporary, direct, adverse impacts are anticipated involving the disturbance and displacement of aquatic species across approximately 3.54 acres of EFH, (0.49 acre of unconsolidated shores and 3.05 acres of unconsolidated bottoms) due to rock revetment and rock berm installation in Sections A–D (Table 2). Impacts would be similar to the design elements in both Alternative 1 and Alternative 2.

Similarly, the impacts on terrestrial wildlife align with Alternative 1 and Alternative 2. Permanent (0.07 acre) and temporary (0.31 acre) impacts on forested areas from Alternative 3 are provided in Table 2 and would be minimized further during design and permitting. FORA does not plan to remove forested cover along bluffs/shorelines unless a tree is compromised or falling into the sound. Similar to the other alternatives, construction access routes (20–25 feet wide and approximately 400 feet long) would be re-planted with appropriate NPS-approved species post-construction. Impacts on aquatic and terrestrial habitat and wildlife as a result of beach fill are identical to those described for Alternative 1.

Past actions in the vicinity of FORA include the previous shoreline protection efforts. Approximately 75 percent of North Roanoke Island has been armored with rock revetments, wooden bulkheads, groins, and breakwaters. Figure 4 in Chapter 1 shows the average, annual, estuarine shoreline erosion rate and the location and type of structures, as well as the distribution of shoreline types (Riggs and Ames 2003). Armoring the shoreline has resulted in both adverse effects on aquatic habitat and beneficial effects on terrestrial habitat. While Alternatives 1–3 would add to the amount of stabilized shoreline, there is approximately 7,200 feet of shoreline remaining that has not been stabilized on North Roanoke Island (estimated from Riggs and Ames 2003), not including FORA shoreline north of U.S 64.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and the resultant loss of terrestrial habitat would continue. The No-Action Alternative would contribute to this trend as it would not protect terrestrial habitat. Alternatives 1–3 would not contribute to this trend but would provide a beneficial effect on this trend as terrestrial habitat, forested areas abutting the existing shoreline/buffs, would be protected from shoreline erosion.

Conclusion

Alternative 1 - rock revetments when used regarding aquatic and terrestrial wildlife and habitats would address the existing steep and high embankment from continual sluffing. By the placement of fill soil, not sand, and a layer of well graded rock along these high embankments there would be a direct positive effect on the state recognized maritime evergreen forest above these embankments. The stabilization of the northern embankments along Roanoke Island would eliminate the continual sluffing of the slope and the eroding out and falling over of these forests' trees. Long term these revetments would trap sediment, organic matter, and plant seeds, providing for eventual forest replacement over these revetments. However, the installation of revetments can also disrupt existing habitats for various species, including aquatic species and other wildlife that rely on natural shorelines.

Alternative 2 - rock berm would be placed on beach fill in a low elevation area between the water's edge and the beach fill area. The berms rocks would be placed resembling a trapezoidal cross-section shape. This placement will protect the beach area from wave action and assist in the establishment of marsh plantings. These rock berms would be constructed having overlapping gaps allowing aquatic organisms to move between areas as water levels change. This in time creates a vegetative barrier thus creating a living shoreline. Negative results can take place in the lack of biodiversity and ecosystem degradation due to hard infrastructure placement to establish the living shoreline. These immediate effects can disrupt the habitats of various species that rely on natural beaches.

With these planned actions, both types of shoreline rock protection along with the beach fill can address and stabilize the parks erosion issues and provide a more environmentally sustainable shoreline.

The No-Action Alternative would perpetuate the permanent, indirect loss of EFH and terrestrial wildlife forest habitat due to coastal erosion processes and have a permanent, indirect, adverse impact on aquatic and terrestrial wildlife.

Alternatives 1–3 would have a permanent, direct, adverse impact on aquatic and terrestrial habitat due to the placement of fill and rock revetment (see Table 2).
Alternatives 1–3 would have a similar permanent, direct, beneficial impact on aquatic and terrestrial habitat due to a reduction of the effects of shoreline erosion and preservation of high-quality upland forested areas from eroding into the Albemarle Sound.
Alternative 2 (5.19 acres total) would result in reduced impact on both temporary and permanent direct EFH resources compared to Alternatives 1 (5.26 acres total) and 3 (5.81 acres total), which necessitate no in-water structures due to the installation of rock revetments.

The temporary, direct, beneficial impacts associated with beach fill are identical among the three alternatives and include short-term shoreline stabilization and providing habitat for various aquatic and terrestrial species. However, temporary, short- to long-term, direct, adverse impacts may arise during and post-sediment placement.

TABLE 2. AQUATIC AND TERRESTRIAL WILDLIFE IMPACTS

Alternative	EFH US[1] Temporary Impacts (Ac)	EFH US Permanent Impacts (Ac)	EFH UB[2] Temporary Impacts (Ac)	EFH UB Permanent Impacts (Ac)	Forested[5] Area Temporary Impacts (Ac)	Forested Area Permanent Impacts (Ac)
No-Action Alternative	NA	NA	NA	NA	Unknown	Unknown
Alternative 1 – Rock Revetment	0.804	1.73	1.31	1.42	0.18	0.05
Alternative 2 – Rock Berm	0.80	1.24	0.92	2.22	0.23	0.03
Alternative 3 – Rock Revetment/Rock Berm Combination	0.49	2.29	3.05	2.45	0.31	0.07

1. Unconsolidated Shoreline
2. Unconsolidated Bottoms
3. Temporary and permanent forested area impacts cannot be quantified for the No-Action Alternative. Forest loss due to climate-induced erosion is anticipated as a permanent impact.
4. Limits of beach fill have not been delineated and are not incorporated into EFH impact calculations for the alternatives.
5. Final temporary and permanent forested impacts would be determined during permitting and design.

SPECIES OF SPECIAL CONCERN

Existing and Expected Future Conditions of the Environment

In accordance with Section 7 of the Endangered Species Act of 1973, the project area was evaluated for the potential occurrences of federally listed threatened and endangered species. The US Fish and Wildlife Service (USFWS) primarily has responsibility for terrestrial and freshwater organisms, while the National Oceanic and Atmospheric Administration (NOAA) – National Marine Fisheries Service has jurisdiction over mainly marine and anadromous wildlife.

The USFWS Information for Planning and Consultation System (IPaC) (USFWS 2022a), the USFWS Domestic Listing Workplan for Fiscal Year 2022–2027 (USFWS 2022b), the North Carolina National Heritage Program (NCNHP 2022), and the NOAA ESA Section 7 Mapper (NOAA 2023) were reviewed as part of this analysis. Additionally, a field survey was conducted within the project area on February 15 and 16, 2022, to assess the potential for the presence of suitable habitat for protected species, and no federally listed species were identified during winter field surveys (HDR 2024).

Federally and state-listed threatened or endangered species with the potential to occur in the vicinity of the project area are provided in the USFWS IPaC and NCNHP database reports in *Biological Resources and Site Condition Assessment Report, 2024*). The USFWS IPaC database determined which protected species are likely to occur within, or in the vicinity of, the project area. The USFWS IPaC database search was updated (March 19, 2025) identified a total of 10 endangered and threatened species, and one proposed threatened species, (monarch butterfly [*Danaus plexippus*]). Endangered species included the red wolf (*Canis rufus*), red-cockaded woodpecker (*Picoides borealis*), hawksbill sea turtle (*Eretmochelys imbricata*), and the Kemp's Ridley Sea turtle (*Lepidochelys kempii*). Threatened species include the West Indian manatee (*Trichechus manatus*), eastern black rail (*Laterallus jamaicensis ssp. jamaicensis*), piping plover (*Charadrius melodus*), rufa red knot (*Calidris canutus rufa*), American alligator (*Alligator* mississippiensis), and the green sea turtle (*Chelonia mydas*). Additionally, the IPaC database report did not identify any designated critical habitat for the federally listed species occurring within the project area.

NMFS and USFWS have shared jurisdiction over sea turtles. NMFS leads the conservation and recovery of sea turtles in the marine environment, and USFWS has the lead for the conservation and recovery of turtles on nesting beaches. The three species of sea turtle identified as having potential to occur in the vicinity of the project area may use the Albemarle Sound for foraging; however, the FORA shoreline is not known to support sea turtle nesting (NCWRC 2022). NMFS fish and aquatic species that may be present in the project area include the green sea turtle (*Chelonia Mydas*), Loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), hawkbill sea turtle (*Eretmochelys imbricata*), shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and the giant manta ray (*Mobula birostris*). The NMFS ESA Critical Habitat Mapper did not report any designated critical habitat for NMFS species in the project area, but the mapper listed proposed critical habitat (ID: NC01) for the green sea turtle along the sounds and shoreline of the North Carolina coast and Atlantic Ocean (NOAA 2023). Consultation with NMFS Protected Resources Division is not necessary for proposed critical habitat and is only necessary when designated critical habitat is listed for a project area.

During an interagency scoping meeting held on August 22, 2022, Kathy Matthews, a USFWS representative, stated only the West Indian manatee would be affected by the project. As of 2017, the USFWS Guidelines for Avoiding Impacts on the West Indian manatee states: "If a manatee is seen within 100 yards of the active construction and/or dredging operation or vessel movement, all appropriate precautions would be implemented to ensure protection of the manatee. These precautions include the immediate shutdown of moving equipment if a manatee comes within 50 feet of the operational area of equipment. Activities would not resume until the manatee has departed the project on its own volition (i.e., it may not be herded or harassed from the area)".

For the purposes of this EA, no discussion of species or impacts is necessary for the remaining federally listed species listed by USFWS.

A bat survey at Fort Raleigh was conducted on March 13-14, 2024. During the survey, 3 Seminole bats (*Lasiurus seminolus*) and 2 big brown bats (*Eptesicus fuscus*) were captured. The Project would adhere to the NPS recommended tree cutting moratoria for bat species spans from May 1 through July 15.

During the permitting process, as NMFS and NOAA Fisheries Protected Resources Division comments are received, which may include in-water moratoria, those recommendations would be adhered to and applied to the construction sequence for resource protection measures).

The NCNHP database report included eight state rare, threatened, and endangered species and species of special concern that have been found currently or historically in the project area or within 1 mile of the project area. The list of species includes eastern giant swallowtail (*Heraclides cresphontes*), a state significantly rare butterfly; northern oak hairstreak (*Satyrium favonius*), a state significantly rare butterfly; rainbow snake (*Farancia erytrogramma*), a state significantly rare snake; diamondback terrapin (*Malaclemys terrapin*), a state species of special concern; Carolina watersnake (*Nerodia sipedon williamengelsi*), a state species of special concern; ringed witch grass (*Dichanthelium annulum*), a state endangered plant; little-spike spikerush (*Eleocharis parvula*), a state threatened plant; and sand heather (*Hudsonia tomentosa*), a state threatened plant. The NCNHP database report is included in (*Biological Resources and Site Condition Assessment Report, 2024*).

Historically occurring species that would not be considered in the impact analysis include the northern oak hairstreak, rainbow snake, ringed witch grass, and sand heather (destroyed by beach erosion). No state-listed species were identified within the project area during field surveys.

As a result of anticipated environmental trends continued loss of shoreline due to erosion is expected to progress.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 U.S.C. § 703–711) states that it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess; offer to sell or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg or product, manufactured or not. The MBTA-protected species are listed in 50 CFR 10.13. USFWS has statutory authority and responsibility for enforcing the Migratory Bird Treaty Act (16 U.S.C. 703–712). Any activity that results in the take of migratory birds is prohibited, unless authorized by USFWS.

The project area is in the Atlantic Flyway and at least 200 species of migratory birds have been reported in the Fort Raleigh area. USFWS has identified both migratory birds of conservation concern (BCC) and non-BCC species that are particularly vulnerable to offshore activities or development (USFWS 2021). There are 7 species of non-breeding migratory birds listed in the Bird Conservation Region M19 in which the project area lies (USFWS 2022a) and include banded-rumped storm-petrel (Atlantic) (*Hydrobates castro*), black-capped petrel (*Pterodroma hasitata*), Fea's petrel (*Pterodroma feae)*, Cory's shearwater (*Calonectris Diomedea*), manx shearwater (*Puffinus puffinus*), Audubon's shearwater (*Puffinus iherminieri*), and magnificent frigatebird (*Fregata magnificens*). Additionally, 10 non-BCC vulnerable species have the potential to occur in the vicinity of the project area, as listed on the USFWS IPaC System database (USFWS 2022a and 2025) and provided in Appendix E. These non-BCC vulnerable species have a varying range of probability of presence within the vicinity of the project area throughout the year, and 3 species could occur within the project area during their breeding seasons. The open water and forested edge associated with the project area is suitable foraging habitat for the species known to occur in coastal areas and near aquatic habitats.

As a result of anticipated environmental trends, continued loss of shoreline due to erosion is expected to progress.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, prohibits the "taking" of bald or golden eagles, including their parts, nests, or eggs, unless issued a permit by the Secretary of the Interior. Bald eagles are a migratory species but are year-round residents on the coast of North Carolina (NCWRC 2018). They nest within approximately 2.5 miles of water bodies, including rivers, lakes, impoundments, bays, and other coastal areas with abundant fish and/or waterfowl populations (NatureServe 2022). Nests typically occur in large, tall trees capable of supporting 4- to 6-foot-wide nests. Nesting sites are usually chosen in areas with limited disturbance. Nesting generally occurs from mid- to late October through mid-March in the southeast (USFWS 2007). Chicks fledge by 12 weeks but often remain in the same territory for an additional 6 weeks as they are still dependent on adults for food. Suitable habitat for bald eagles was identified in the project area; however, the project is expected to have no effect on the species as no bald eagle or active nests were observed during field reconnaissance surveys. Monitoring for new, active bald eagle nests within 660 feet of the project area would occur throughout the duration of construction.

As a result of anticipated environmental trends continued loss of shoreline due to erosion is expected to progress.

Environmental Consequences

No-Action Alternative

Under the No-Action Alternative, there is no permanent and/or temporary, direct and/or indirect, adverse impacts that would occur to federally/state listed threatened and endangered species as no new actions are proposed.

Impacts of Alternative 1 – Rock Revetment

Under Alternative 1, permanent, long-term, direct, beneficial impacts on federally/state listed, insects, bats, birds, and aquatic species would result from the retention of forested habitat along the shoreline that serves as nesting and foraging habitat for the listed terrestrial species of special concern, and the impacts of shoreline erosion on the aquatic habitat quality of the listed aquatic species of concern would be reduced.

Permanent, direct, adverse impacts on the federally/state listed insects, bats, birds, and freshwater aquatic species would result from the small loss of forested habitat due to improvements on access routes (20–25 feet wide) to accommodate equipment access necessary for installation. USFWS-recommended tree clearing moratoria windows would be adhered to in order to avoid listed bat breeding season for resource protection measures). Based on early agency coordination in 2022, it is anticipated that informal Section 7 consultation with USFWS would be necessary during permitting as NPS provided a "May Affect Not Likely to Adversely Affect" (MANLAA) determination for northern long-eared bat and proposed endangered, tricolored bat. A "No Effect" determination has been provided for the red wolf, American alligator, four bird species, and five turtles listed species for the project.

Temporary, direct, adverse impacts on federally/state listed aquatic species would occur from construction of the project. Informal consultation with USFWS and NMFS discovered that there is potential suitable habitat in the unconsolidated bottoms EFH habitat for the West Indian manatee. However, the occurrence of the West Indian manatee far north of its habitat range remains uncertain; therefore, 2017 USFWS Guidelines stated above would be followed. Based on this information, a MANLAA has been determined for the West Indian manatee. Further consultation with NMFS Fisheries Protected Division during the permitting process would determine if any moratoria for sturgeon species or giant manta ray will be recommended. Consultation with NMFS Protected Resources Division would occur by the submission of a EFH impact assessment for the preferred alternative. See Appendix E for an EFH assessment of project area resources that will support further consultation.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits to species of special concern by supplying a temporary sediment source to reduce erosional impacts and protect federally/state listed species and their habitats. Beach fill, while offering a temporary benefit lasting 3–5 years, contingent on the quantity deposited within the project area, serves to stabilize the shoreline and foster critical habitat for various federally/state listed aquatic and terrestrial species. Beach fill activities are anticipated to cause temporary, direct, adverse impacts on federally/state listed aquatic species due to sediment accumulation, coinciding with increased turbidity levels. To minimize construction related impacts, in-water barriers (e.g., turbidity curtains) would be employed prior to construction commencement to contain sediment in the immediate vicinity of the construction area. Furthermore, temporary, indirect, adverse impacts due to elevated turbidity could occur outside the project footprint in the Albemarle Sound and impact aquatic life. Beach fill activities would occur in the winter months and outside of any established dredge moratorium by USFWS, NMFS, and NCDMF.

Any pipeline dredge work associated with the beach fill would occur outside the mandated dredge moratoriums and only after securing appropriate permits through the DWR electronic pre-construction notification (PCN) process. The NPS would follow all resource protection measures for all federally threatened and endangered species listed by USFWS and NMFS.

Impacts of Alternative 2 – Rock Berm

As stated above for Alternative 1, potential impacts on federally/state listed species would be of similar nature for Alternative 2.

Permanent, direct, adverse impacts on federally/state listed terrestrial species of concern are similar to those described in Alternative 1.
Impacts on federally/state listed aquatic and terrestrial species as a result of beach fill are identical to those described for Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

As stated above for Alternative 1, potential impacts on federally/state listed species would be of similar nature for Alternative 3. Any permanent, direct, adverse impacts on federally/state listed terrestrial species of concern are similar to those described in the Alternative 1. And impacts on federally/state listed aquatic and terrestrial species as a result of beach fill are identical to those described for Alternative 1.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and would continue. This trend is not contributing to the potential loss of the majority of federal or state-listed species on FORA property. A species exception to the environmental trends is the state listed sand heather plant population, located in maritime dry grasslands in project area Section C of FORA, that has been destroyed through coastal erosion, as noted in the existing conditions. The implementation of all alternatives would have adverse effect on the persistence of sand heather at FORA resulting from the eventual complete loss of maritime dry grasslands. For the remainder of the listed species of concern, neither the No-Action Alternative nor Alternatives 1–3 would be affected by or contribute to the predicted environmental trends.

Conclusion

The No-Action Alternative would have no impact on federally/state listed species as no new actions are proposed.

Alternatives 1–3 would have temporary, direct, adverse impacts on federally/state listed aquatic species due to the increase in turbidity from implementation. Long-term, adverse effects would occur on the sand heather plant as its current extirpation status at the shoreline would persist, and the remaining maritime dry grasslands would eventually be lost to coastal erosion processes.

VEGETATION

Existing and Expected Future Conditions of the Environment

Natural communities and vegetation were assessed within the project area by observing species and comparing vegetation assemblies to the known common and rare communities in the Classification of the Natural Communities of North Carolina – Fourth Approximation (Schafale 2012). The North Carolina NHP Data Explorer Report was also accessed to determine if rare natural communities were present. The FORA maritime forest natural area was identified by the NHP Report and is located in the project area. Three natural vegetation communities exist within the project area and include coastal fringe evergreen forest (Typic subtype), maritime evergreen forest (Mid Atlantic subtype), and maritime dry grassland (Typic subtype). Details regarding each vegetation community within the project area are available in (*Biological Resources and Site Condition Assessment Report*, *HDR 2024*). Table 3 states the vegetation communities along with their locations and acreage across the project area and provides further descriptions of each vegetation community. The *Biological Resources and Site Condition Assessment Report, 2024,* illustrates the location of each natural vegetation community in the project area in Sections A through D and access routes.

Coastal fringe evergreen forest is present on the southern edges of Section A in the project area and consists of mixed pine species (*Pinus taeda* and *Pinus* spp.), yaupon holly (*Ilex vomitoria*), American holly (*Ilex opaca*), inkberry (*Ilex glabra*), eastern red cedar (*Juniperus virginiana*), southern live oak (*Quercus virginiana*), laurel oak (*Quercus hemisphaerica*), other hybridizing oaks (*Q.* spp.), red bay (*Persea borbonia*), wax myrtle (*Morella cerifera*), blueberry (*Vaccinium* sp.), dangleberry (*Gaylussacia frondosa*), southern magnolia (*Magnolia grandifolia*), saw greenbrier (*Smilax bona-nox*), yellow jessamine (*Gelsemium sempervirens*), and Japanese honeysuckle (*Lonicera japonica*).

TABLE 3. VEGETATION COMMUNITIES WITHIN THE PROJECT AREA

Vegetation Community	Project Location	Area (acres)
Coastal Fringe Evergreen Forest (Typic subtype)	Section A, Access Route 1	0.07
Maritime Evergreen Forest (Mid Atlantic subtype)	Section B, C, D, and all access routes	0.31
Maritime Dry Grassland (Typic subtype)	Sections A and D	0.22
Maintained/Disturbed areas	Rock berm Sections A and B, rock revetment Sections C and D and all access routes	1.0
Total Vegetation Community Impacts	Sections A-D and all access routes	1.6

Maritime evergreen forest (Mid Atlantic subtype) is present in project area Sections B, C, and D and all four access routes. This community was distinguished from the coastal fringe evergreen forest due to its dominance of southern live oaks, laurel oaks, and other evergreen species that appear to be affected by salt spray and had few to no pines. The maritime evergreen forest included the following species: southern live oak, Darlington oak, yaupon holly, American holly, inkberry, wax myrtle, Japanese privet, Chinese privet, saw greenbrier, American beautyberry (*Callicarpa americana*), wild olive (*Osmanthus americanus*), partridge berry (*Mitchella repens*), largeleaf pennywort (*Hydrocotyle bonariensis*), Virginia creeper (*Parthenocissus quinquefolia*), and Spanish moss (*Tillandsia usneoides*). A primary significant maritime evergreen forest (Mid Atlantic subtype) community area was identified by the NHP report and is a state-rated NHNA, as mentioned in Chapter 1. The FORA maritime evergreen forest natural area (not delineated in EA maps) is located south, west, and north of the Reconstructed Earthen Fort and is the best remaining example of mature maritime evergreen forest in the state of North Carolina. The FORA maritime evergreen forest natural area contains and supports a population of the eastern giant swallowtail, a significant rare species in North Carolina. Access Route 2, which follows the Waterside Theatre walkway from the parking lot west and the existing sewer easement to the beach, intersects with this maritime evergreen forest natural area.

Small areas with wider beaches and low gradient shoreline slopes in Sections A and D included species assemblies that are consistent with maritime dry grasslands. Maritime dry grassland communities within the project area included salt meadow cordgrass (*Sporobolus pumilus*), goldenrod (*Solidago* sp.), pussytoes (*Antennaria* sp.), yucca (*Yucca* sp.), saw greenbrier, muscadine (*Vitis rotundifolia*), Japanese honeysuckle, common reed, and other grasses (*Panicum* spp.).

Beach areas are characterized as degrading or aggrading shifting sands with no existing vegetation. Project area Section C beach areas previously supported sand heather, a state threatened plant. The population has been recorded as being destroyed due to natural bluff/beach erosion succession and was last observed in 1936, as reported in the NHP report.

Disturbed vegetation areas in the project area included beach erosional slope areas, rock berm areas, access routes/paths, and a sewer easement area that crosses access route 2 adjacent to the Waterside Theatre. These disturbed areas included yaupon holly, Japanese privet (*Ligustrum japonicum*), Chinese privet (*Ligustrum sinense*), silverling (*Baccharis halimifolia*), Florida hedgenettle (*Stachys floridana*), American beautyberry (*Callicarpa americana*), dogfennel (*Eupatorium capillifolium*), yellow jessamine, English ivy (*Hedera helix*), muscadine, goldenrods, and other herbaceous species.

According to NPS Management Policies (2006), natural landscapes altered by human activity may be manipulated where the park management provides for restoring the lands to a natural condition. Landscape revegetation efforts would represent species and gene pools native to the ecological portion of the park in which the restoration project is occurring. Therefore, disturbed areas where vegetation is removed would consider these policies.

As a result of anticipated environmental trends continued loss of shoreline due to erosion is expected to continue contributing to the loss of forested habitat, as tree fall occurs along the ecotone of forested communities, unconsolidated shoreline, and within the unconsolidated bottoms.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, continued bluff erosion and tree fall would naturally occur along the unarmored portions of the shoreline, which could be characterized as a long-term, permanent, direct, adverse impact on the coastal fringe evergreen forest and maritime evergreen forest communities. As erosion continues, the potential for the loss of maritime dry grassland ecotonal communities could occur due to the loss of intertidal areas.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would have a permanent, direct, beneficial impact on coastal fringe evergreen forest and maritime evergreen forests due to the shoreline erosion reduction benefits that the rock revetment would provide. At the estimated rate of shoreline erosion (6.0 ft/yr), the installation of rock revetment would reduce shoreline erosion and the resultant loss of these forested communities.

The maritime dry grassland and maritime evergreen forest would experience permanent fill impacts (0.20 acre and 0.05 acre, respectively) due to the placement of fill dirt and riprap within the footprint of the rock revetment resulting in permanent, direct, adverse impacts (*Biological Resources and Site Condition Assessment Report, 2024*). Within the project area, this accounts for the majority of the maritime dry grassland (0.22 acre), but a small amount of the total of maritime evergreen forest (0.31 acre).

Tree removal would be needed for construction access for Alternative. 1. The majority of tree removal is associated primarily with Section C, Access Route 2 (*Biological Resources and Site Condition Assessment Report, 2024*). The impacts associated with the temporary removal of maritime evergreen forest (0.18 acre) and coastal fringe evergreen forest communities (<0.01 acre) from access route clearing (mainly in Section C, Access Route 2) would result in long-term, direct, adverse impacts.

Tree removal would be minimized during design and construction to the greatest extent practicable to minimize disturbance to existing trees and root systems along the shoreline/bluff installation area. Post-construction, access routes would be stabilized with NPS-approved vegetation for short-term stabilization needs. Long-term re-vegetative efforts would include planting with NPS-approved species representing the types of species commonly found in maritime evergreen forests and resections would be covered with temporary or permanent vegetation (using native seed mixtures) or bioengineering materials like waddles or coir fiber matting to reduce runoff and sediment loss during construction.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits to vegetation communities by supplying a temporary sediment source to reduce erosional impacts and protect existing maritime dry grasslands, coastal fringe evergreen forest, and maritime evergreen forest. Beach fill, while offering a temporary benefit lasting 3–5 years, contingent on the quantity deposited within the project area, serves to stabilize the shoreline and protect the vegetation communities. Beach fill activities are expected to cause short-term, direct, adverse impacts due to equipment access on the existing vegetation within the project area as there would be minimal removal of existing maritime dry grassland, maritime evergreen forest, and coastal fringe forest. Conversely, beach fill activities could create temporary, short-term, beneficial impacts by providing favorable sediment sources for the expansion and establishment of maritime dry grassland communities. Avoidance and minimization efforts would be taken to clear smaller shrubs and trees and to avoid and protect larger established oaks and their root systems along access routes.

Impacts of Alternative 2 – Rock Berm

As stated above for Alternative 1, effects on sensitive vegetation communities would be of similar nature for Alternative 2 along the access routes and along the shoreline/bluff installation area (*Biological Resources and Site Condition Assessment Report, 2024*). The permanent impacts from the rock berm footprint on the maritime dry grassland communities in Sections A and D and maritime evergreen forest are 0.03 acre and 0.23 acre, respectively. In Alternative 2, since the trapezoidal shape of the rock berm would be placed in front of the shoreline and not keyed-in to the bluff/shoreline, the erosion of the bluff and loss of maritime evergreen forest would continue along the shoreline during storm surges and large storms until a stabilized slope condition exists.

Construction access would result in temporary, direct, adverse effects for maritime dry grassland and long-term direct adverse effects on maritime evergreen forest and coastal fringe evergreen forest due to the construction of the access route. Effects on the forest communities are considered long-term because the effects on maritime dry grasslands, maritime evergreen forest, and coastal fringe evergreen forest are 0.07 acre, 0.23 acre, and <0.01 acre, respectively.

The impacts on the FORA maritime evergreen forest natural area from the access routes due to beach fill are similar to those described in Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

As stated above for the other alternatives, effects on sensitive vegetation communities would be of similar nature for Alternative 3 along the access routes and along the shoreline/bluff areas (*Biological Resources and Site Condition Assessment Report, 2024*). The impacts on the maritime dry grasslands in Sections A and D from the rock revetment and rock berm footprints and tie-in points to existing revetments and berm would be temporary (<0.01 acre) and permanent (0.22 acre), resulting in direct adverse impacts. The impacts on the maritime evergreen forest communities (0.24 acre temporary and 0.07 acre permanent) and coastal fringe evergreen forest communities (0.07 acre temporary and no permanent acres of loss) due to access route clearing would be direct, adverse impacts.

The impacts on the FORA maritime evergreen forest natural area from the access routes due to beach fill are comparable to those described in Alternative 1.

Past actions in the vicinity of FORA include the previous shoreline protection efforts. The past actions of these various shoreline stabilization efforts along with the proposed action would result in a beneficial effect by providing stabilization of the existing shoreline and preserving forest communities, while potentially adversely impacting maritime grassland communities. However, within North Roanoke Island, unprotected shoreline (approximately 7,200 acres as identified by Riggs and Ames 2003) remains providing for opportunities for maritime grassland communities to exist.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted and would continue. The No-Action Alternative would not contribute to this trend, nor would it protect the vegetation communities as a result of this trend. Alternatives 1–3 would not contribute to this trend and would protect the forested vegetation communities in the long-term that are adversely affected by this trend.

Conclusion

Alternative 2 -the rock revetments once placed would stabilize the northern Roanoke Island embankments eliminating the continual sluffing of the slope. By the placement of fill soil below the layer of well graded rock new plant root systems would take hold and provide wildlife habitat, food sources, and essential protection during storms.

Alternative 3 - the rock berm would be placed in a low elevation area between the water's edge and the beach fill area. These berms would be constructed with overlapping gaps allowing the sound to move between areas as the water levels change. With these small, protected areas hydrophytic vegetation can establish providing a sustainable shoreline environment.

By using both types of shoreline rock protection this project along with the beach fill can address and stabilize the parks erosion issues.

Under the No-Action Alterative, permanent, direct, adverse impacts on the vegetation communities would continue as the present rate of erosion would continue.

Compared to the No-Action Alternative, Alternatives 1–3 would have permanent, direct, beneficial impacts on coastal fringe evergreen forest and maritime evergreen forest due to anticipated shoreline erosion reduction benefits.

Alternatives 1–3 would have permanent, direct, adverse impacts on maritime dry grasslands and maritime evergreen forest due to the permanent placement of fill and revetment material. Tree removal would be minimized during design and construction to the greatest extent practicable to minimize disturbance to existing trees and root systems along the shoreline/bluff installation area.

Alternatives 1–3 would have short and long-term, direct, adverse impacts on the vegetation communities due to the construction and widening of the access routes. The largest impact would be to the maritime evergreen forest removal along Access Route 2.

WETLANDS AND WATERCOURSES

Existing and Expected Future Conditions of the Environment

Based on NCDEQ and United States Geological Survey (USGS) online mapping resources, the project area is within the Pasquotank River Basin (Hydrologic Unit Code 03010205) and lies within two subwatershed areas. Area's west of Pear Pad Road are in the Albemarle Sound-Croatan Sound subwatershed (HUC: 030102051405) and areas east of Pear Pad Road are in the Buzzard Bay-Roanoke Sound subwatershed (HUC: 030102051404). The USFWS National Wetland Inventory (NWI) online mapper designates the Albemarle Sound as an "E1UBL" or estuarine, subtidal, unconsolidated bottom, subtidal. NWI did not indicate any other wetland or deepwater habitat resources in the project area.

Executive Order 11990 directs NPS to provide leadership and to take action to minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial values of wetlands; and avoid direct or indirect support of new construction of wetlands, adverse impacts on wetlands. NPS established Director's Order #77-1 and Procedural Manual #77-1 for implementation of Executive Order 11990. A Wetland Statement of Findings documenting compliance with both the Director's Order and Procedural Manual #77-1 would be completed during design of the preferred alternative and would meet compensatory mitigation requirements for compliance with Executive Order 11990.

A water resources field investigation of the project area was conducted in February 2022, and results are provided in Appendix E. The wetlands were delineated using the three-parameter approach as described in the United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory 1987), USACE Post-Rapanos guidance, USACE Atlantic and Gulf Coastal Plain Regional Supplement (USACE 2010), and the NPS Procedural Manual #77-1. Wetlands were classified by hydrologic regime and vegetation cover type was classified in accordance with the Cowardin Classification System (Cowardin et al. 1979). Wetlands in the project area were not found to be jurisdictional CAMA wetlands.

The delineation guidelines within NPS Procedural Manual #77-1, Wetland Protection (2016), follow the FGDC Wetlands Classification Standard (2013), and procedures for marine and estuarine wetland limits are described within this manual. In maritime systems, the upper landward limits of the intertidal zones include the landward limit of tidal inundation (extreme high water of spring tides), and in estuarine systems, the landward limit extends to where ocean-derived salts measure less than 0.5 parts per thousand (ppt) during annual low flow. The project area shoreline is a combination of both the marine and estuarine systems since it experiences low energy tides, and during storms the wave and wind action can be severe causing extreme high tides. For the purposes of this project, the landward limit of the intertidal zone was considered the most recent wrack line, which coincides with the February Spring tides. Local tide charts show the full moon occurring on February 16, 2022, which was during the field collection time periods (February 15 and 16) of the spring high and spring low tides.

An intertidal wetland (Wetland 1 [WL-1]) was identified that is 0.94 acre in total size among all project area sections and access routes, spans approximately 5,146 feet of shoreline, and ranges in width from 3 to 25 feet. This intertidal wetland has been classified by the Cowardin system as an estuarine, unconsolidated shoreline with a sand substrate (E2US2). Hydrology indicators observed within WL-1 include surface water, high water table, and saturation. WL-1 fails to meet the USACE definition of a wetland as it lacks wetland soil characteristics and does not have any wetland vegetation due to the tumultuous nature of the intertidal zone. However, this wetland meets criteria under DO 77-1 due to flooding and exposure from tidal action (see Table 4). Additionally, the Federal Geographic Data Committee (FDGC) defines the boundary of wetlands in the marine and estuarine systems as coinciding with the elevation of the extreme low of spring tide and the upper landward limit as the extreme high of spring tide.

Albemarle Sound (Open Water 1) is in the project area and is classified as an estuarine, subtidal, unconsolidated bottom with a sand substrate (E1UB2). Water depths were estimated to range from 1 inch to approximately 4 feet deep (NOAA 1998). A total of 5.5 acres of Albemarle Sound lies within the project area. Table 4 lists the classification, jurisdiction, and size of each of the wetlands and watercourses in the project area.

As a result of anticipated environmental trends continued loss of shoreline due to erosion is expected to progress, contributing to the ephemeral location of the dynamic intertidal areas. Potential reduction and loss of the existing and already narrow intertidal wetland areas could occur as sea level rise and storm frequency and magnitude increase.

TABLE 4. WETLANDS AND WATERCOURSES IN THE PROJECT AREA

Wetland Identifier	Type[1]	USACE Jurisdictional	DO 77-1 Jurisdictional	Area (Ac)
Wetland 1 (WL-1)	E2US2	No	Yes	0.94
Albemarle Sound (Open Water 1)	E1UB2	Yes	Yes	5.5

1. Classification codes as defined by Cowardin et al (1979).
   E2US2 - estuarine, unconsolidated shoreline with a sand substrate
   E1UB2 - estuarine, subtidal, unconsolidated bottom with a sand substrate

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, shoreline erosion would continue to impact the location and size of the intertidal zone and subsequent demarcation of the Albemarle Sound. Bluff sandy sediments would continue to slump onto the shoreline and be reworked into the intertidal zone. It is anticipated the narrow intertidal zone (Wetland 1) will naturally recede landward and potentially decrease in width over time as long shore sediment transport processes carry bluff/shoreline sediment down shore and out of the project area. Impacts of the No-Action Alternative on intertidal wetlands have not been estimated; however, shoreline erosion rates at FORA are approximately 6 ft/yr (Riggs and Ames 2003), and it is inferred they would continue landward at this rate (Table 5).

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would result in permanent and temporary rock revetment fill within the intertidal wetland (Wetland 1) and Albemarle Sound (Open Water 1). The rock revetment footprint would result in permanent, direct, adverse impacts on Wetland 1 (0.45 acre) and Open Water 1 impacts (1.42 acres) (Table 5). Within the studied project area, a total of 0.94 acre of Wetland 1 and 5.5 acres of Open Water 1 were identified (see Table 4).
Temporary, direct, adverse impacts on wetlands and open waters would occur due to the minimal excavation and grading required for the rock revetment toe and top of slope and shoreline access of construction equipment (Table 5). A total of 0.30 acre of Wetland 1 and 1.31 acres of Open Water 1 would be temporarily impacted.

Permanent, indirect, adverse impacts on the intertidal wetlands at the Elizabethan Gardens could occur from the potential loss of intertidal wetlands and conversion to deeper water due to changes in the natural longshore sediment transport caused by the shoreline stabilization action in Alternative 1. Intertidal areas and sandy beach areas landward could be starved of sediment additions from the disruption of the natural longshore sediment transport and this, in turn, could accelerate erosion of existing intertidal areas at the Elizabethan Gardens.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits by supplying a temporary sediment source to reduce erosional impacts and protect Wetland 1 and Open Water 1. Beach fill, while offering a temporary benefit lasting 3–5 years, contingent on the quantity deposited within the project area, serves to stabilize the shoreline and Wetland 1 and Open Water 1. Permanent, direct, adverse impacts on Wetland 1 would occur due to placement of sediment, which alters sediment supply and hydrology needed for Wetland 1 and in turn modifies tidal flow patterns. This could lead to habitat loss for ecological niches found in Wetland 1, but effects would be short-term as Wetland 1 would naturally reform from the shoreline dynamics of tides and winds. Permanent, direct, adverse impacts would be associated with Open Water 1 as placement of sediment would occur within the Albemarle Sound to extend the sandy beach and intertidal areas.

Temporary, direct, adverse impacts on Wetland 1 and Open Water 1 would occur due to associated access routes and staging for construction and the deployment of a pipeline barge.

Impacts of Alternative 2 – Rock Berm

Alternative 2 would result in permanent and temporary rock berm fill within Wetland 1 and Open Water 1. The rock berm footprint would result in permanent, direct, adverse impacts on

Wetland 1 (0.64 acre) and Open Water 1 (2.22 acres) (Table 5). Within the studied project area, a total of 0.94 acre of Wetland 1 and 5.5 acres Open Water 1 were identified (see Table 4).

Temporary, direct, adverse impacts would occur due to the minimal excavation and grading required for the rock revetment toe and top of slope and shoreline access of construction equipment (Table 5). A total of 0.23 acre of Wetland 1 and 0.92 acre of Open Water 1 would be temporarily impacted.

Permanent, indirect impacts on The Elizabethan Gardens would be similar to those described in Alternative 1.

The impacts on Wetland 1 and Open Water 1 due to beach fill would be comparable to those described in Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

As stated in Alternative 1 and Alternative 2, the execution of both alternatives would cause both permanent and temporary adverse impacts on Wetland 1 and Open Water 1. The Alternative 3 footprint of both the rock revetment and rock berm structures would result in permanent, direct, adverse impacts on Wetland 1 (0.80 acre) and Open Water 1 (2.45 acres). Within the studied project area, a total of 0.94 acre of Wetland 1 and 5.5 acres of Open Water 1 were identified (see Table 4).

Temporary, direct, adverse impacts would occur due to the minimal excavation and grading required for the rock revetment toe and top of slope, rock berm toe of slope, and shoreline access of construction equipment (Table 5). A total of 0.14 acre of Wetland 1 and 3.05 acres of Open Water 1 would be temporarily impacted. These temporary impacts are mainly impacts from the scope of work that involves exclusively in-water construction activities.

Permanent, indirect impacts on The Elizabethan Gardens would be similar to those described in Alternative 1.

The impacts on Wetland 1 and Open Water 1 due to beach fill would be similar to those described in Alternative 1.

In association with the Preferred Alternative and in compliance with Director's Order #77-1, compensatory wetland mitigation would be developed and implemented. As such, no net loss of wetland would occur as a result of the Preferred Alternative. In addition, there are no past or present actions that have or would result in a beneficial or adverse effect on Albemarle Sound, when combined with the effects of the No-Action Alternative or Alternative 1, 2, or 3. This findings of no long-term effects is attributable to the large size of the Albemarle Sound, which is approximately 450 square miles and considered the largest brackish and freshwater sound in North America.

Past shoreline protection efforts, particularly rock revetment projects, in the vicinity of FORA have likely adversely impacted intertidal wetland communities due to their construction. Alternatives 1–3 would all have an adverse, direct impact on intertidal wetlands. Within North Roanoke Island, unprotected shoreline (approximately 7,200 linear feet per Riggs and Ames,

2003) remains and provides opportunities for the intertidal wetlands to exist through natural sediment loading from the surrounding bluffs and shoreline.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted and would progress. These trends are unlikely to affect wetlands and watercourses as these resources would continue to adapt to the changing water levels and influences from storm events. Neither the No-Action Alternative nor Alternatives 1, 2, or 3, would affect the trends influencing wetland and watercourse evolution. Alternatives 1–3 would not contribute to this trend nor prevent future wetland evolution.

Conclusion

Under the No-Action Alternative, intertidal wetlands and the Albemarle Sound would continue shifting locations based on the rates of shoreline erosion at each of the project area sections, specifically with the intertidal areas moving landward as the bluff sediments continue to slump onto the shoreline and erode. Alternative 3 would have the largest permanent and temporary adverse fill impacts to Wetland 1 and Open Water 1 resources (Table 5). In contrast to the No-Action Alternative, Alternatives 1–3 would limit the long-term stability of a sandy intertidal zone due to the location of rock placement in the intertidal zones; however, beach fill additions prior to rock revetment or berm installation could temporarily create wider intertidal areas and mitigate for the future direct intertidal construction impacts.

Alternatives 1–3 may all result in permanent, indirect, adverse impacts on The Elizabethan Gardens intertidal wetlands.

TABLE 5. WETLANDS AND OPEN WATERS IMPACTS

Alternative	Intertidal Temporary Impacts (Ac)	Intertidal Permanent Impacts (Ac)	Albemarle Sound Temporary Impacts (Ac)	Albemarle Sound Permanent Impacts (Ac)	Impact Totals (Ac)
No-Action Alternative	NA	NA	NA	NA	NA
Alt 1 – Rock Revetment	0.30[1]	0.45	1.31	1.42	3.47
Alt 2 – Rock Berm	0.23	0.64	0.92	2.22	4.01
Alt 3 – Rock Revetment/Rock Berm Combination	0.14	0.80	3.05	2.45	6.44

1. Limits of beach fill have not been delineated and are not incorporated into water impact calculations for Alternatives 1, 2, and 3.

FLOODPLAINS

It is NPS policy to preserve natural floodplain values and minimize potentially hazardous conditions associated with flooding, to both humans and infrastructure. Additionally, it is NPS policy to restore the natural functions of floodplains whenever practicable. Executive Order 11988, "Floodplain Management," requires the National Park Service and other federal agencies to evaluate the likely impacts of actions in floodplains. The objectives of the executive order are to avoid, to the extent possible, the long-term and short-term adverse impacts associated with occupancy, modification, or destruction of floodplains and to avoid indirect support of development and new construction in such areas wherever there is a practicable alternative. The NPS administers floodplain policy through Director's Order 77-2, Floodplain Management (DO 77-2), and Procedural Manual 77-2, Floodplain Management (PM 77-2). Executive Order (EO) 13690 established the Federal Flood Risk Management Standard (FFRMS) and amended EO 11988 to consider current and future flooding. EO 13690 is a resilience standard that requires agencies to not only build higher, but also more resiliently through natural systems, ecosystem processes, and nature-based approaches.

According to the Federal Emergency Management Agency (FEMA), a floodplain is any land area susceptible to being inundated by floodwaters from any source.

Once a project design is developed a Floodplains Statement of Findings would be required to assess any impacts associated with this projects action alternatives.

Existing and Expected Future Conditions of the Environment

FEMA defines geographic areas as flood zones according to varying levels of flood risk. Each zone reflects the severity or type of flooding in the area. According to Flood Insurance Rate Maps, the project area is within two flood zones.

One flood zone, Zone AE, is a Special Flood Hazard Area subject to inundation by the 1-percent annual chance flood (100-year flood). The project area is within this zone, indicating that Base Flood Elevations have been determined. The Base Flood Elevation is the water-surface elevation of the 1-percent annual chance flood. The Base Flood Elevations are 10 feet in the northeastern portion of FORA, so the project area should exhibit Base Flood Elevations of 10 feet.

Part of the project area is located within Zone X, indicating areas of 0.2-percent (500-year flood) annual chance flood and areas of 1-percent annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile (NPS 2013).

According to current mapping within the project area, Zone AE is the open water area of the Albemarle Sound adjacent to the shoreline while Zone X contains portions of the shoreline and the beach (FEMA 2020). Based on the current mapping, portions of the project area are additionally outside Zone AE and Zone X. However, the conditions of the project area are not currently mapped as Zone AE or Zone X are reflective of the conditions observed in Zone AE and Zone X. Areas along the shoreline and beach outside Zone AE and Zone X have not been included in calculated areas. It is assumed impacts on both FEMA zones would be larger as coastal erosion areas have not been included and updated since June 19, 2020.
As a result of anticipated environmental trends continued loss of shoreline due to erosion is expected to progress and floodplain topography and location will change due to the trends of sea level rise and increased frequency of coastal flooding. The 2020 mapped floodplain will continue to deviate from current conditions due to these existing trends.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, shoreline erosion would continue, causing adjustments to the existing FEMA floodplain mapping and creating additional disparities. With shoreline erosion occurring at an average rate of 6 ft/yr, there is potential for the floodplain to expand inland as the shoreline recedes, increasing the susceptibility of more land to flooding. This erosion rate has the capacity to modify flood dynamics, potentially alternating flow dynamics into previously unaffected areas or intensifying flooding within current floodplain zones. Therefore, the No-Action Alternative could cause direct and long-term impacts on the floodplain.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would lead to permanent fill of 0.93 acre in Zone AE (60.6 percent of Alternative 1 project area Zone AE) and 0.2 acre in Zone X (65.0 percent of Alternative 1 project area Zone X), resulting in direct impacts on the floodplain due to the fill footprint of the rock revetment (Table 6).

In terms of coastal processes in the mapped floodplain, the revetment would not introduce new flow boundaries or adversely affect storm surge, wave reflection, wave focusing, or regional erosion rates. Lateral scour at the project terminations would be limited, and measures, including toe protection, are incorporated to minimize adverse effects. While regional erosion rates may increase, the armored shoreline would mitigate the adverse impacts. Alternative 1, partially mapped within floodplain, would have no direct impact on the floodplain processes.

During construction, temporary, direct, adverse impacts on 0.6 acre of Zone AE and 0.11 acre of Zone X are anticipated to occur due to the temporary presence of equipment and access routes. Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits by supplying a temporary sediment source to reduce erosional impacts and protect the floodplain. Beach fill, while offering a temporary benefit lasting 3–5 years, contingent on the quantity deposited within the project area, serves to stabilize the shoreline and the floodplain. Temporary, beneficial, direct, adverse impacts may rise from beach fill operations aimed at mitigating flood hazards. These disturbances must persist over extended periods, aligning with the duration of a comprehensive flood study, typically ranging from 5 to 20 years. Therefore, the long-term, permanent or temporary, direct, adverse impacts of beach fill activities on the floodplain remain uncertain in the absence of analysis.

Impacts of Alternative 2 – Rock Berm

Alternative 2 would lead to permanent fill of 1.39 acres in Zone AE (75.1 percent of Alternative 2 project area Zone AE) and 0.2 acre in Zone X (54.9 percent of Alternative 2 project area Zone X), resulting in direct, adverse impacts on the floodplain due to the fill footprint of the rock revetment (Table 6; Figures 3-9, 3-11a, and 3-11b). The coastal processes occurring in the mapped floodplain and effects of Alternative 2 on these processes mirror those identified for Alternative 1.

During construction of Alternative 2, the temporary presence of equipment and access routes, mentioned in Alternative 1, would result in temporary, direct impacts on 0.46 acre in Zone AE and 0.16 acre in Zone X.

The impacts on the floodplain due to beach fill would be similar to those described in Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (ProposedPreferred)

As stated for Alternatives 1 and 2, permanent, direct impacts on 1.65 acres in Zone AE (43.9 percent of Alternative 1 project area Zone AE) and 0.35 acre in Zone X (78.4 percent of Alternative 1 project area Zone X) are anticipated due to permanent fill in the floodplain due to the rock revetment footprint (Table 6; Figures 3-9, 3-12a, and 3-12b). The implementation of both alternatives involves temporary construction activities leading to the presence of equipment and access roads within the floodplain. Temporary and direct impacts on 2.11 acres in Zone AE and 0.1 acre in Zone X are anticipated during construction of both alternatives.

The impacts on the floodplain due to beach fill would be similar to those described in Alternative 1.

TABLE 6. FLOODPLAIN IMPACTS

Alternative	100 Year[1] Floodplain (Zone AE) Temporary Impacts (Ac)	100 Year Floodplain (Zone AE) Permanent Impacts (Ac)	500 Year Floodplain (Zone X) Temporary Impacts (Ac)	500 Year Floodplain (Zone X) Permanent Impacts (Ac)	Totals
No-Action Alternative	NA	NA	NA	NA	NA
Alt 1 – Rock Revetment	0.6[1]	0.93	0.11	0.20	1.84
Alt 2 – Rock Berm	0.46	1.39	0.16	0.20	2.21
Alt 3 - Rock Revetment/Rock Berm Combination	2.11	1.65	0.10	0.35	4.20

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and the resultant loss of known and unknown floodplain would continue. The No-Action Alternative would contribute to this trend through continued shoreline erosion causing adjustments to the existing floodplain mapping and creating additional disparities. Alternatives 1–3 would not contribute to this trend and would provide a beneficial effect on floodplain through reduction of shoreline erosion that are adversely affected by this trend.

Limits of beach fill have not been delineated and are not incorporated into impact calculations for the alternatives.

Conclusion

Alternative 1 - While rock revetments can provide immediate protection to embankments, they can also have measurable and potentially negative impacts on the natural dynamics and ecological functions of adjacent floodplains. They can increase erosion in the adjacent and downstream areas by concentrating wave energy and alternating sediment transport processes. This can lead to further degradation of natural floodplains.

Alternative 2 -The construction of rock berms can affect water flow patterns, potentially leading to changes in how floodwaters interact with adjacent floodplains. This can impact the ability of floodplains to absorb excess water during storms, potentially increasing flooding risks in some areas.

Beach fill can change the natural sediment transport processes along the shoreline. This alteration can affect how sediments are deposited in adjacent floodplains, potentially leading to changes in their structure and function.

Under the No-Action Alternative, the floodplain would continue to be adversely affected due to continued shoreline erosion.

Alternatives 1–3 would have permanent beneficial impacts on the floodplain through the reduction of shoreline erosion.

Alternative 1 has greater permanent, direct, adverse impacts on Zone X than compared to Alternative 2 and 3. Furthermore, Alternative 2 has greater permanent, direct, adverse impacts on Zone AE than compared to Alternative 1 and 3. The combined permanent and temporary impacts on Zone X and Zone AE from Alternative 3 would have a greater impact on the floodplains.

WATER QUALITY

Water quality can be thought of as a measure of the suitability of water for particular use based on selected physical, chemical, and biological characteristics (USGS 2018).

Existing and Expected Future Conditions of the Environment

The NCDEQ Surface Water Classification lists the Roanoke Sound (Stream #30-21) as having Class SA designation, which encompasses tidal salt waters that are used for shell fishing for marketing purposes. Class SA waters are also protected for all Class SC and Class SB uses. Class SC are protected for aquatic life propagation, survival, and maintenance of biological integrity, wildlife, and secondary contact recreation. Secondary contact recreation means wading, boating, other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized, or incidental basis. Class SB are tidal salt waters protected for all SC uses in addition to primary contact recreation. Primary contact recreation activities include swimming, water skiing, and similar uses involving human body contact with water where such activities take place on a frequent basis. All SA waters are also High-Quality Waters (HQW) by supplemental classification. HQW supplemental classification is intended to protect waters that are rated excellent based on biological, and physical/chemical characteristics, primary nursery areas and other functional nursery areas designated by the Marine Fisheries Commission (NCDEQ 2023).

An array of aquatic recreational opportunities is provided to visitors at FORA. To maintain the safety of waters for recreational activities within the Albemarle Sound, the Albemarle-Pamlico National Estuary Partnership (APNEP) collaborates through a cooperative agreement with NCDEQ and USEPA to identify, safeguard, and rehabilitate critical resources within this estuarine ecosystem. The program has initiated multiple projects and programs for water quality monitoring to offer a more current assessment of water quality levels in this estuarine system. The most recent assessment, providing statuses and trends, was conducted in 2012. Subsequently, an initiative for a Comprehensive Conservation and Management Plan (2012-2022) has been instituted to address deficiencies in water quality management and preservation and ensure the safety of waters for recreational use.

As a result of anticipated environmental trends, the loss of shoreline due to erosion is expected to continue and contribute to periods of decreased water quality (increased turbidity) during increased wave and storm activity within the Albemarle, Croatan, and Roanoke Sounds.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, the ongoing process of shoreline erosion would persist, potentially leading to elevated levels of turbidity, thereby diminishing water quality. As erosion progresses, there would be continued detachment and transportation of soil particles into the Albemarle Sound, resulting in reduced light penetration and subsequent accumulation of sediments on the unconsolidated bottoms of the Albemarle Sound. This sediment deposition can fundamentally alter benthic habitats, disrupting ecological dynamics and potentially exacerbating the degradation of water quality parameters beyond turbidity, including nutrient cycling and habitat suitability. Therefore, the No-Action Alternative would result in a long-term, direct, adverse impact on water quality.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would result in the reduction of shoreline erosion. Reducing shoreline erosion would result in a reduction of detachment and transportation of soil particles into the Albemarle Sound. This would reduce turbidity and subsequent accumulation of sediments on the unconsolidated bottoms of Albemarle Sound, therefore, Alternative 1 would result in a permanent, direct, beneficial impact on water quality.

Construction of the rock revetment would require material and/or equipment delivery to access the shoreline to perform toe of slope excavation and material placement. As a result, there is a potential for temporary impacts on water quality due to stormwater runoff during construction, thus increasing turbidity in Albemarle Sound. Therefore, Alternative 1 would have temporary, direct, adverse effect on water quality. Implementation of required erosion and sediment controls would minimize the impacts on water quality during construction. The erosion and sediment controls would be designed as part of the Storm Water Pollution Prevention Plan (SWPPP), which would be required for the National Pollution Discharge Elimination System construction permit issued from North Carolina Department of Environmental Quality Division of Water Resources (DEQ-DWR).

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits by supplying a temporary sediment source to reduce erosional impacts. Beach fill, while offering a temporary benefit lasting 3–5 years, contingent on the quantity deposited within the project area, serves to stabilize the shoreline. The deposition and placement of sand can elevate turbidity levels, promoting sedimentation. However, the timeline for implementation of this alternative is variable and may extend for several years; therefore, erosion and sediment controls would be designed as part of the SWPPP, which would require an

NPDES construction permit. Therefore, there would be temporary, direct, adverse impacts on water quality during the process due to the placement of beach fill.

Impacts of Alternative 2 – Rock Berm

Construction of the rock berm would cause temporary, direct, adverse impacts, as stated in Alternative 1, as minimal excavation is required to tie in the berm to the toe of slope and for material placement to implement this strategy. However, the timeline for implementation of this alternative is variable and may extend for several years; therefore, erosion and sediment controls would be designed as part of the SWPPP, which would require an NPDES construction permit. There would be temporary, short-term impacts on water quality during construction due to increased turbidity, decreasing water quality.

The impacts on water quality due to beach fill would be comparable to those described in Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

Similar to Alternatives 1 and 2, construction of Alternative 3 would require material and/or equipment delivery to access the shoreline to perform toe of slope excavation tying the berm into the revetment and material placement of riprap. As stated for Alternatives 1 and 2, the implementation of required erosion and sediment controls would be designed as part of the SWPPP, which would be required for the NPDES construction permit due to soil disturbance, excavation, and grading along the shoreline. During the construction phase, temporary, direct, adverse impacts on water quality are anticipated. The simultaneous construction activities for Alternative 3 would contribute to an increase in turbidity during excavation and material placement.

The impacts on water quality due to beach fill would be similar to those described in Alternative 1.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and the changes in water quality will continue (salinity, pH levels, nutrient cycling, temperature, sediment influxes, etc.). The No-Action Alternative would contribute to this trend. Alternatives 1–3 would not contribute to this trend and would provide a beneficial effect on water quality that is affected by this trend through reduction of shoreline erosion.

Conclusion

By using Alternatives 1 and 2, revetments and berms, along with the beach fill to establish what is essentially a living shoreline. This shoreline will filter nutrient pollutants from the water, reducing excessive amounts of nutrients, fertilizers and pesticides, carried by eroded soils. This can lead to reduced algae levels and improved oxygen levels reducing harmful effects to aquatic animals and humans. However, the introduction of fill material and these rock structures can affect water quality by changing how water flows and interacts with the existing stratigraphy.

Compared to Alternatives 1–3, the No-Action Alternative could potentially have more long-term, direct, adverse impacts on water quality as the amount of sedimentation lost due to current conditions would be greater and would therefore increase turbidity.

Alternatives 1–3 have similar temporary, direct, adverse impacts on water quality due to minor excavation and construction.

ESTUARINE RESOURCES

Estuarine resources are material and attributes found in an estuary that are considered to have value.

Existing and Expected Future Conditions of the Environment

The physical materials and habitats of the estuarine resources and associated project action impacts have been defined previously in Biological Resources, in the sub-topic sections of aquatic and terrestrial wildlife habitats, species of special concern, vegetation, and water resources, and subsequently in Geological Resources. This section defines the natural patterns and processes of the Albemarle-Pamlico estuarine system and the impact on the Albemarle estuarine waterbody and intertidal zones in the subsequent impact sections. The existing acreage of the Albemarle Sound is approximately 450 square miles and is considered the largest brackish and freshwater sound in North America.

FORA is situated on the north end of Roanoke Island, which is located at the juncture of the Albemarle, Pamlico, and Croatan Sounds, collectively referred to as the Albemarle-Pamlico Sound (Eshleman and York 2011). The Albemarle-Pamlico Sound is a shallow yet broad lagoonal estuary with an average depth of 0.5 meter (Jia and Li 2012). The Albemarle Sound receives freshwater from the Chowan and Roanoke Rivers and does not have direct exchange with the Atlantic Ocean, resulting in nearly fresh salinity levels (i.e., <1 ppt) (Jia and Li 2012). However, salinity increases sharply across the Croatan and Roanoke Sounds and is much higher in the Pamlico Sound, which has three exchange points with the Atlantic Ocean, including the Oregon, Ocracoke, and Hatteras Inlets. Salinity is typically greatest near the inlets where there is tidal influence from the Atlantic Ocean. The FORA site is approximately 6 miles from the Oregon Inlet.

Lunar tides within the Albemarle-Pamlico Sound are weak resulting from the limited connectivity with the Atlantic Ocean (Jia and Li 2012). The north end of Roanoke Island faces large fetches (i.e., areas of wind-generated waves) to the north and direction of strong winds, exposing it to storm waves and surges from nor'easters or other low-pressure systems. The direction, intensity, and duration of winds dictate the currents and tide levels in the sound (Eshleman and York 2011). Normal wind tides are less than 1 foot, while storm tides reach 3 to 5 feet in amplitude and as high as 10 feet during rare storm events such as hurricanes. Strong northerly winds push water from Albemarle Sound into Pamlico Sound, leading to storm surge at Roanoke Island. Wave heights are superimposed on the increased water elevation, allowing them to break on and directly impact the sediment bank sections.

Circulation patterns within the Albemarle-Pamlico Sound system consist of surface currents that flow out of the Albemarle Sound, with highest speeds through the narrow Roanoke and Croatan Sounds (Jia and Li 2012). The current then forks, with one branch exiting the sound through the

Oregon Inlet and the other continuing southbound into the Pamlico Sound. Strong surface outflows are also observed exiting the Neuse and Pamlico Rivers, developing a convergence zone where the eastward flow from these rivers meets the southward flows of the Albemarle Sound.

Bottom currents within the Albemarle-Pamlico Sound generally move in the opposite direction from the surface currents. Westward flows are directed into the Pamlico and Neuse Rivers while bottom water flows northward in the northern half of the Pamlico Sound and intrudes into the Roanoke and Croatan Sounds. This circulation pattern causes the Albemarle Sound to behave like an extended river so that the bottom current moves in the same direction as the surface current, with current speeds reaching several centimeters per second.

Anticipated environmental trends include changes in sea level and the resultant increases in tide, storm surge level, and increases in extreme water levels. In addition to these trends affecting continued shoreline erosion, the two trends most likely to affect estuarine processes would be related to sea level rise and storm surges.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, the ongoing process of shoreline erosion would persist as this process is a component of the estuarine processes that form the topography of the FORA shoreline and the bathymetry of the estuarine system (Albemarle Sound and intertidal zones). The larger Albemarle Sound estuarine waterbody and associated intertidal zones would not be impacted by the current shoreline erosion. Estuarine resources, specifically estuary processes, would not be affected by the No-Action Alternative since the salinity, wind-generated waves, circulation patterns, and bottom currents would persist regardless of current FORA shoreline erosion rates. Therefore, the No-Action Alternative would not have an effect on Albemarle Sound estuarine resources and processes.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would result in 1.87 acres of permanent fill and 1.61 acres of temporary fill in the Albemarle Sound estuarine system (Sound and intertidal zone combined) (Table 5). This quantity of permanent fill would displace soft unconsolidated bottom with hardened rock surface, and temporary impacts would be attributed to the in-water access needed for construction equipment to construct the revetment. The displacement of this unconsolidated bottom is a fraction of the 450 square mile Albemarle Sound estuarine system and would have no effect on the salinity, wind-generated waves, circulation patterns, or bottom currents of the overall Albemarle Sound estuarine system.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits by supplying a temporary sediment source to reduce erosional impacts and protect the estuarine resources. Beach fill, while offering a temporary benefit lasting 3–5 years, contingent on the quantity deposited within the project area, serves to stabilize the shoreline and would influence estuarine processes. The deposition of sediment would not alter the salinity, wind-generated waves, circulation patterns, or bottom currents of the larger

Albemarle Sound estuarine system, and the quantity of impact to the estuarine system would be unmeasurable.

Impacts of Alternative 2 – Rock Berm

Alternative 2 would result in 2.87 acres of permanent fill and 1.15 acres of temporary fill in the Albemarle Sound estuarine system (Sound and intertidal zone combined). This quantity of permanent fill would displace soft unconsolidated bottom with hardened rock surface, and temporary impacts would be attributed to the in-water access needed for construction equipment to construct the berm. The displacement of this unconsolidated bottom is a fraction of the 450 square mile Albemarle Sound estuarine system and would have no effect on the salinity, wind-generated waves, circulation patterns, or bottom currents of the overall Albemarle Sound estuarine system.

The impacts on estuarine resources due to beach fill are comparable to those described in Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Preferred)

Alternative 3 would result in 3.25 acres of permanent fill and 3.19 acres of temporary fill in the Albemarle Sound estuarine system (Sound and intertidal zone combined) (Table 5). This quantity of permanent fill would displace soft unconsolidated bottom with hardened rock surface, and temporary impacts would be attributed to the in-water access needed for construction equipment to construct the rock revetment and rock berm combination. The displacement of this unconsolidated bottom is a fraction of the 450 square mile Albemarle Sound estuarine system and would have no effect on the salinity, wind-generated waves, circulation patterns, or bottom currents of the overall Albemarle Sound estuarine system.

The impacts on estuarine resources due to beach fill are similar to those described in Alternative 1.

There is no past, present, or reasonably foreseeable future actions that have or would result in a beneficial or adverse effect on estuarine processes and resource levels that, when considered with the effects of Alternative 1, 2, or 3, would result in an overall effect on the Albemarle Sound estuary system.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted and would continue. The No-Action Alternative and Alternatives 1–3 would not contribute to this trend nor affect salinity, wind-generated waves, circulation patterns, or bottom currents of the overall Albemarle Sound estuarine system.

Conclusion

Compared to Alternatives 1–3, the No-Action Alternative could potentially have elevated long-term, direct, adverse impacts on estuarine resources as the increase in sedimentation can alter and influence currents responsible for sediment control. Alternatives 1–3 would have similar temporary, direct, adverse impacts on estuarine resources as a result of construction activities.

ARCHAEOLOGICAL RESOURCES

Cultural resources are aspects of a cultural system that are valued by, significantly representative of, or contain significant information about a culture. As noted previously in Chapter 1, the subtopics of archeological resources and cultural landscapes would be analyzed for impacts in this EA while the subtopics of ethnographic resources, museum collections, and prehistoric and historic structures have been dismissed from further analysis where this determination can be found in Appendix A.

NPS defines archeological resources as the material evidence of human culture and activity in the past including artifacts, features, sites, and associated documentation (NPS 2023b).

Existing and Expected Future Conditions of the Environment

FORA's boundaries encompass a broad range of archeological sites that embody nearly the full spectrum of eastern Carolina American Indian culture, the colonial settlements established in America by Sir Walter Raleigh between 1584 and 1590, the American Civil War, the African American Freedmen's Colony, a Depression-era Works Progress Administration (WPA) camp, and the life and career of radio pioneer Reginald Fessenden (NPS 1978).

Early American Indian settlements persisted on Roanoke Island and other surrounding islands, forming a greater community with common leaders. The tribe living on Roanoke Island at the end of the sixteenth century spoke a dialect of the Algonquian language group and grew corn, beans, and squash. The local Algonquian community would largely shape the first English settlement on Roanoke Island. The towns of Wanchese and Manteo on present-day Roanoke Island were named for members of the Roanoac and Croatoan tribes encountered during the first English contact. However, archeological evidence of the American Indian village of "Roanoac" on Roanoke Island is limited (Binkley 2003).

Sir Walter Raleigh established England's first colonial settlement in the New World at Roanoke Island in the 1580s under his charter from Queen Elizabeth I (NPS 2013). Raleigh sent out two small ships in 1584 to explore the coast. Another expedition in 1585 consisted of six to seven ships and established a fortified settlement on Roanoke Island. In addition to a variety of structures built as part of the settlement, the colonists constructed one or more earthen fortifications and a peculiar structure known as a "science center" (Binkley 2003). A second settlement known today as the "lost colony" was established in 1587 to reestablish the Roanoke Island colony. The settlement site had been abandoned by 1590. Archeological artifacts, including the remnants of the Earthen Fort, American Indian pottery, iron and metallurgy objects, a copper necklace, and tin-glazed apothecary jar fragments, among others, have been discovered during excavations.

Portions of former Confederate fortifications and Union camps associated with the Civil War Battle of Roanoke Island are located within FORA. Archeological investigations conducted in 1989 and 1991 uncovered many Civil War-era artifacts. The Roanoke Island Freedmen's Colony existed from 1862 to 1867 and comprised more than 3,000 formerly enslaved people. The colony included hundreds of dwellings and community buildings; however, no standing structures remain. Despite this, archeological investigations have discovered artifacts potentially related to the colony.

Camp Wirth, a WPA camp from the 1930s on the north end of Roanoke Island, was established as part of a larger effort to develop the area. During the Great Depression, hundreds of unemployed men were assigned to construct a series of structures there to aid in the recovery of the nation's economy (Binkley 2003). Ruins of Camp Wirth are located in the 50-acre area northwest of the Pear Pad Road terminus and consist of a cistern, two trash dumps, piping, wastewater vaults, and concrete foundations (Prentice and Groh 2010).

In 1901, Reginald Fessenden chose Roanoke Island as a site for radio experimentation. Fessenden performed several radio transmitting and receiving experiments between the north end of Roanoke Island and Cape Hatteras.

No standing structures associated with Civil War-era military camps, Freedmen's Colony, or Reginald Fessenden's radio experiments have survived within the confines. However, documentary evidence indicates that several archeological resources may be present within FORA.

Numerous archeological excavations have occurred at FORA. They began with the rise of the US historic preservation movement in the late nineteenth century, which resulted in the excavation of several historic sites, including FORA in 1895 by Talcott Williams. Jean C. Harrington, a leading historical archeologist, oversaw excavations at FORA following the Second World War from 1947 to 1950 and from 1963 to 1965. Archeologist Ivor Noel Hume conducted the next phase of archeological work from 1991 to 1993. A further archeological investigation, managed by Nicholas Luccketti, followed Hume's work from 1994 to 1995. Archeological investigations by the National Park Service Southeast Archeological Center began in 2000 and are ongoing. The First Colony Foundation, formed in 2004, has also led numerous archeological investigations at the site over the last two decades.

Some of the known and recovered archeological resources discovered as a result of those excavations include the following (NPS 2013):

- Earthen Fort
- Structural features of an outwork
- Science Center location and associated archeological resources, including crucibles, weights, glassware, and other artifacts
- Algonquian elongated clay pot
- Roanoke voyages red clay tile/shingle, large broadaxe, barrel well, concave ring, aglet, and copper necklace
- Civil War-era minie balls and bullets
- Freedmen's Colony slate pencils, buttons, etc.

At the time of first human habitation, the FORA shoreline extended approximately 150 yards into the Albemarle Sound. There is potential that archeological resources have been lost through historical erosion. Today, FORA is a significant archeological site with an incomplete survey. FORA's currently known archeological resources are considered fundamental resources as they provide information and artifacts that are important to understanding FORA's significance (NPS 2017). The protection, preservation, and interpretation of these resources are important to understanding FORA's prehistory and history. The loss of archeological resources has been documented, and salvage operations have occurred to prevent further loss of artifacts.

In 1965 Archeologist Jean C. Harrington documented an American Indian ossuary eroding out of the beach at the terminus of Pear Pad Road. In 1982, Ranger Phil Evans discovered the remains of a barrel well in the surf adjacent to Prince House Woods. Salvage operations in 2016 recovered a tin-glazed ointment pot sherd and remnants from an early 19th century farmstead along the shoreline. The unknown archeological resources that are yet to be discovered could reveal further insights about the cultures and people that occupied FORA's boundaries.

An archeological survey performed in January 2023 within Sections A–D and the associated access routes did not identify any archeological resources eligible for listing on the National Register of Historic Places (Commonwealth Heritage Group, Inc. 2024). However, there is potential for the presence of unknown archeological resources.

As a result of anticipated environmental trends (see General Methods for Assessing Impacts), loss of shoreline due to erosion is expected to continue.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, the shoreline would continue to recede approximately 6 ft/yr (Riggs and Ames 2003). Known and unknown archeological resources within and adjacent to the FORA shoreline, and the historical context of their location, could fall into or otherwise migrate into the Albemarle Sound, resulting in a permanent loss of archeological resources. The No-Action Alternative would not introduce new impacts on archeological resources; however, erosion and the potential for the permanent loss of archeological resource would continue.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would stabilize and protect unprotected portions of the FORA shoreline from wave action for elevations ranging from 5 to 15 feet above the current normal water level. Any unarmored soil above the revetment would be stabilized through lighter measures, such as geotextiles and turfing. These secondary measures would help prevent erosion from rainfall and surface water runoff, permanently reducing shoreline erosion. The reduction of erosion would directly result in beneficial impacts on archeological resources by permanently reducing the potential for the loss of known and unknown archeological resources and the historical context of their locations.

Construction of this alternative would require adding fill soil between the existing slope and the layer of rock revetment. This activity would not require grading activities along the existing bluffs. Therefore, there would be no impacts to known or unknown archeological resources. However, excavation of shoreline sediment would be required to secure the rock revetment into native soil (or sediment) material. This excavation could damage or relocate unknown archeological resources, directly resulting in a permanent adverse impact. However, archeological resources within the shoreline sediment would likely have been relocated due to past erosion of the bluff and shoreline. Therefore, the historical context of the location of these resources would have already been lost. A total of 0.45 acres of the rock revetment footprint within the shoreline has been surveyed previously for archeological resources. The remaining footprint (1.42 acres) within the bottom sediment of the Albemarle Sound, has not yet been surveyed. An archeological survey would be performed prior to construction, and an archeological monitor would be present during construction to assist in identifying resources if any are discovered.

Construction of this alternative would also require temporary access routes and staging areas. A total of approximately 4.75 acres of temporary ground disturbance would be needed for temporary access routes and staging areas. Although no known archeological resources exist in the areas identified for temporary construction access (Commonwealth Heritage Group, Inc. 2024), there is potential for the presence of unknown archeological resources. The ground disturbance associated with grading activities needed for the access routes could permanently damage or relocate unknown archeological resources. This would directly result in a permanent adverse impact. An archeological monitor would be present during construction to assist in identifying resources if any are discovered.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits to the archeological resources by supplying a temporary sediment source to reduce erosional impacts and protect the resources along Roanoke Island.

Two construction methods are being considered for beach fill: (1) land-based mechanical implementation; (2) off-loading from barges. Land-based mechanical implementation would use access routes to transport sediment to beach fill areas, including grading activities. Resulting impacts would be comparable to those identified for construction of the rock revetment. The effect determination to archeological resources within potential dredging and barge areas is undetermined. Dredging and/or off-loading from barges would require anchoring into the sediment of Albemarle Sound. Anchoring is commonly performed by spud bars (long poles) that are driven into the ground, resulting in relatively small areas of disturbance. Because these areas have not yet been surveyed for archeological resources, there is potential for unknown archeological resources to be damaged due to the anchoring required for floating barges and associated causeways, resulting in a permanent adverse impact.

Under both land-based mechanical and offshore beach fill options, the sediment source would be provided by a third party and, therefore, was not reviewed for this resource topic.

Impacts of Alternative 2 – Rock Berm

Impacts due to the implementation of Alternative 2 would be similar to Alternative 1. However, under Alternative 2, the bank material above the rock berm would remain unprotected and would be subject to surface water runoff, potentially resulting in continued erosion. Bank erosion would be limited to the natural angle of repose, which would act as a stable slope, and the "tie-in" with the rock berm would become a reinforced toe-of-slope. As a result, any unknown archeological resources carried with eroded material would remain located above the rock berm. However, permanent adverse impacts may occur to unknown archeological resources above the rock berm due to the potential relocation of resources and the resulting loss of the historical context of their location.

Establishing a rock berm would require minor excavation and grading within the berm footprint to create a uniform foundation. Shoreline sediment excavation would also be required to trench-in the rock berm and to tie-in each rock berm to existing rock revetments and berms. These excavations would have similar impacts on those described in Alternative 1. A total of 0.64 acres of the rock berm footprint within the shoreline has been surveyed previously for archeological resources. The remaining footprint within the bottom sediment of the Albemarle Sound, including 2.22 acres, has not yet been surveyed. An archeological survey would be performed prior to construction, and an archeological monitor would be present during construction to assist in identifying resources if any are discovered.

Impacts associated with temporary construction access and staging and those due to the implementation of beach fill would be identical to Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Preferred)
In the areas of shoreline best fit for construction of a rock revetment, impacts would duplicate those described in Alternative 1. In the areas of shoreline best fit for construction of a rock berm, impacts would duplicate those described in Alternative 2.

There are no past, present, or reasonably foreseeable future actions that have or would result in a beneficial or adverse effect on archeological resources that, when considered with the effects of the No-Action Alternative or Alternative 1, 2, or 3, would result in an overall effect.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and the resultant loss of known and unknown archeological resources would continue. The No-Action alternative would not contribute to this trend, nor would it protect archeological resources as a result of this trend. Alternatives 1–3 would also not contribute to this trend but would provide a beneficial effect on archeological resources through reduction of shoreline erosion because of this trend.

Conclusion

Under the No-Action Alternative, archeological resources would continue to be adversely affected due to continued shoreline erosion. Alternatives 1–3 would have permanent beneficial impacts on archeological resources through the reduction of shoreline erosion. Alternative 1 would have slightly more benefits to archeological resources than Alternative 2 due to the immediate stabilization of the bluff compared to the expectation under Alternative 2 that some bluff erosion would continue over time until the bluff “ties-in” with the rock berm, acting as a reinforced toe-of-slope. Alternative 3 would be a blend of these beneficial impacts, pending where either a rock revetment or a rock berm is used. For Alternatives 1–3, there is potential for adverse impacts on unknown archeological resources due to grading.

For Alternatives 1–3, potions of the footprint within the bottom sediment of the Albemarle Sound have not yet been surveyed. An archeological survey would be performed in those areas prior to construction, and an archeological monitor would be present during construction to assist in identifying resources if any are discovered.

CULTURAL LANDSCAPES

The National Park Service defines a cultural landscape as a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values (NPS 2021b).

Existing and Expected Future Conditions of the Environment

FORA was established on April 5, 1941, and was initially placed on the National Register of Historic Places (NRHP) in 1966, with additional revisions submitted in 1978 (NPS 2013). The NRHP documentation was amended in 1999 to re-evaluate earlier research (NRHP 1978). FORA is listed on the National Register of Historic Places, under both Criteria A and D, for its association with events that made a significant contribution to the broad patterns of our history and for its potential to yield information important in history, respectively. Archeological resources contributing to FORA's site status include Fort Raleigh and the Outwork and Science Center. These resources, as well as the Cittie of Raleigh, Camp Foster, Freedmen's Colony, and Camp Wirth, are eligible for listing on the National Register of Historic Places. The Fort Raleigh Reconstructed Earthen Fort historic structure contributes to FORA's site status and is also eligible for listing on the National Register of Historic Places (NPS 2013).

The cultural landscape features at FORA are part of the periods of significance listed in the NRHP nomination. The first period of significance is 1584–1587 and 1590. The second period of significance is 1860–1953. Years of specific importance that correlate with development of site features that enhance the interpretive value of the landscape include 1896, the 1930s, and 1947–1953. A third period of significance is associated with Mission 66 development from 1963–1966. Most of the offices and other buildings were constructed at FORA during this period. Those landscape features include (NPS 2010):

- Virginia Dare Monument
- Waterside Theatre
- Thomas Hariot Trail
- Elizabethan Gardens
- Memorials of Franklin D. Roosevelt's speech in the park and his attendance at the twenty-third performance of *The Lost Colony*
- Restoration of natural vegetation
- Erosion control measures at Dough Cemetery and Waterside Theatre
- Reconstructed Earthen Fort based on the archeological studies by Jean C. Harrington, and the Freedmen's Colony interpretation
- First Light of Freedom monument

The Virginia Dare Monument is a stone marker that commemorates Virginia Dare and the members of the Fort Raleigh "Roanoke colonies." The granite stone is approximately 4 feet tall and is inscribed on the front and rear faces.

The Waterside Theatre was originally constructed in 1937 to house the inaugural performance of Paul Green's symphonic drama, *The Lost Colony*. Subsequently, the Waterside Theatre has been rebuilt two times. Two structures including the Beehive House and Prince House, located along the shoreline near Dare Avenue, were once associated with the Waterside Theatre. Both structures were demolished; however, remnants of their foundations remain.

The Elizabethan Gardens is a 10-acre garden adjacent to the Waterside Theatre. These gardens serve as a living memorial to Sir Walter Raleigh's lost colonists. The inspiration for these private gardens was to typify the kind of garden a successful colony might have built. The gardens opened in August of 1960. These gardens are not part of FORA property.

US President Franklin D. Roosevelt attended a performance of *The Lost Colony* on August 18, 1937, during the symphonic drama's inaugural year as part of a speaking engagement commemorating the 350th anniversary of the birth of Virginia Dare. A stone marker was placed inside the Waterside Theatre, close to the location where the President watched the performance.

Dough Cemetery was originally part of the Dough homestead at the north end of Roanoke Island and included a house, outbuildings, farmland, and a family cemetery. The cemetery and a grapevine are all that remains of the homestead. The Roanoke Colony Memorial Association purchased the Dough homestead in 1894.

The Reconstructed Earthen Fort is the last structural relic of the original Roanoke colonies. As previously referenced, it was excavated and reconstructed in the late 1940s, and a number of artifacts were recovered. These features include potential archeological remains from the attempts to establish a permanent colony in the New World in the 1580s, the Civil War Battle of 1862, and the Roanoke Island Freedmen's Colony.

The First Light of Freedom monument commemorates the Roanoke Island Freedmen's Colony, which was created shortly following the Battle of Roanoke Island in February 1862, when Union forces seized control of the area from Confederate troops during the American Civil War. The colony provided refuge and education to formerly enslaved people to help prepare them for a new life.

The cultural landscape of FORA also includes the viewshed. FORA's viewshed consists of the recreational amenities, biological environment, shoreline, Albemarle Sound, and adjacent Elizabethan Gardens and residential areas that can be viewed within FORA. The shoreline and Albemarle Sound environment within FORA consists of the sand beaches, bluffs, Albemarle Sound, vegetation, and existing erosion control structures. The view of the FORA shoreline from the Albemarle Sound also contributes to the viewshed. The viewshed also includes nearby residential properties to the east and west of FORA, consisting of houses, fences, boat docks and piers, and erosional control structures visible from FORA.

As a result of anticipated environmental trends, continued loss of shoreline due to erosion and the continued loss of known and unknown cultural resources is expected to continue.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, the shoreline would continue to recede approximately 1 to 5 ft/yr (Riggs and Ames 2003). Features of the cultural landscape, especially those in proximity to the shoreline, could eventually fall into the Albemarle Sound, resulting in a permanent loss of features contributing to the cultural landscape. Continued erosion would also reduce the sediment along the bluffs and beach areas along the FORA shoreline, resulting in a permanent impact to the viewshed. The No-Action Alternative would not introduce any new impacts; however, erosion would continue and the potential for the permanent loss of features that create the cultural landscape would continue.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would stabilize and protect unprotected portions of the FORA shoreline from wave action. The reduction of erosion would directly result in beneficial impacts on the cultural landscape by permanently reducing the potential for loss of features contributing to the cultural landscape.

Construction of this alternative would require temporary access routes and staging areas, including grading activities. The ground disturbance associated with the grading activities needed for the access routes could temporarily impact the natural vegetation that contributes to the cultural landscape within the access routes. See Section 3.4.3, Vegetation, for further discussion on impacts on vegetation.

Construction activities within Sections A–D and along access routes may also cause temporary, adverse impacts on the aesthetic of the FORA viewshed due to the presence of construction equipment and materials. Following construction and the removal of equipment and materials, the viewshed's aesthetic along the access routes would be restored. However, the viewshed along the shoreline would consist of a riprap lined slope, rather than the current sand beaches and bluffs, resulting in a permanent impact on the viewshed.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits to the cultural landscape by supplying a temporary sediment source to reduce erosional impacts and protect the resources along Roanoke Island.

Two construction methods are being considered for beach fill: (1) land-based mechanical implementation; (2) off-loading from barges (see Chapter 2 for descriptions). The recommended Section 106 effect determination within potential dredging and barge areas is undetermined. However, no features associated with the cultural landscape are located within the Albemarle Sound. Therefore, the offshore construction methods mentioned above would have no impact on the cultural landscape due to the lack of cultural landscape features. Both land-based and offshore beach fill construction activities within Sections A–D, along access routes, and within the Albemarle Sound may also cause temporary, adverse impacts on the aesthetic of the FORA viewshed due to the presence of construction equipment and materials. Following construction and the removal of equipment and materials, the viewshed's aesthetic along the access routes and within the Albemarle Sound would be restored. However, the viewshed along the shoreline would consist of increased sand beaches compared to the current conditions, resulting in a permanent impact on the viewshed.

Under both land-based mechanical and barge off-loading options, the sediment source would be provided by a third party and, therefore, was not reviewed for this resource topic.

Impacts of Alternative 2 – Rock Berm

Impacts due to the implementation of Alternative 2 would be similar to Alternative 1. However, under Alternative 2, the bank material above the rock berm would remain unprotected and would be subject to surface water runoff, potentially resulting in continued erosion. Bank erosion would be limited to the natural angle of repose, which would act as a stable slope, and the “tie-in” with the rock berm would become a reinforced toe-of-slope. Adverse, permanent impacts on natural vegetation above the rock berm may occur indirectly due to the potential sloughing associated with continued bank material erosion.

Under Alternative 2, impacts on natural vegetation associated with temporary construction access and staging, impacts due to construction activities, and impacts due to the implementation of beach fill would be identical to those for Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

In the areas of shoreline where rock revetments can best be utilized for construction, impacts would be consistent with those described in Alternative 1. In the areas of shoreline where rock berms can best be utilized for construction, impacts would be consistent with those described in Alternative 2.

Prior work completed in FORA include the previous shoreline protection efforts at Dough Cemetery and Waterside Theatre. These past actions of shoreline stabilization along with the proposed action would result in a beneficial effect on known and unknown cultural resources by reducing shoreline erosion. There are no past, present, or reasonably foreseeable future actions that have or would result in an adverse effect on the cultural landscape that, when considered with the effects of the No-Action Alternative or Alternative 1, 2, or 3, would result in an overall effect.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and the resultant impacts on the cultural landscape would continue. The No-Action alternative would not contribute to this trend, nor would it protect the cultural landscape as a result of this trend. Alternatives 1–3 would also not contribute to this trend but would provide a beneficial effect on the cultural landscape that is affected by this trend through reduction of shoreline erosion.

Conclusion

The continued loss of cultural resources and historic viewshed by the eroding FORA shoreline will alter the historic landscape. When these viewsheds are compromised the integrity of the cultural resources are diminished, potentially eliminating the site and its historic significance. These viewsheds are an important part of a parks and a community's cultural history. Protecting a viewshed is essential for preserving the authenticity and integrity of cultural resources, ensuring that they continue to convey their stories and significance in purposeful ways.

Under the No-Action Alternative, the cultural landscape would continue to be adversely affected due to continued shoreline erosion. Alternatives 1–3 would have permanent beneficial impacts on the cultural landscape through the reduction of shoreline erosion. Alternative 1 would have fewer temporary adverse impacts on natural vegetation than Alternative 2 due to the lack of continued bluff erosion. Alternative 3 would be a blend of these impacts, pending where either a rock revetment or a rock berm is used. Permanent impacts on the viewshed are expected for Alternatives 1–3.

GEOLOGICAL RESOURCES

Existing and Expected Future Conditions of the Environment

Geological resources are significant features, processes, landforms, and viewsheds that frame the natural and cultural heritage of the nation. Geologic features include the shoreline bluffs, beaches, and other geologic physical phenomena present within FORA. Geological features are typically formed through long-term processes that include erosion and sediment deposition. However, short-term events, such as hurricanes, can accelerate these processes.

Roanoke Island is located on the Pamlico terrace, where sediments were deposited during the Pleistocene and Holocene epochs approximately 1.8 million years ago. The north shoreline, where the project area is located, is comprised of Pleistocene parent material, while the beach and bluff are primarily sand (Eschleman and York 2011). Rippled sand bottoms are adjacent and parallel to the shore due to prevailing wind and current direction. Large woody debris is scattered in sand and sediments across the shoreline.

Project Sections B, C and D are located predominantly in Fripp fine sand, 2–30 percent slopes. This is a very deep, excessively drained, and rapidly permeable soil formed in loamy and sandy marine sediments of the lower Coastal Plain (NCSS 2002). Project Section A is located wholly in Baymeade fine sand, 0–10 percent slopes. This is a deep, well-drained soil with moderately rapid permeability formed in loamy and sandy marine sediments of the lower Coastal Plain (NCSS 1999).

The Fripp and Baymeade soil series have the soil properties to support buildings, such as the Dough Cemetery and the Waterside Theatre and accompanying parking lot. However, the lack of clay and organic matter combined with the poor soil structure (weak granular and single grained) makes the soils susceptible to erosion by Albemarle Sound currents and storm surge. Steep slopes (2–30 percent, Fripp; 0–10 percent, Baymeade) do not contribute extensively to shoreline erosion on bluffs via precipitation. Rapid permeability (Fripp) and moderately rapid permeability (Baymeade) promote slow runoff due to high sand content.

Beach areas exist along FORA between the base of the bluffs and the Albemarle Sound. These areas build, erode, and reform as part of natural sediment transport processes.

Shoreline erosion on Roanoke Island's north and west shorelines (including the project area) occurs because of Albemarle Sound currents, waves, sea level rise, and coastal storms. These natural environmental events greatly affect the unarmored portions of the island and multi-directional erosion occurs to the east and west. As discussed in Chapter 1, many actions have been taken at FORA since the 1940s to control shoreline erosion. The existing approximately 550 feet of rock revetment at Dough Cemetery, 720 feet of rock berm at the Watershed Theatre, and 790 feet of breakwater east of the Waterside Theatre comprise 2,060 feet of the total 12,670 feet of shoreline on FORA property. Approximately 75 percent of North Roanoke Island, including FORA and the adjacent areas, has been armored with rock revetments, wooden bulkheads, groins, and breakwaters (Riggs and Ames 2003).

Two recent studies evaluated shoreline stabilization alternatives for the FORA shoreline. Stantec (2018) evaluated seven shoreline stabilization options that considered constructability, life span, permitting, public access, and NPS goals, in which the recommended alternatives with living shorelines in combination with either a rock breakwater, sheet pile breakwater, concrete breakwater, or rock revetments were chosen as the best suitable stabilization options (Stantec 2018). Additionally, a Value Analysis Study performed in 2018 identified a similar alternative design. A living shoreline with rock breakwater was identified and offered the highest total importance of advantages at the lowest costs (both initial and life cycle) (Kirk 2018). Upon NPS initiation of compliance activities to support the decision-making process of selecting alternatives, additional alternatives were conceptualized, reviewed, and dismissed, including the living shoreline and rock breakwater alternative, and any alternative with a rock breakwater component. The dismissal of the rock breakwater and other considered alternatives are described in Chapter 2.

It is important to manage FORA geologic resources as Roanoke Island, and specifically the shoreline, has served as a historic habitation area for humans for centuries (NPS 2013).

As a result of anticipated environmental trends, the natural erosion processes of the unarmored bluffs and shorelines at FORA will continue at an estimated erosion rate of 1 to 5 ft/yr, and the armored sections of shoreline will continue to disrupt the natural local sediment dynamics by halting the natural erosion of sediment along the shoreline and bluffs into Albemarle Sound and along the shoreline of Roanoke Island.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, natural erosion processes would continue to threaten FORA's geological resources along the unarmored portions of the shoreline. These erosional impacts would be adverse, direct, and permanent with erosion rates and loss of geological features estimated at 6 ft/yr along the existing shoreline. Beach areas would continue to form and erode as part of the natural process of sediment deposition and transport. The No-Action Alternative would not introduce any new impacts, and coastal geological processes would continue unimpeded.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 implementation would protect FORA's shoreline bluff from continued erosion. This alternative would protect geological resources and reduce erosion by armoring the shoreline and bluffs with a rock revetment to disperse wave and wind energy. Some erosion would continue as wave action from severe storms have the potential to exceed the height of the revetment protection. However, the overall impact associated with shoreline bluff erosion would be beneficial, direct, and permanent.

Construction of a rock revetment would include adding fill soil between the existing slope and/or bluff and grading the fill material to match the existing site soils and establish a uniform slope from the shoreline to the top of the bluff. As a result, adverse, direct, permanent impacts on the topography of the shoreline would occur due to the rock revetment installation and final structure footprint (Table 7).

Alternative 1 would result in an adverse, indirect effect on existing beach areas along the FORA shoreline. This is due to the gradual effect (due to phasing of project construction and time for natural process to occur) of the rock revetment reducing the interaction of waves and tides with the natural shoreline. Beach areas of varying size currently exist in most areas of FORA shoreline, except where existing rock revetement and rock berms are in place at the Dough Cemetery and Waterside Theatre, respectively. Therefore, an additional approximately 850 linear feet of shoreline that currently contains beach area would be lost over time. This is represented by 460 linear feet of shoreline (0.46 acre) at Etheridge Point Beach in Section A, and 390 linear feet of shoreline (0.19 acre) west of Waterside Theatre in Section D. In the short-term, there are some beach areas that would temporarily remain post-construction of Alternative 1, which includes portions of Section A—east of the Camp Wirth remnants to the Dough Cemetery—and the majority of Section C—west of the Waterside Theatre to the Elizabethan Gardens (Figure 2-2a and Figure 2-2c). In the long-term, the majority of these remnant sandy beach areas would be adversely impacted and result in a total loss. The total loss (Section A [0.47 acre] and Section D [0.19 acre]) would be attributable to shoreline erosion dynamics with the rock revetment, likely until there is no beach left and the revetment becomes the shoreface. These temporary beach area sections would eventually look similar to the shoreline at Dough Cemetery and the Waterside Theatre (Photographs 2-1 and 2-2, respectively).

The total direct, temporary, and permanent footprint impacts from the rock revetment structure and construction on the shoreline geological features are 2.11 acres and 3.61 acres, respectively.

Impacts associated with shoreline protection measures are not limited to the FORA property. Previous studies have shown coastal structures can adversely impact adjacent (downdrift) beaches by interrupting longshore sand transport (USACE 2002). This creates a condition called downdrift erosion. Downdrift erosion occurs when adjacent, unarmored beaches erode faster due to containment of updrift sediment through armoring. Permanent, adverse, indirect impacts on adjacent landowners outside of NPS property, including Elizabethan Gardens, could be attributable to potential downdrift erosion from Alternative 1 because the contained sediment would otherwise serve as a partial sediment source for downdrift shorelines. Downdrift erosion is unlikely to occur on the west and east adjacent property as there are existing rock revetments in place. Additionally, as previously noted, approximately 75 percent of the shoreline of North Roanoke Island currently has some form of shoreline protection. Beach fill (discussed below), used in the interim before Alternative 1 sections are constructed, can help offset this loss of sediment supply by providing a temporary sediment source that would help mitigate the downdrift erosion effect on adjacent, unarmored properties.

Establishment of a rock revetment would also require excavation of shoreline sediment to key the toe of each revetment into the existing ground. However, no bluff excavation would be required, and no sediment would be moved offsite. As a result, Alternative 1 would have adverse, direct, permanent impacts on geological features within Sections A–D due to the displacement of sediment caused by toe of slope excavation required for revetment construction.

Adverse, direct, temporary impacts on sediment would occur due to sediment displaced during construction of temporary access routes and staging areas, including grading activities needed for land-based mechanical implementation. However, there would be no overall loss of material as displaced sediment would remain onsite.

Temporary and permanent impacts are shown by shoreline section in Table 7 and described in the Conclusion section below. Neither land-based nor offshore construction methods would impact the geological processes at FOR A.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide temporary benefits to the project areas by providing a sediment source to the beaches on FOR A property. This sediment source may provide temporary protection to geological features and reduce potential erosional impacts. Therefore, beach fill would have beneficial, direct, temporary impacts on geological features due to the temporary protection to geological features provided by the sediment source.

Three construction methods are being considered for beach fill, including land-based mechanical implementation, pipeline dredge distribution to barges, and off-loading from barges. Land-based mechanical implementation would use access routes to transport sediment to beach fill areas. Adverse, direct, temporary impacts on sediment within the access roads would occur due to sediment displacement caused by construction of temporary access routes, including grading activities. However, there would be no overall loss of material as displaced sediment would remain onsite.

Other beach fill construction methods include placing the sand hydraulically with a pipeline dredge and/or off-loading from barges within Albemarle Sound through smaller barges. Dredging activities within the Albemarle Sound would displace sediment that would ultimately become recharged, resulting in adverse, direct, temporary impacts. Similarly, impacts from off-loading from barges are assumed to be adverse, direct, and temporary due to the displacement of sediment caused by anchoring required for the floating barges and associated causeways.

Under both land-based mechanical and barge off-loading options, the sediment source for the beach fill would be provided by a third party and, therefore, was not reviewed for this resource topic. Only beach-quality sand would be considered, and testing would be performed to confirm the sediment is free of hazardous substances.

Impacts of Alternative 2 – Rock Berm

Impacts due to the implementation of Alternative 2 would be beneficial, direct, and permanent, similar to Alternative 1. However, under Alternative 2, surface water runoff may result in continued bank material erosion above and/or behind the rock berm. Bank erosion would be limited to the natural angle of repose, which would act as a stable slope, and the "tie-in" with the rock berm would become a reinforced toe-of-slope. In addition, in Section A, the rock berm would end before the existing beach area between the Camp Wirth remnant concrete in-water structure and existing rock revetment for Dough Cemetery, thereby potentially preserving this geologic resource in this area.

Establishment of a rock berm would require minor toe of slope excavation and grading within the berm footprint to create a uniform foundation. Excavation of shoreline sediment would also be required to trench-in the rock berm and to tie-in each rock berm to existing rock revetments and berms. However, no bluff excavation would be required, and no sediment would be moved offsite. As a result, Alternative 2 would have adverse, direct, permanent impacts on geological features within Sections A–D due to the displacement of sediment caused by toe of slope and tie-in excavation required for rock berm construction. As a result of rock berm installation and the final structure footprint, adverse, direct, temporary, and permanent impacts on the topography of the shoreline would occur. The total direct temporary and permanent footprint impacts from the rock berm structure and construction on the shoreline geological features are 1.96 acres and 3.63 acres, respectively. Temporary and permanent impacts are shown by shoreline section in Table 7. Neither land-based nor offshore construction methods would impact the geological processes at FORA.

The rock berm would be placed in front of the bluffs and shoreline; therefore, wind and high storm events would continue to erode the face of the geological features. Migration and movement of sediment from the bluffs and shoreline could settle and become unstable between the rock berm structure and existing slope. Adverse, indirect, permanent impacts on sediment would occur due to the migration and movement of sediment above and behind the rock berm to lower shoreline elevations.

Impacts associated with temporary construction access and staging, implementation of beach fill, and indirect impacts on adjacent landowners would be identical to those for Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Preferred)

Impacts due to the implementation of Alternative 3 would be similar to those for Alternative 1 and Alternative 2. The total direct temporary and permanent footprint impacts from the rock revetment/rock berm and construction on the shoreline geological features are 3.56 acres and 5.24 acres, respectively. Temporary and permanent impacts are shown by the shoreline section in Table 7. There are no measurable impact differences between the shoreline protection measures of Alternatives 1, 2, and 3 on geological processes; however, the rock revetment structure and associated fill between the rock and shoreline would provide a more robust shoreline stabilization system by deflecting wave and wind energies from the face of the shoreline.

Past actions in the vicinity of FORA include the previous shoreline protection efforts. Approximately 75 percent of North Roanoke Island has been armored with rock revetments, wooden bulkheads, groins, and breakwaters (Riggs and Ames 2003). Alternatives 1, 2, or 3 combined with past actions would result in an additional approximately 5,145 to 5,245 feet of newly armored shoreline in addition to the approximately 8,250 feet of shoreline already protected on North Roanoke Island (estimated by HDR from Riggs and Ames 2003). The past actions of these various shoreline stabilization efforts along with the proposed action would result in a beneficial effect by providing stabilization of the existing geological features within FORA property but would also add to the adverse effect by continuing the effect of downdrift erosion and would arrest the natural geological process of erosion along the exposed shorelines.

Relative to environmental trends—increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion—the resultant loss of geological features would continue. The No-Action Alternative would contribute to this trend, and it would not protect geological resources as a result of this trend. Alternatives 1–3 would not contribute to this trend but would provide a beneficial effect on this trend as geological resources would be protected from shoreline erosion.

Conclusion

The rock revetments when used regarding aquatic and terrestrial wildlife and habitats would address the existing steep and high embankment from continual sluffing. By the placement of fill soil, not sand, and a layer of well graded rock along these high embankments there would be a direct positive effect on addressing soil erosion.

The rock berm would be placed in a low elevation area between the water's edge and the beach fill area. These rock berms would be constructed having overlapping gaps and be placed resembling a trapezoidal cross-section shape. This placement will protect the beach area from wave action and assist in the establishment of marsh plantings.

By using both types of shoreline rock protection, revetments and berms, along with the beach fill to establish what is essentially a living shoreline. This shoreline once established would absorb approximately 50 percent of the energy of an incoming wave, affectively reducing a percentage of shoreline erosion that takes place.

Compared to Alternatives 1–3, the No-Action Alternative would cause adverse impacts that are more severe and permanent and would result in the loss of geological features and continued shoreline sediment loss on unarmored portions of the study area. Existing coastal structures, in various states of viability, consisting of breakwaters, bulkheads, groins, jetties, piers, and revetment have protected roughly 3,510 feet of FORA's shoreline since the 1940s (Lacosse et al. 2014), which includes approximately 1,270 feet of existing rock revetment and rock berm shoreline protection at the Dough Cemetery and Waterside Theatre.

Alternatives 1–3 would propose additional coastal structures in the form of rock revetment or rock berm ranging between approximately 5,145 and 5,245 feet as compared to the No-Action Alternative.

Alternatives 1-3 would have permanent adverse impacts on natural geological processes of longshore sediment (sand) transport. Potential downdrift erosion to the Elizabethan Gardens shoreline could occur while the revetment-armored adjacent properties would not be impacted. To mitigate downdrift at the Elizabethan Gardens, FORA would collaborate with Roanoke Island Historical Association and/or the state through cooperative agreements to take the necessary actions outside NPS property to determine the best course of action at the Elizabethan Gardens shoreline. To mitigate downdrift on North Roanoke Island in general, beach fill placed ahead of construction can help offset sediment supply loss by providing a temporary, beneficial sediment source that would help mitigate the downdrift erosion effect on adjacent, unarmored properties.

VISITOR USE AND EXPERIENCE

Visitor use and experience includes the feeling of a visitor before, during, and after their visit, as well as the various experiences they have while visiting.

Existing and Expected Future Conditions of the Environment

Between 2013 and 2023, the Fort Raleigh National Historic Site has welcomed approximately 250,000 to 300,000 visitors per year (NPS 2023c). The exception to the trend was 2020 when only 153,519 visits were recorded and most likely attributed to the COVID-19 pandemic (NPS 2023c).

The statistics do not capture visitor traffic that park their vehicles at the Elizabethan Gardens or at Etheridge Point on Pear Pad Road. As a result, actual visitor use is higher than what is officially reported but it has remained relatively consistent over the past ten years, nonetheless. FORA had a visitor satisfaction rating of 98.0 percent in 2015, after a 92.9 percent rating over a 10-year average (NPS 2016). Peak-season extends from May through August. People visit FORA primarily to better understand the history of the area, including seeing *The Lost Colony* production at the Waterside Theatre and learning about the historical and archeological significance of the location (NPS 2013). Although not the intention of FORA, the narrow beaches along the shoreline also attract recreational visitors.

TABLE 7. SHORELINE GEOLOGIC IMPACTS

Permanent and Temporary Impacts on Shoreline Sediment (Ac) [1]	No-Action Alternative	Alternative 1 – Rock Revetment	Alternative 2 – Rock Berm	Alternative 3 – Rock Revetment/Rock Berm Combination
Shoreline Permanent Structure Footprint Area[1]				
Section A	0	0.80	1.01	1.29
Section B	0	1.54	1.30	1.72
Section C	0	0.43	0.49	0.77
Section D	0	0.84	0.84	1.47
Total (Sections A-D)	0	3.61	3.63	5.24
Shoreline Temporary Work Access Areas				
Section A	0	1.35	0.97	1.66
Section B	0	0.18	0.28	0.96
Section C	0	0.43	0.16	0.48
Section D	0	0.16	0.55	0.46
Total (Sections A-D)	0	2.11	1.96	3.56

1. Shoreline permanent structure footprint areas and shoreline temporary work access areas do not include inland based access road impacts (i.e., areas on existing access roads). The shoreline sediment calculated areas encompass the unconsolidated shoreline and bottoms (sandy beaches and bluffs) and vegetation communities at the shoreline.

Visitors also enjoy FORA's recreational resources. Recreational amenities at FORA include the Lindsay Warren Visitor Center, 1896 Monument, Earthen Fort, First Light of Freedom Monument, Thomas Hariot Trail, Freedom Trail, Etheridge Point Beach, and the Waterside Theatre and accompanying parking lot. Although not located within the boundary of FORA, the Elizabethan Gardens is an additional amenity available to visitors.

The Lindsay Warren Visitor Center houses immersive exhibits on the Algonquian culture, English exploration, the Roanoke Island Freedmen's Colony, the Civil War Battle of Roanoke Island, and Reginald Fessenden. A 17-minute dramatic video on the interaction between the Algonquian and the English is displayed in the Visitor Center's theatre (NPS 2023a).

The 1896 Monument marks the beginning of on-site preservation efforts. The stone marker commemorates the baptisms of Virginia Dare and the Croatan native Manteo by the English. The Earthen Fort, reconstructed in 1950, represents an earthwork structure present on the site in the1580s.

The First Light of Freedom Monument commemorates the Roanoke Island Freedmen’s Colony, which was established during the American Civil War. The colony provided a haven and education for the formerly enslaved to help prepare them for a new life.

The Freedom Trail, Dare Avenue, and other unmarked trails and beach pathways within FORA provide for access to the shoreline that abuts the Croatan and Roanoke Sounds. Etheridge Point Beach is a small, sandy, sound side beach along the sound where visitors can enjoy sound side beach activities (NPS 2023a).

Access to Etheridge Point Beach, at the end of Pear Pad Road (Access Route #1), is available for visitors to engage in activities such as swimming, playing, launching canoes/kayaks (non-motorized boats), or relaxing in the water. The beach lacks lifeguards, necessitating visitors to swim at their own risk. Fishing is permitted; however, visitors must adhere strictly to the regulations outlined by the North Carolina Division of Fisheries.

The Thomas Hariot Trail is a 0.3-mile loop through the island's maritime forest to the sandy shores of the Albemarle Sound. The trail includes interpretive signs describing the forest habitat, Algonquian methods for gathering food, and resources the English found valuable on Roanoke Island.

The Freedom Trail is a 1.25-mile trail through the maritime forest that ends with views of the Croatan Sound on the park's western edge. The end point at the Croatan Sound is currently unarmored and there are no plans for shoreline protection at this time The trail ends near the location where the Freedmen's Colony and Civil War forts once stood.

Outside of the recreational amenities and cultural resources that visitors can experience at FORA, visitors can engage in recreational activities such as hiking, bird watching, kayaking, swimming, and fishing.

As a result of anticipated environmental trends, continued loss of shoreline due to erosion is expected to continue. In addition, more frequent and intense storms may reduce the opportunities for visitors to recreate due to the short-term weather conditions and/or long-term recovery or clean-up needed after storm events. No trends related to cumulative effects have been identified.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, the shoreline would continue to recede approximately 6 ft/year (Riggs and Ames 2003). Erosion of narrow, unarmored beaches along the north and west shorelines of Roanoke Island would promote failure of near-shoreline resources. As a result, relocation of near-shoreline resources may be required. This could reduce visitor satisfaction and recreational visitation numbers in future years, resulting in an adverse impact on visitor use and experience. The No-Action Alternative would not introduce new impacts; however, erosion would continue the loss of near-shore resources.

Impacts of Alternative 1 – Rock Revetment

Implementation of Alternative 1 would protect FORAs shoreline bluff from continued erosion and would protect some of the resources and amenities within FORA that attract visitors, such as the Waterside Theatre. Preserving the resources and amenities within FORA would have a permanent, beneficial impact on visitor use and experience.

In contrast, the extent of shoreline available for recreational use would be reduced and replaced with a hardened shoreline, which presents a hard, uneven surface that is less safe and has less recreational value. As a result, permanent adverse impacts on visitor numbers and satisfaction ratings may occur due to modified visitor use and experience caused by the decrease in recreational space. This includes the reduction of recreational beach areas and general access along the shoreline.

Construction efforts would be prioritized during FORA's off-season; that is, months where recreational visitation numbers are lower. However, during construction, land-based mechanical implementation would require the closure of construction areas to visitors. In addition, the atmosphere at FORA may be altered temporarily by the presence and sounds of construction equipment and materials. Additionally, movement throughout FORA and access to recreational areas would be reduced to visitors during the construction period. Temporary Access Route 1 includes the use of Pear Pad Road, a road used to enter Etheridge Point Beach, as an access route to transport construction equipment and materials. As a result, visitors would not be able to access Etheridge Point Beach during construction within Section A. Temporary Access Route 2 is access through the visitor parking lot and utilizes portions of the walking path between the parking lot and Waterside Theatre. This access route also utilizes the beach areas along the shoreline from Waterside Theatre to the existing rock revetment at the Dough Cemetery. Temporary Access Route 3 would utilize beach areas from Dare Avenue to the Watershed Theatre. Temporary construction staging is anticipated to occur on cleared, paved, or open areas along existing site roads and parking lots. As a result, temporary adverse impacts on visitor numbers and satisfaction ratings may indirectly occur due to the closures and altered visitor experience. Following construction, access to all FORA areas would be reopened to the public.

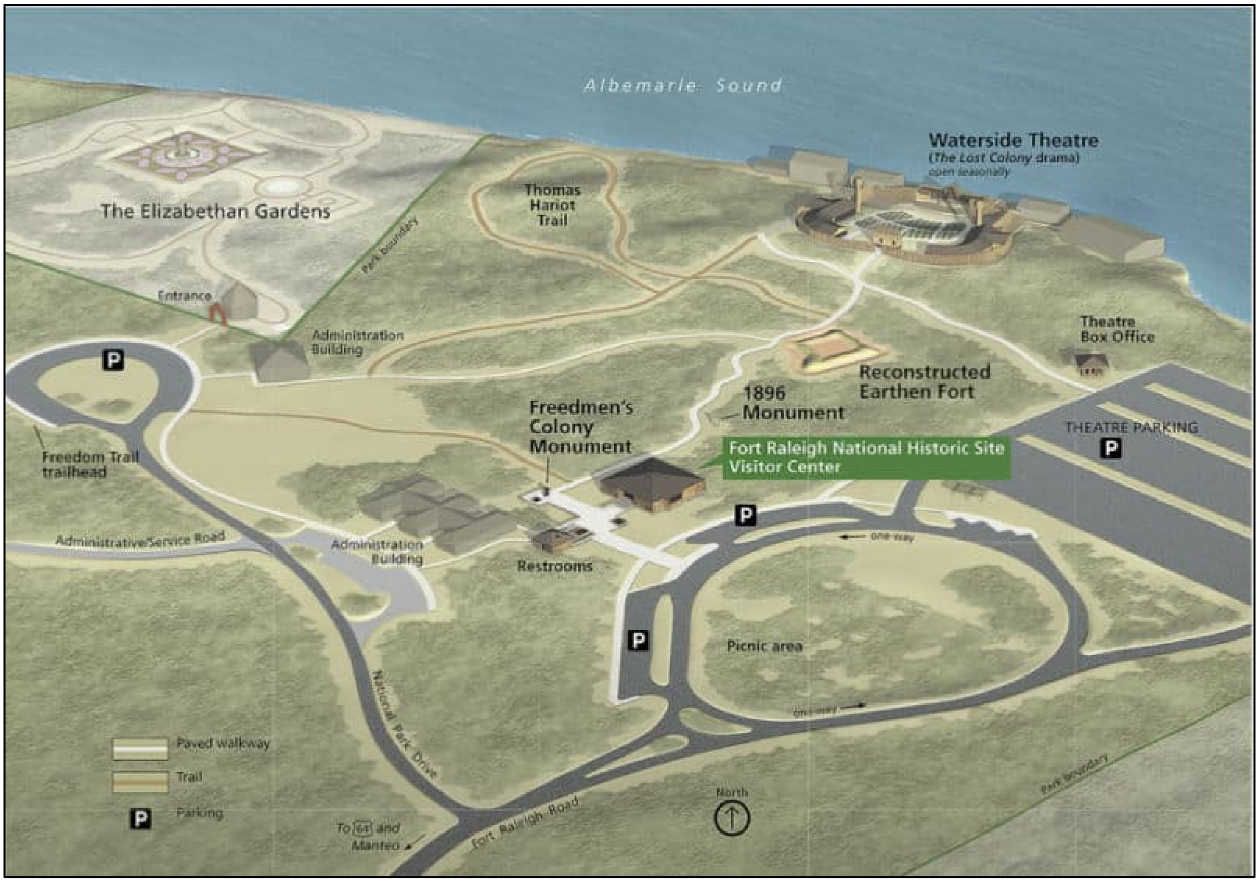

Figure 13. Fort Raleigh (FORA) Recreational Resources.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits to visitors by supplying a temporary sediment source to reduce erosional impacts and protect the resources along Roanoke Island. Temporary impacts on visitor numbers and satisfaction ratings due to construction efforts would be similar to those identified for construction of the rock revetment. Temporary impacts in regard to access to Etheridge Point Beach due to the use of Pear Pad Road would also be similar to those identified for construction of the rock revetment. Following construction, access to the beach would be restored and the extent of shoreline available for recreational use would increase and have higher recreational value. As a result, temporary beneficial impacts on visitor numbers and satisfaction ratings may occur due to the increase in recreational space. Neither land-based nor offshore construction methods would impact the remaining recreation resources within FORA due to their position further from the shoreline and the access roads.

Impacts of Alternative 2 – Rock Berm

Impacts due to the implementation of Alternative 2 would be similar to Alternative 1. Establishment of a rock berm would also implement similar land-based mechanical implementation methods as Alternative 1, including the use of Pear Pad Road, and subsequent impacts on Etheridge Point Beach during and following construction. However, following construction, the rock berm may cause lower visitor satisfaction compared to Alternative 1 due to the larger footprint of the berm, resulting in less beach access for recreational activities. Other recreational beach areas would experience similar impacts as Etheridge Point Beach. However, following construction, no hardened structures are proposed for the eastern, wider beach portion in Section A, allowing for continued recreational land use within that portion of shoreline. Following construction, the remaining sections would be consistent with Alternative 1.

Remaining impacts associated with visitor use and experience and impacts due to the implementation of beach fill would also be similar to those for Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

In the shoreline areas best fit for construction of a rock revetment, impacts would be the same as those described for Alternative 1. In the areas of shoreline best fit for construction of a rock berm, impacts would be the same as those described for Alternative 2.

Past actions in FORA includes the previous shoreline protection efforts at Dough Cemetery and Waterside Theatre. These past shoreline stabilization actions along with the proposed action would result in a beneficial effect on the resources and amenities within FORA that attract visitation while reducing shoreline erosion. There are no actions that have or would result in a permanent, adverse effect on visitor use and experience.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and the resultant impacts on visitor use and experience would continue. To mitigate potential effects to visitor, use and experience, the Outer Banks Group Parks, including Fort Raleigh National Historic Site, have an established Severe Weather Emergency Action Plan. This plan is activated for anticipated severe weather events throughout the year, such as nor'easters, floods, heavy rainfall, tropical storms, and hurricanes. It details the actions needed to prepare facilities for storms, outlines procedures for public notifications and park evacuations, and describes post-storm response efforts to assess damages. The No-Action alternative would not contribute to this trend, nor would it protect visitor use and experience as a result of this trend. Alternatives 1-3 would also not contribute to this trend but would provide a beneficial effect on visitor use and experience that is affected by this trend through the reduction of shoreline erosion.

Conclusion

Under the No-Action Alternative, long-term visitor use, and experience would be adversely affected due to continued shoreline erosion. Alternatives 1–3 would have permanent, beneficial impacts on visitor use and experience due to the reduction of shoreline erosion. However, Alternatives 1-3 would also have direct adverse effects to visitors who use these beaches to recreate in the soundside beach environment. Visitors who have used these areas in the past would be most affected by the loss of this resource. Soundside beaches are limited within the Outer Banks and are typically used by locals and visitors who do not want their children/families swimming in the rough ocean. Alternative 2 would have a larger overall footprint compared to Alternative 1, potentially resulting in in less beach access for recreational activities. However, compared to Alternative 1, Alternative 2 would lack a hardened structure within the eastern portion of Section A (Etheridge Point Beach), resulting in continued recreational land use in that area. Alternative 3 would be a blend of these impacts, pending where either a rock revetment or a rock berm is used.

SOUNDSCAPE

Existing and Expected Future Conditions of the Environment

NPS natural soundscape resources encompass all the natural sounds that occur in parks, including the physical capacity for transmitting those natural sounds and the interrelationships among park natural sounds of different frequencies and volumes. Natural sounds occur within and beyond the range of sounds that humans can perceive, and they can be transmitted through air, water, or solid materials. The National Park Service would preserve, to the greatest extent possible, the natural soundscapes of parks (NPS 2006).

The soundscape's quality can be measured by determining the contribution of anthropogenic noise to the soundscape. This measure is called the mean acoustic impact level and is A-weighted in decibels (dBA) (NPS 2016). In the A-weighted system, low frequency values are reduced. The mean acoustic impact level at FORA is 5.0 dBA, a level that indicates a poor quality of soundscape (NPS 2016). Unnatural sounds (e.g., adjacent residential areas, vehicular traffic from nearby roads, air traffic from the Dare County Regional Airport) and natural sounds (e.g., the Albemarle Sound, wildlife activity, wind) are all aspects of the existing soundscape at FORA. Sounds from park activities, including productions of "*The Lost Colony*," parking vehicles, and foot traffic and voice levels from visitors also contribute to the soundscape at FORA.

As a result of anticipated environmental trends, continued loss of shoreline due to erosion is expected to continue. No trends related to cumulative effects have been identified.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, the shoreline would continue to erode, but there would be no impacts on the soundscape.

Impacts of Alternative 1 – Rock Revetment

Construction required for rock revetment implementation would introduce anthropogenic noise from heavy machinery (e.g., engine noise, beeping, horns) and construction activities (e.g. crashing or splashing related to rock placement). Construction sounds, including those described above, generally range from approximately 80-90 dBA at 50 feet away from equipment and would result in a temporary increase from the current 5.0 dBA (FHWA 2017). In addition, sound is amplified both in and over the water due to the refraction of sound waves (Russell 2011). Therefore, sound created from construction activities may be heard by boaters within and communities throughout Roanoke Sound. The anticipated timeframe for the construction of each Section (A-D) is 1 year. Additionally, the construction of each Section (A-D) would be phased, so portions of the FORA soundscape may remain muted or undisturbed during construction. As a result, temporary adverse impacts on FORA's soundscape would occur as a result of rock revetment construction. Following construction, the mean acoustic impact level would return to 5.0 dBA.

Impacts associated with both land-based and offshore construction activities required for the implementation of beach fill would be similar to those associated with construction of the rock revetment.

Impacts of Alternative 2 – Rock Berm

Impacts on the soundscape during and following construction of a rock berm would be similar to those for Alternative 1. Impacts due to the implementation of beach fill would also be identical to those for Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

In the areas of shoreline best fit for construction of a rock revetment, impacts would be similar to those described in Alternative 1. In the areas of shoreline best fit for construction of a rock berm, impacts would be similar to those described in Alternative 2.

There are no past or present actions that have or would result in a beneficial or adverse effect on the soundscape that, when combined with the effects of the No-Action Alternative or Alternative 1, 2, or 3, would result in a cumulative effect. Reasonably foreseeable future projects (see Appendix D) may occur either concurrent with construction of the Preferred Alternative or overlapping in construction seasons, creating a longer total time period with ongoing construction at the park. Multiple concurrent ongoing construction activities would collectively create a higher amount of construction sounds that would have a temporary direct adverse effect on soundscape. Additionally, multiple overlapping construction projects would increase the total duration of construction related noise at the park. When possible, construction would be limited to off-season (late fall and winter months) when visitation is lowest.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted and would continue. The No-Action Alternative and Alternatives 1-3 would not contribute to this trend, nor would they protect the soundscape as a result of this trend.

Conclusion

Alternatives 1–3 have more adverse impacts than the No-Action Alternative. Alternatives 1–3 would have similar adverse impacts on the soundscape as a result of increased anthropogenic noise during construction. No permanent impacts on the soundscape would occur.

LAND USE

Existing and Expected Future Conditions of the Environment

Land use at FORA consists primarily of recreation and historic preservation. The shoreline area within FORA includes beaches and bluffs. The beaches are open to the public to play, swim, and relax. Surrounding land use includes the Elizabethan Gardens, private property, and state lands. The Elizabethan Gardens borders FORA within the north central portion of the property and includes landscaped gardens, walkways, and several associated buildings and structures. Private properties to the east and west are primarily residential. State lands begin at the low water line within the Albemarle Sound. These submerged state lands are managed and regulated by the State of North Carolina Division of Environmental Quality and within the Division that encompass the Division of Water Resources (DWR), Division of Coastal Management (DCM), Division of Marine Fisheries (DMF), Division of Energy, Mineral and Land Resources (DEMLR), Wildlife Resources Commission (WRC), and USACE.

As a result of anticipated environmental trends, continued loss of shoreline due to erosion is expected to continue.

Environmental Consequences

Impacts of the No-Action Alternative

Under the No-Action Alternative, the shoreline would continue to recede approximately 6 ft/yr (Riggs and Ames 2003). Continued erosion would permanently adversely impact the land use at FORA due to the loss of shoreline. The No-Action Alternative would not introduce new impacts.

Impacts of Alternative 1 – Rock Revetment

Alternative 1 would stabilize and protect unprotected portions of the FORA shoreline from wave action for elevations ranging from 5 to 15 feet above the current normal water level, ultimately preventing continued erosion and preserving the land and associated land use within FORA. Preserving the land within FORA would have a permanent, beneficial impact on land use.

Immediately adjacent private properties (west of Section A and east of Section D) currently have shoreline protection measures in place. The land use within those properties would not be impacted by construction of the rock revetment. The Elizabethan Gardens, however, has approximately 550 feet of unprotected shoreline. Erosion along their shoreline would continue at approximately 6 ft/yr and may increase as a result of the protection of FORA's shoreline due to lack of sediment transport from the abutting shoreline, potentially altering the land use further. See Geological Resources, for a discussion on anticipated, system-wide erosional impacts. The National Park Service would attempt to collaborate with the Elizabethan Gardens through a cooperative agreement to provide similar shoreline bank protection to prevent erosion and protect the land use within their property. Construction would also involve the occupation of state lands. See Chapter 2 for a discussion of state and federal permits required to support this action.

Construction of this alternative would require the use of temporary access routes and staging areas to transport construction equipment and materials. The use of these access routes and staging areas would temporarily convert land within Sections A–D from recreational to construction areas. Following construction, land use within the access roads and Sections A–D would return to recreational; however, recreational use within Sections A–D would be reduced due to the replacement of shoreline with a hardened shoreline. A hardened shoreline presents a hard, uneven surface that is less safe and has less recreational value, resulting in permanent adverse impacts on land use due to the reduced recreational use along the shoreline.

Should the opportunity arise prior to rock revetment construction, beach fill may be used to provide short-term benefits to land use by supplying a temporary sediment source to reduce erosional impacts and protect the resources along Roanoke Island.

Both land-based mechanical implementation and offshore construction methods may be required for beach fill. Land-based mechanical implementation would use access routes to transport sediment to beach fill areas. Temporary impacts during construction due to the use of temporary access routes and staging areas would be similar to those identified for construction of the rock revetment. Following construction, land use within the access roads and Sections A–D would return to recreational; however, recreational use within Sections A–D would be increased due to the temporary additional beach areas. Increased beach areas would have increased recreational value, resulting in temporary beneficial impacts on land use.

Offshore construction methods, including placing the sand hydraulically with a pipeline dredge and/or off-loading from barges through smaller barges would not impact land use within FOR A due to the construction activities being located within the Albemarle Sound. However, construction impacts along the shoreline within Sections A–D would be consistent with those associated with land-based implementation.

Impacts of Alternative 2 – Rock Berm

Impacts due to the implementation of Alternative 2 would be similar to Alternative 1. However, under Alternative 2, the bank material above the rock berm would remain unprotected and would be subject to surface water runoff, potentially resulting in continued erosion. Bank erosion would be limited to the natural angle of repose, which would act as a stable slope, and the “tie-in” with the rock berm would become a reinforced toe-of-slope. As a result, less recreational land use would be available above the berm.

Impacts on land use during construction within Sections A–D would be similar to those for Alternative 1. However, following construction, no hardened structures are proposed for the eastern, wider beach portion in Section A, allowing for continued recreational land use within that portion of shoreline. Following construction, the remaining Sections would be consistent with Alternative 1.

Impacts on land use during and following construction within the access routes and adjacent properties would be similar to those for Alternative 1. Impacts due to the implementation of beach fill would be identical to those for Alternative 1.

Impacts of Alternative 3 – Rock Revetment/Rock Berm Combination (Proposed/Preferred)

In the areas of shoreline best fit for construction of a rock revetment, impacts would be similar to those described for Alternative 1. In the areas of shoreline best fit for construction of a rock berm, impacts would be similar to those described for Alternative 2.

There are no past, present, or reasonably foreseeable future actions that have or would result in a beneficial or adverse effect on visitor use and experience that, when combined with the effects of the No-Action Alternative or Alternative 1, 2, or 3, would result in a cumulative effect.

Relative to environmental trends, increases in sea level, high tides, coastal flooding, storm surges, and continued shoreline erosion are predicted, and the resultant impacts on land use would continue. The No-Action Alternative would not contribute to this trend, nor would it protect land use as a result of this trend. Alternatives 1–3 would also not contribute to this trend but would provide a beneficial effect on land use through reduction of shoreline erosion because of this trend.

Conclusion

Under the No-Action Alternative, long-term land use would be adversely affected due to continued shoreline erosion. Alternatives 1–3 would have permanent beneficial impacts on land use due to the reduction of shoreline erosion. Alternative 2 would have less recreational land use available above the rock berm compared to Alternative 1 due to erosion of the bluff behind the rock berm. However, compared to Alternative 1, Alternative 2 would lack a hardened structure within the eastern portion of Section A, resulting in continued recreational land use in that area. Alternative 3 would be a blend of these beneficial impacts, pending where either a rock revetment or a rock berm is used. For Alternatives 1–3, there is potential for adverse impacts on adjacent properties. The National Park Service would attempt to collaborate with Elizabethan Gardens through a cooperative agreement to provide similar bank protection to prevent erosion and protect the land use within their property.

Chapter 4: CONSULTATION AND COORDINATION

This chapter documents the federal, state and local agencies and Tribes consulted during the NEPA process and summarizes the public involvement for this EA. NPS Director's Order #12: Conservation Planning, Environmental Impact Analysis, and Decision-making, requires the NPS to make "diligent" efforts to involve the interested and affected public in the NEPA process. Consultation and coordination help to refine the alternatives and identify issues and/or concerns related to environmental impact topics. This section provides a summary of the public involvement, and agency consultation and coordination that occurred during planning.

AGENCY AND TRIBAL CONSULTATION

National Historic Preservation Act, Section 106

As required by Section 106 of the NHPA, FORA consulted with the North Carolina State Historic Preservation Office, the National Historic Landmarks Program, and the Tribes identified in Section 4.1.2 to assess the project's effects on historic properties. The NPS determined that the project actions would have No Adverse Effect on adjacent historic properties or on cultural landscapes. The Section 106 consultation process is being conducted separate from and concurrent with the NEPA process. Consultation under Section 106 is ongoing but would be completed prior to the release of a NEPA decision document. FORA would continue consultation, as appropriate, during project implementation.

During the planning process for the EA, FORA contacted the following American Indian Tribes to initiate consultation: Absentee Shawnee Tribe, Catawba Indian Nation, Eastern Shawnee Tribe of Oklahoma, and Tuscarora Nation (see Appendix F). The NPS would inform these Tribes of availability of the EA for their review.

Endangered Species Act, Section 7

The NPS reviewed the US Fish and Wildlife Service Information for Planning and Consultation database to determine the potential for any special status species to occur within the project area. Based on a review, FORA staff determined that project activities would have a *May Affect Not Likely to Adversely Affect* to federal special status species. There are no critical habitats for special status species within the vicinity of the project area. The NPS submitted a request for determination to the US Fish and Wildlife Service on March 20, 2025, and they concurred with this determination on March 31, 2025. The NPS submitted a request to the National Marine Fisheries Service on March 18, 2025, and they acknowledged their having received the NPS request for Endangered Species Act Section 7 consultation. The NPS determined that the project activities would have a *May Affect Not Likely to Adversely Affect* to federal special status species. The project would not commence until a determination is received.

Coastal Zone Management Act

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Zone Management Act, the State's Dredge and Fill Law, Chapter 7 of Title 15A of North Carolina's Administrative Code, and Dare County's land use plan. The North Carolina Division of Coastal Management's objective is to manage the State's coastal resources to ensure the proposed federal actions would be compatible with safeguarding and perpetuating the biological, social, economic, and aesthetic values of the State's coastal waters. When construction designs are available, FORA would submit a Federal Consistency Determination to document the project's consistency with the State's coastal management program for a consistency review.

Clean Water Act, Section 404

Section 404 establishes a program to regulate the discharge of dredged and fill materials into waters of the United States, including wetlands. The Army Corps of Engineers (USACE) establishes permit regulations that specifies the procedures and criteria for the issuance of Section 404 permits. The preferred alternative may require a 404 permit for the filling of jurisdictional wetlands. When construction designs are available, the NPS may be required to submit a pre-construction notification to USACE to determine if a Section 404 permit is needed.

PUBLIC INVOLVEMENT

As required by NPS NEPA regulations, public involvement occurred throughout the EA process. A press release and notice of public scoping period was published on January 8, 2025, and was open through February 21, 2025. During this comment period, the NPS released information about the project background, objectives, key issues, and preliminary alternatives. On February 12, 2025, a public scoping meeting was held at the Fort Raleigh National Historic Site Visitor Center in Manteo, North Carolina to obtain public feedback on the initial purpose, need, objectives, issues and concerns, and preliminary alternative concepts and elements for shoreline stabilization options. Sixteen correspondences were received during the 44-day comment period.

Most comments received were in support of the project and the preliminary alternatives presented. This EA reflects the suggestions, ideas, and concerns shared by the public during the public scoping period. This EA would be available for public review and comment during a 30-day period following publication and has been distributed to a variety of interested individuals, agencies, and organizations. The NPS PEPC page for the project: https://parkplanning.nps.gov/FORA_shoreline is the primary location where project documents are available for public review and comment and hard copies are available upon request. Substantive comments would receive a response as part of the comment review process; responses to substantive comments would be addressed in a report appended to the decision document.

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The following team members comprised the interdisciplinary team for the preparation of this document.

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APPENDIX A: Impact Topics Dismissed from Further Analysis

Section 4.2 E of the National Park Service (NPS) NEPA Handbook (NPS 2015) states that, generally, issues should be discussed in detail in an Environmental Assessment (EA) if any of the following apply:

- The environmental impacts associated with the issue are central to the proposal or of critical importance
- A detailed analysis of environmental impacts related to the issue is necessary to make a reasoned choice between alternatives
- The environmental impacts associated with the issue are a big point of contention among the public or other agencies
- There are potentially significant impacts to resources associated with the issue

The NPS NEPA Handbook further states that if the considerations above do not apply, issues should be dismissed from detailed analysis. The following issues and impact topics were not fully addressed in the EA because the listed resources are not in the project area; the environmental impacts associated with the issue are not central to the proposal, pivotal, or of critical importance; a detailed analysis of environmental impacts related to the issue is not necessary to make a reasoned choice between alternatives; or the resource would not be or only negligibly impacted and there is no potential for significant impacts.

Air Quality

The 2006 NPS Management Policies, specifically Section 4.7.1, outline the NPS's responsibility to protect air quality under the 1916 Organic Act and the Clean Air Act (CAA). This responsibility is important for preserving natural resources, conserving cultural resources, and improving visitor experiences.

Clean air is essential for the health of park ecosystems and the protection of historical and cultural sites. It also supports visitor enjoyment and human health while maintaining scenic views. Air quality within FORA could be affected temporarily by construction activities which could create furtive dust created from heavy equipment constructing and using the temporary roads and for the placement of stabilization structures. The potential localized short-term impact of the proposed action alternatives would vary minimally in scale due to different sizes and locations of construction footprints. Mitigating actions such as keeping vehicle speeds low and using water to spray down unpaved access roads, if needed, would ensure these impacts remain unmeasurable. Therefore, air quality was dismissed from detailed analysis.

Commercial Fishing

In the past commercial fishing nets have been set in nearshore waters of Albemarle Sound, located outside of FORA boundaries, at depths between 2 to 8 feet. Targeted fish species include red drum (*Sciaenops ocellatus*), speckled trout (*Cynoscion nebulosus*), and southern flounder (*Paralichthys lethostigma*). The commercial fishing history for this specific area, northern Roanoke Island, are vague.

There may be temporary impacts to commercial fishing during project activities from sounds of equipment and sediment and rock placement activities which would create turbidity near the fishing nets. These short-term impacts would vary depending on the extent of the project's footprint. Consequently, commercial fishing was dismissed from detailed analysis.

Potential impacts of the proposed action alternatives would be short-term having an effect during the project's construction period for Alternatives 1, 2, and 3.

Ethnographic Resources, Museum Collections, Prehistoric and Historic Structures

The National Park Service is the steward of many of America's most important cultural resources. These resources are categorized as archeological resources, cultural landscapes, ethnographic resources, historic and prehistoric structures, and museum collections.

As defined in NPS Director's Order 28: Cultural Resource Management Guidelines (NPS 1998), ethnographic resources can be both natural and cultural resources that have been identified as having cultural significance by culturally associated users. They can include subsistence and ceremonial sites, structures, objects, and rural and urban landscapes assigned cultural significance by traditional users. There are no known ethnographic resources that would be affected by this project.

There is potential through archeological monitoring performed during construction to find artifacts that would be added to FORA's Museum collections. Any additional artifacts found would be collected, processed, and stored at the Museum Resource Center at FOR A or the Southeast Archeological Center in Tallahassee, FL. There is adequate space within the two facilities to house additional archeological objects and no impacts on current collections would result from new acquisitions.

The Earthen Fort, reconstructed in 1950 by the National Park Service, is considered a historic structure. However, the proposed alternatives would not have any impacts to the Earthen Fort because this feature is outside the project footprint.

For the above reasons, ethnographic resources, museum collections, prehistoric and historic structures were dismissed from analysis in the EA.

Human Health and Safety

Project actions would modify the beach profile and access to the shoreline by creating a hardened shoreline in places that could result in limited or non-traditional beach use. Riprap, which has an unstable surface, may become a safety hazard to visitors and staff. Health and safety are an important aspect of visitor experience; consequently, while human health and safety is not carried forward as an individual resource, it is considered under Visitor Use and Experience in Chapter 3.

APPENDIX B: Impact Actions

For the purposes of establishing the affected environment and assessing the alternatives and impacts, the National Park Service identified the following projects, plans, or actions that have affected, are currently affecting, or may potentially affect the resources analyzed in the EA.

Past Actions

- Fort Raleigh National Historic Site has undertaken many actions to stabilize the shoreline, including jetties with pilings, breakwaters, wooden groins, and rock riprap revetments from 1940 to 1980.
- Construction of the Waterside Theatre facilities occurred in the 1930s. In the 1960s, during the Mission 66 era, the theatre was redesigned with a more historically accurate look. The entire theatre was renovated in the 1990s. Through the years, the facilities were upgraded to accommodate more modern technology. In 2007, the costume shop was destroyed by fire and rebuilt with a modern structure.
- The Elizabethan Gardens were constructed in the 1950s, and the gardens were formerly opened to the public on August 18, 1960. Shoreline erosion has caused several facilities constructed near the shoreline to become damaged from erosion, and a large area was closed off to visitor access in 2017 due to hazardous conditions adjacent to the project area.
- In the winter of 2013, the park removed two houses (the Beehive and Prince House) and their associated infrastructure within the project area due to shoreline erosion.
- Private property owners adjacent to the project areas installed bulkheads and revetments to stabilize their shorelines and property.
- The National Park Service performed invasive plant treatments adjacent to the Elizabethan Gardens and throughout FORA.
- Archeological surveys throughout the park have been conducted primarily in relation to constructing new facilities or to further investigate known archeological sites.

Current Actions

- There are ongoing archeological assessments occurring within FORA. These assessments include isolated, sub-surface archeological investigations.
- The National Park Service is currently replacing the Waterside Theatre's septic system due to failing components and new North Carolina code requirements. The septic drain field orientation is being modified in response to shoreline erosion and required state setbacks.
- Infrastructure from the Beehive and Prince House have become exposed due to shoreline erosion.
- Trees and shrubs continue to be eroded along the shoreline due to wave action destabilizing the shoreline.
- There are ongoing repairs to the Waterside Theatre dock over the existing revetment and wood decking around the theatre.

Reasonably Foreseeable Future Actions

- Archeological investigations of known archeological sites are anticipated to continue.
- FORA is seeking funding to establish a future, multi-use pathway to allow bicycle use on a new trail within the park, which would be connected to the existing Manteo bike/multi-use pathway outside of FORA. This pathway would be constructed along the entrance road to the visitor center. This new transportation corridor would bring another recreational element into the park.
- Continued upgrades to the Waterside Theatre for new lighting, power, and sound technologies and continued routine maintenance and repairs to degrading facilities are anticipated.
- There is a future project to replace the septic tank and drain field serving the Waterside Theatre facilities. The existing area is within the 200-foot setback to the water's edge. This projects shoreline protection and beach nourishment will be necessary to keep the ticket booth tank and drain field in compliance with setback requirements.
- In association with the Preferred Alternative and in compliance with Director's Order #77-1, compensatory wetland mitigation would be developed and implemented. As such, no net loss of wetland would occur as a result of the Preferred Alternative.

APPENDIX C: Consultation Letters

United States Department of the Interior
NATIONAL PARK SERVICE
Cape Hatteras National Seashore I Fort Raleigh National Historic Site
Wright Brothers National Memorial
1401 National Park Drive
Manteo, NC 27954

1.A.2. (FORA-RM)

MAR 0 6 2025

Ms, Ramona Bartos
Deputy State Historic Preservation Officer
NC State Historic Preservation Office
4617 Mail Service Center Raleigh,
NC 27699-4617

Dear Ms. Bartos:

The National Park Service (NPS) is developing an Environmental Assessment (EA) for Fort Raleigh National Historic Site (FORA), located at the north end of Roanoke Island in Dare County, North Carolina. The purpose of this undertaking is to address shoreline erosion that causes continued loss of FORA land with associated cultural and natural resources, most notably subsurface archeological resources. The EA will evaluate alternatives for managing erosion and preserving the critical resources at FORA.

The NPS proposes to stabilize the FORA shoreline for the protection of cultural and natural resources. The 355-acre site was established on April 5, 1941, to preserve land declared to be of national significance as a portion of the colonial settlement established in America by Sir Walter Raleigh between 1584 and 1590 and the history of the Native Americans, European Americans, and African Americans who lived on Roanoke Island. Fort Raleigh National Historic Site was placed on the National Register of Historic Places in 1966.

Combating erosion along FORA's shoreline has been a management issue since the park's creation. The shoreline is estimated to have eroded a. quarter mile or more since fhc late 16th century, resulting in loss of resources and site land. Jetties, a breakwater of sandbags, and granite block revetments have been constructed over the decades to slow down erosion and protect the park's cultural resources. Despite these efforts, erosion continues to threaten resources and is accelerated by storm events and sea level rise. The unarmored portions of the shoreline, including undercut cliffs as high as 25 feet, pose a serious threat to potential archeologically significant sites and park facilities. Without action, the erosion will continue, causing continued loss of park lands and vegetation.

In accordance with the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended (54 U.S.C. 306108), and the Advisory Council on Historic Preservation's implementing regulations (36 CFR the NPS will consider the effects of this undertaking to historic properties. The purpose of this letter is to officially initiate Section consultation between the NPS and the North Carolina State Historic Preservation Office- Please find attached a map showing the proposed Area of Potential Effect (APE) for your review and comment (Enclosure Figure 2). The APE for this project includes four project sections comprising approximately 34 acres along the FORA shoreline bordering the Albemarle sound at the north end of Roanoke Island.

Concurrent to Section 106'. the NPS will review this project in accordance with the National Environmental Policy Act of 1969 (NEPA) to evaluate the potential environmental impacts that would result from the proposed action.

The NPS will conduct appropriate consultations in accordance with Section 106, providing materials for review as they become available. The NPS invites you to provide any initial comments regarding the proposed undertaking,

Should you have any questions regarding this correspondence, please contact Jami Lanier, Fort Raleigh National Historic Site Deputy Chief of Cultural Resources, at (252) 475-9021 or jami_p_lanier@nps.gov.

Thank you for your continued assistance.

Sincerely,

David E. Hallac
Superintendent

Enclosure:
- Figure T. Project Area Location
- Figure 2. Historic Site Points of Interest and Area of Potential Effect
- Figure 3. Photographs

cc: Brett Cockrell NPS-FORA
Robin Snyder NPS-FORA
Meaghan Johnson NPS-FORA
Michael Flynn NPS-FORA
Sabrina Henry NPS-IR2