Fog Point Living Shoreline Project

Draft Environmental Assessment

U. S. Fish and Wildlife Service

2/19/2015

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Chapter 1 Purpose and Need

1.1 Introduction and Background

Glenn Martin National Wildlife Refuge (Martin NWR) is a 4,423 acre tract of tidal marsh, shallow water, and isolated upland areas bisected by numerous tidal creeks and guts situated at the northern end of Smith Island, Somerset County, Maryland (Figure 1.1). The northern and western shorelines of the refuge are exposed to the broad fetches of Chesapeake Bay and experiences shoreline retreat on the order of 10 or more feet per year, resulting in the loss of nearly 3.3 acres of prime fish and wildlife habitat annually. In keeping with its mission to manage and protect sensitive habitats across the nation, the U.S. Fish and Wildlife Service initiated efforts to stabilize approximately 21,000 linear feet of shoreline, extending from Swan Island northward to Fog Point, then eastward to Fishing Point (Figure 1.1). The Proposed Action would use a combination of headland control structures, sand nourishment, and wetland plantings to slow shoreline erosion where it is most problematic. Limited use of continuous breakwaters is proposed where the shoreline is actively breaching and more support is warranted. This action would slow erosion, protecting valuable habitat and human interests on the island, while minimizing impacts to the ecological integrity of shoreline habitats.

Initial planning efforts to stabilize the shoreline began with the development of a shore protection plan by the U.S. Army Corps of Engineers, in partnership with Somerset County, Maryland, Maryland Department of Natural Resources, and Maryland Department of the Environment. The Finding of No Significant Impact for that proposal is issued in May of 2001 (USACE 2001). However, that project was never implemented because of funding constraints. Much of that work, including the final plans and geotechnical information were used as a basis for the development of the current project. This project, the Fog Point Living Shoreline Restoration, is being funded under Hurricane Sandy Resiliency Project #31. The appropriation for this project is the Hurricane Sandy Disaster Relief Supplemental Appropriation Act of 2013, Public Law 113-12.

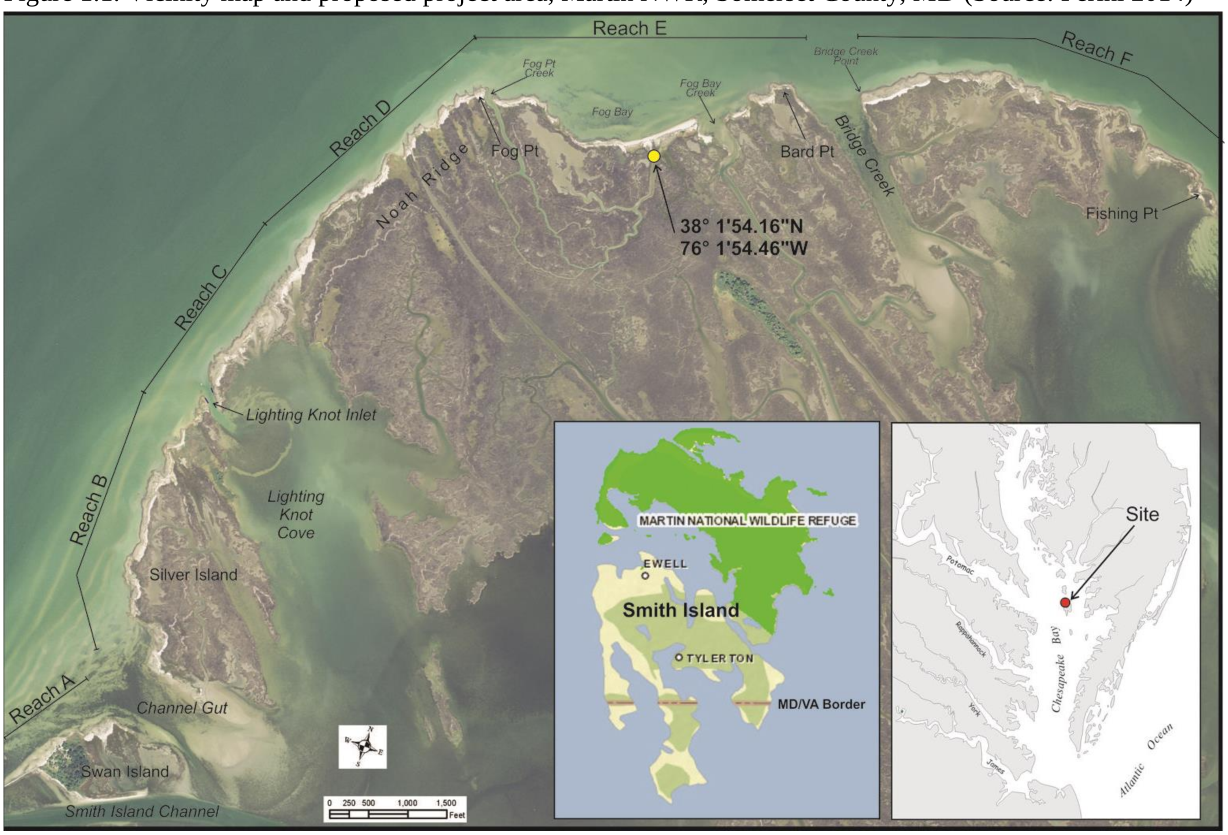
Smith Island is part of a chain of islands that form the western boundary of Tangier Sound, one of the largest areas of submerged aquatic vegetation (SAV) in the Chesapeake Bay. This mosaic of habitats provides for a wide array of wildlife, as well as commercially and recreationally important finfish and shellfish. The island also hosts three communities, Ewell, Tylerton, and Rhodes Point.

First established in 1954 under the Migratory Bird Conservation Act (16 U.S.C. 715 d), the authorized purpose of Martin NWR is “for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” The refuge is managed by the Chesapeake Marshlands NWR Complex, located in Cambridge, Maryland. In August 2006, the Chesapeake Marshlands NWR Complex completed its Comprehensive Conservation Plan (CCP) for the refuges it administers, including Martin NWR. CCPs provide long term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes. The planning process to develop the CCP included development of an EA in May 2005. Protecting this part of Martin NWR from erosion is specifically discussed on page 4-20 in the Draft CCP and EA (USFWS 2005), and became Objective 2.2.2 for the refuge in the final CCP (USFWS 2006).

1.2 Purpose and Need for the Proposed Action

The purpose of this project is to effectively reduce erosion along a 21,000 foot section of shoreline on Martin NWR, protecting valuable habitat and human interests on the island, while maintaining the ecological integrity of shoreline and nearshore environments. This length of shoreline is fully exposed to the prevailing wind and wave energy of the open Chesapeake Bay. Shoreline erosion is an immediate threat to this refuge and the human and wildlife benefits provided. This project will dissipate wave energy and slow erosion, increasing the resiliency of refuge estuarine habitats and the local economy to storm events. Specific goals of the project are to: 1) slow the loss of existing tidal marsh and SAV habitats; and, 2) create approximately eight acres of dune and emergent marsh habitat through the addition of sand and planting of vegetation to support shoreline stabilization.

Figure 1.1. Vicinity map and proposed project area, Martin NWR, Somerset County, MD (Source: Perini 2014)

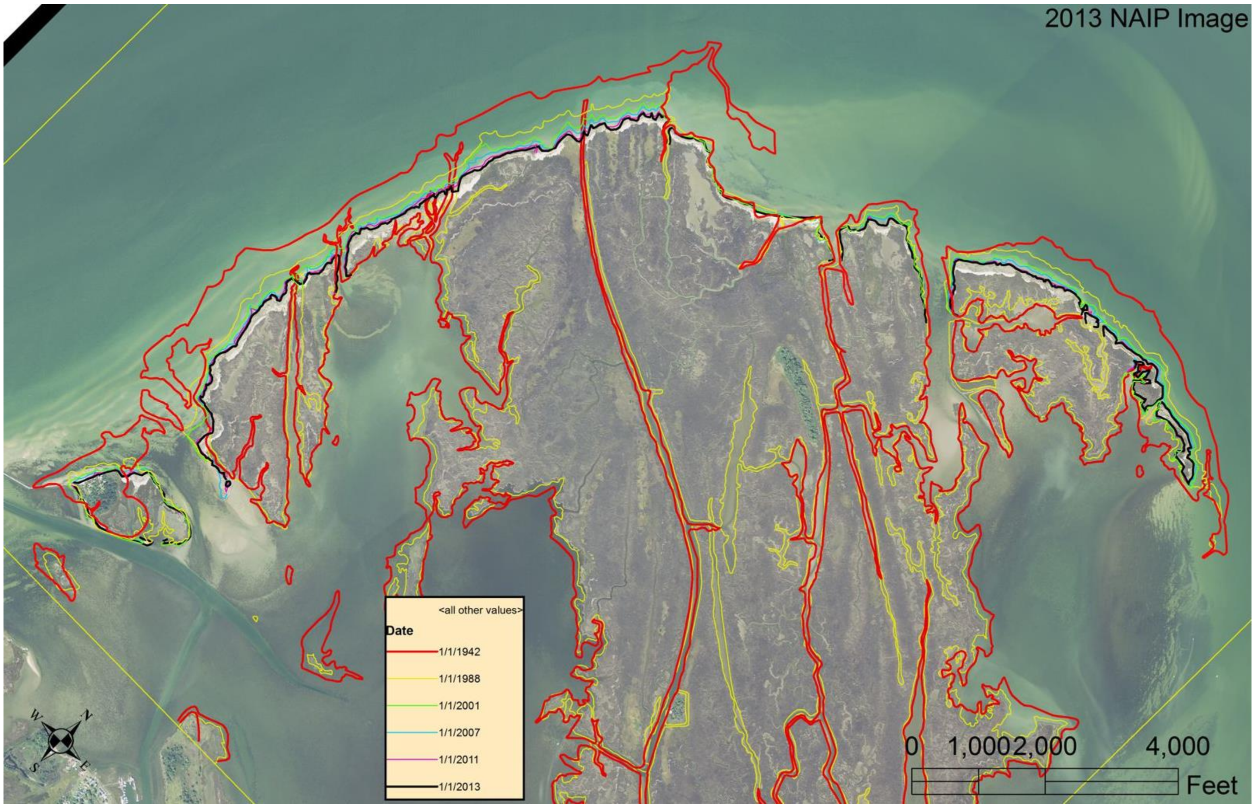


The western and northern shorelines of Martin NWR have a long history of shore recession due, in part, to its large fetch exposure and resultant high energy wave climate. The shore along the west and northwest coast from 2001 to 2013 had rates of erosion range from -2 to -18 feet per year (Figure 1.2). The Martin NWR shoreline is eroding faster in some areas than others, and the shore morphology undulates along the shore, due to the constantly eroding marsh headlands and the opening and closing of tidal creeks.

Through time the erosion pattern maintains general planform of marsh headlands and pocket beach and evolve as a system in many cases. Lighting Knot Inlet is fully formed by 2007. A recent analysis of shoreline erosion indicates high shoreline erosion rates occur within the project area (Perini 2014). The results of the shoreline change analysis are summarized below:

- Erosion rates vary along the shoreline depending on substrate conditions and exposure. Erosion rates were found to range from < 1m/yr to 6 m/yr (-2 ft to -18 ft/yr)
- Between 1942 and 2013, 238 acres of marsh habitat was lost at rate of 3.3 acres/yr
- With an average eroding bank height of 4 feet (elevation range of +1.0 to -3.0), the sediment volume eroded from 1942 to 2013 = 1,535,893 cubic yards (cy) or about 21,632 cy/yr.
- Eroded bank sediments are fine sandy silts and clays
- Eroded bank sediments are transported southward along the west coast and eastward along the north coast.

Figure 1.2. Shoreline change 1942-2013. Martin NWR, Somerset County, Maryland (Source: Perini 2014)



The importance of these habitats to the overall Chesapeake Bay ecosystem cannot be overstated. For example, the Tangier Island-to-Bloodsworth Island archipelago sits squarely within the Atlantic Flyway, an important corridor of wetland habitats for migratory birds. Further, coastal marshes and submerged aquatic vegetation (SAV) grounds are critical resources for native fish and important aquatic fauna like crabs, bivalves, and other benthic species. These habitats, and the ecosystems they support, continue to be threatened by climate-change-induced sea level rise and human development of coastlines. By adopting a 'living shoreline' approach, shorelines can be stabilized, slowing the loss of valuable habitats while maintaining the ecological integrity of shoreline habitats, a long-term benefit for the inhabiting flora and fauna of the Chesapeake Bay.

The highest priority section of shoreline is found on the western part of the refuge, adjacent to Lighting Knot Cove (shown as Reach C in Figure 1.1). This quickly eroding peninsula protects a large body of water known as Big Thorofare. This is one of the main channels used by the residents to access the Chesapeake Bay from the western side of the island. The peninsula is beginning to breach in several areas and large SAV beds will soon be exposed to sedimentation and wave action.

1.3 Scope of Analysis

This Draft EA documents current environmental and habitat conditions on Martin NWR and adjacent Smith Island, an analysis of potential improvements in the study area, and a summary of future conditions with and without restoration. The evaluations of the alternatives and recommendations are based on site-specific technical information and literature research. This information includes recent surveys and new mapping, environmental habitat and geotechnical evaluations, economic studies, SAV research, and hydraulic modeling and evaluations. Alternatives and their resultant impacts included various methods of coastal protection for the purpose of reducing erosion that causes the loss of hundreds of acres of SAV habitat and wetlands.

1.4 Public Participation

On April 5, 2014 refuge staff attended a community meeting in Ewell. The purpose of that visit was to inform the community of Smith Island that an erosion control project had been funded for the refuge, as well as to receive comments and ideas on how to best implement this work. As part of development of this EA, refuge staff will hold a public meeting on the proposed project during the public comment period.

Initial planning efforts to stabilize the shoreline began with the development of a shore protection plan by the U.S. Army Corps of Engineers in 2001 (USACE 2001). However, because of funding shortages, that project was never implemented. As part of that effort, the USACE held several conversations with the local residents. After meetings with each of the island's three communities, the study team compiled a list of identified problems. The information was critical to forming the close working relationships that are required when there is no local representative government. It was discovered early on that the people of the island and the natural resources of the island are inextricably linked. The island wetlands provide employment for a culture of watermen, protection from the dangers of the open water, and vital wildlife habitat that benefits the entire Chesapeake Bay and the even larger flyways of migratory birds. Given the link between human welfare and wildlife habitat, the local residents greatly value the SAV and wetlands that are abundant around the island. A major concern identified through that effort was the constant loss of land to the Bay and the downward trend in SAV coverage.

Chapter 2 Alternatives Including the Proposed Action

Several alternatives were evaluated during the development of this EA. Various shoreline protection strategies including non-structural design options, riprap, and others were considered, but eliminated from further discussion. The Proposed Action, a hybrid shoreline protection strategy consisting of headland control structures, limited use of semi-continuous breakwaters, sand nourishment, and wetland plantings is considered the most effective and efficient way of meeting the project objectives. Those alternatives and the No Action Alternative are discussed in the following sections.

2.1 Alternative A – Proposed Action

The proposed shoreline stabilization project will reduce erosion along the western and northwestern shores of Martin NWR. The project shoreline extends from the jetties at Swan Island northward then eastward to Fishing Point, a distance of about 21,000 feet. The project coast can be divided into six reaches based on shoreline morphology, intersecting tidal channels, and changes in nearshore water depths (labeled A-F in Figure 2.1). Each shoreline reach will be addressed based on its geologic underpinnings and geomorphic expression in order to determine those reaches most vulnerable to erosion and those that have the highest potential for establishing viable intertidal marsh and backshore vegetation communities.

Portions of shoreline reaches B, D, E and F (Figure 2.1) would be protected using headland control structures, sand nourishment, and wetland plantings. Headland control structures provide long-term erosion control along the project coast through the creation of stable equilibrium embayments between headlands over time. Structures are used to create headlands, and the shoreline between these established headlands is allowed to naturally evolve under acting coastal processes toward dynamic equilibrium (Hardaway and Gunn 2010). The wider the gap between fixed headlands, the further landward the equilibrium shore planform will evolve. This is dependent on the nature of the impinging wave climate, shoreline composition, and availability of sand in the littoral system. On Martin NWR, as the shoreline responds to the structure placement, the rate of change will decrease over time until equilibrium is reached. This may take several years but, when achieved, the resultant shoreline will be protected by a system of alternating headland and stable pocket embayments.

Establishment of controlling headlands along the shoreline allows for the evolution of stable embayments between these features, characterized by beaches and tidal flats upon which tidal marsh vegetation and sandy beach/dune features will develop. This approach allows these critical habitat features to establish a dynamic equilibrium with the evolving landforms, further allowing colonization by marsh and dune vegetation. Through this approach, the Martin NWR coast will become secure, and the immense acreage of wetland and nearshore habitat will no longer be threatened with a rapidly eroding shoreline.

The bay shoreline adjacent to Lighting Knot Cove (reach C) and the eastern end of reach F (Fishing Point) will require more rock and sand per linear foot of shoreline to insure long-term stability. These sections of the shoreline are actively breaching. They will need the additional protection to restore and maintain shoreline integrity and protect interior submerged aquatic vegetation (SAV) and human interests. These areas will be protected by a semi-continuous breakwater, sand nourishment, and wetland plantings that will maintain shoreline integrity and protect SAV habitat in Lighting Knot Cove and Back Cove.

During the survey and design phase of this project, it was determined that shoreline Reach A (Swan Island) and the southern end of Reach B (Silver Island) was relatively stable and had considerable amounts of SAV channelward of the shoreline. Because of this, shoreline protection structures are not proposed for this area. Reach E (Fog Point Cove) has also proven to be fairly stable and supports patches of SAV channelward of the shoreline. Shoreline protection structures are only proposed in this area where necessary to secure key headlands. Structures are not proposed where there are recent records of SAV.

The rock structures serving as breakwaters and headland control structures will total approximately 8,920 linear feet. The 22 headland breakwaters will range from 150-270 feet in length. The proposed continuous breakwater protecting Lighting Knot Cove (reach C) would total 2,280 feet and provide sufficient protection to prevent breaching. A second continuous breakwater is proposed to support Fishing Point. This structure would be approximately 950 feet in length, with an adjacent structure about 160 feet in length, to hold the distal end of Fishing Point. Both continuous structures are designed to support thin and actively fragmenting stretches of shoreline for the specific purpose of maintaining SAV habitat in the adjacent coves, as well as support navigation and commercial fishing interests.

Structures will be placed offshore, and parallel to, the existing shoreline. Top elevation of the structures will be approximately +3.5’ MLW, a 6 – 7.5’ crown with 1.5:1 side slope. Mean tidal range in the project area is approximately 1.5 feet. Most structures are expected to be between 25 and 30 feet wide. Medium to coarse sand will be imported via barge to insure relative stability where it will be used in conjunction with each rock breakwater. The sand will be a substrate, or planting terrace, for establishing *Spartina alterniflora*, *S. patens*, and/or *Ammophila breviligulata* where appropriate. Once vegetated with these native grasses, substrates will then be more conducive to natural colonization by other native species (e.g., *Juncus roemerianus*, *Solidago sempervirens*, etc.), encouraging habitat diversity and ecosystem integrity as the restored site conditions stabilize and mature. Approximately eight acres of wetland and dune habitat will be created through sand placement and vegetation plantings.

Where the water depth is approximately -4 MLW adjacent to the breakwaters, the headland breakwaters will be constructed directly from a spud barge. Lighter barges (shallow draft barges with heavy deck mats and heavy bulwarks) will be loaded from the line barges that will be moored in -14 MLW of water with a rig barge and then ferried to shore with shallow draft tugs. The breakwaters will be constructed first and then the sand forming the tombolo will be installed afterwards. Wetlands planting will occur after placed sand has had an opportunity to equilibrate under acting coastal processes. The final breakwater and planting locations will be adjusted as necessary to install plants at the appropriate elevation and shoreline position at the time of installation. Shoreline recession is expected between the site survey (August 2014) and the proposed start date (May 2015). Every effort will be made to leave existing low marsh (*Spartina alterniflora)* intact and work the sand fill into adjacent non-vegetated peat terraces, narrow channels and nearshore region.

In areas where the water is too shallow for direct barge placement, the sand and rock will be brought ashore where there is enough water adjacent to the work site. Sandy material that will ultimately be planted with marsh and dune vegetation will be preliminarily placed to create a sand access road. This berm feature will allow the materials to be transported via articulated off road trucks to the breakwater placement areas. The sand access road will be reworked to form beach berms, etc. after the breakwaters are built. It is expected that this construction approach will be needed along Silver Island (reach B). The smaller breakwater on the distal end of Fishing Point (reach F) will also likely need land based access and construction.

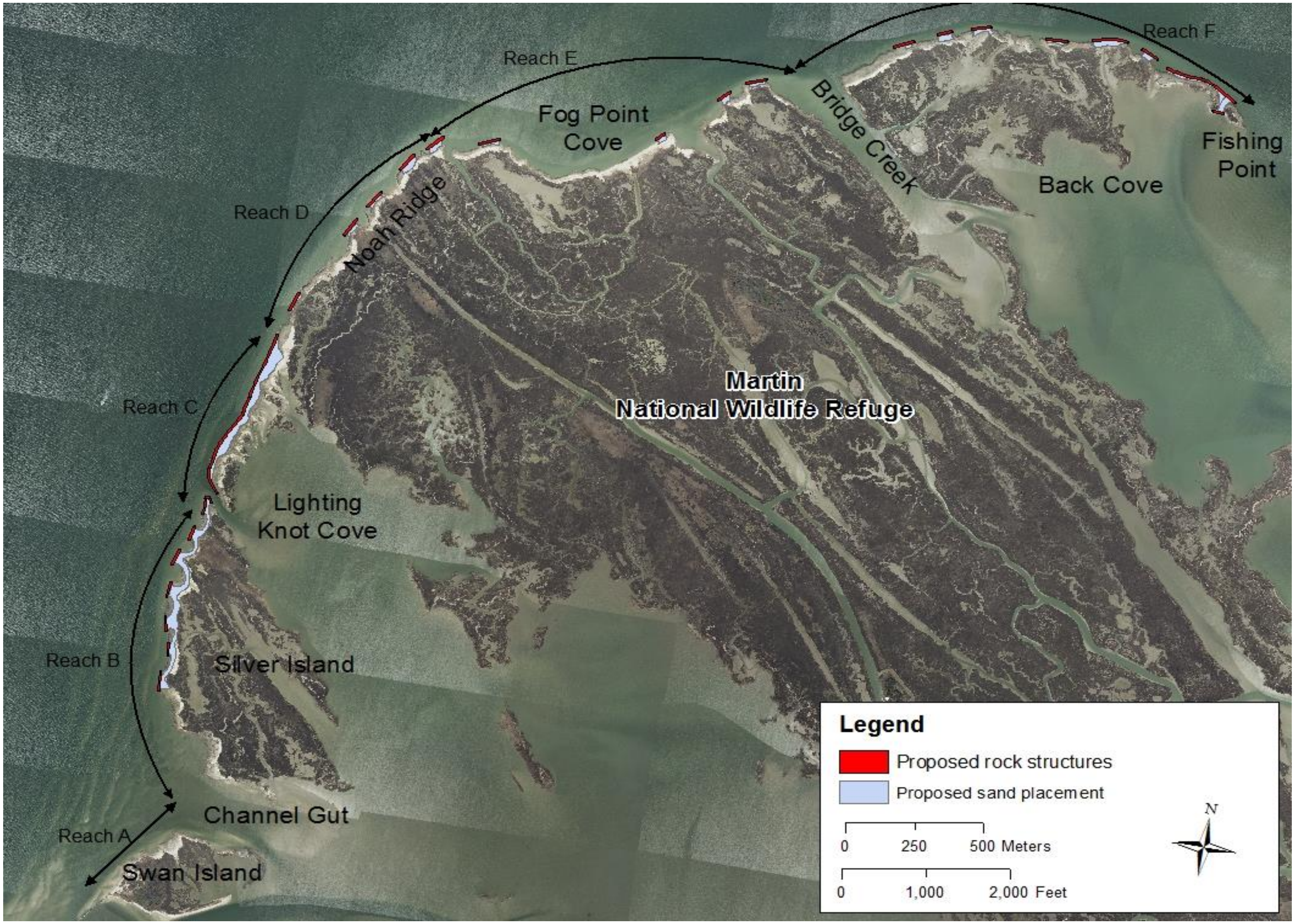
2.2 Alternative B – No Action

Inclusion of the No Action alternative is prescribed by Council of Environmental Quality (CEQ) regulations as the benchmark against which proposed Federal actions are to be evaluated. The No Action alternative is generally either ‘no change’ or ‘do nothing’ alternative to the Proposed Action. In this case, the No Action alternative involves not implementing shoreline protection work on the western and northwestern shorelines of Martin NWR. Selecting the No Action alternative is equivalent to allowing the existing baseline environmental conditions as identified in Chapter 3 of this document, to continue and deteriorate over time. Under the No Action alternative, erosion along this section of coastline would continue at approximately 2 to 18 ft. per year, causing the loss of SAV, tidal wetland habitats, and associated fish, wildlife, and human benefits. The full impact of the No Action and the Proposed Action are presented in Chapter 4 of this document.

2.3 Other Alternatives Considered

Additional alternatives were considered during the development of this EA but were eliminated from further discussion. We evaluated the use of non-structural stabilization methods that emphasize the use of dense wetland vegetation, bank grading, and/or fiber logs, but dismissed them as being ineffective in this environmental setting. While these approaches are clearly preferable in appropriate conditions, the high energy wave environment and rapid rate of shoreline erosion precludes their use on this part of Martin NWR. Structural alternatives suited to this environmental setting consist of stone revetments and similar structures. While this type of

Figure 2.1 – Project Features



strategy would protect the shoreline from erosion, it does not maintain the ecological integrity of shoreline and nearshore environments, a key component of the project goal. These alternatives were dismissed because they do not meet the purpose and need of the project.

Chapter 3 Affected Environments and their Existing Conditions

3.1 Introduction

Martin NWR is composed primarily of estuarine wetlands, submerged aquatic vegetation (SAV), and scattered upland habitats, appearing like islands of high ground within vast expanses of tidal marsh. These upland sites provide nesting habitat for wading birds and other colonial waterbirds, waterfowl, and raptors. The SAV beds associated with Smith Island are considered one of the largest and most important SAV beds in the Chesapeake for blue crab fisheries. Despite the quality of the marsh, the marsh is severely threatened by continued erosion, which has claimed approximately 238 acres since 1942. Continued erosion throughout the marsh system will severely reduce the size and quality of the marsh and undermine the viability of the island ecosystem. Scarcity of useable habitat has become a major problem in the Chesapeake Bay region and highlights the need to protect and expand, where possible, the resources of the refuge. The following description of affected environments is the result of a combination of literature reviews and site visits to the project area.

3.2 Physical Environment

3.2.1 Geologic Setting

During the last low stand in sea level, about 15,000 years ago, the main channel of Chesapeake Bay and Tangier Sound were meandering rivers that exited into the Atlantic Ocean at Cape Charles, Virginia. Coleman et al. (1990) describe three generations of the ancestral Susquehanna River System. The channel systems were formed during glacial low sea level stands, and each contains a channel fill sequence that records the subsequent transgression. During high stands in sea level the coast was a shallow marine/estuarine system where sands, silts and clays were eroded from older strata and redeposited in tidal flats, sand bars and other depositional environments that later became uplands as the sea receded. The present day Chesapeake Bay is a result of these changes in sea level, erosion and deposition. Smith Island geology is a result of these historic transgressions and regressions and consists of modern Holocene tidal marsh peats overlying late Pleistocene fine sandy silts and clay sediments. The majority of the soils in the project area are Transquaking and Mispillion soils, tidal and very frequently flooded.

The present shorelines along the project site are mostly eroding marsh peats which are constantly impacted by wave action (Figure 3.1). Wave action eventually undercuts the peat, falling into the nearshore to be subsequently dissolved or thrown upon the peat terrace. The exposed peat terrace extends landward to a sandy overwash berm. This berm extends from the peat terrace landward 10 to 50 feet and is a function of the impinging storm waves. This feature moves landward in response to the receding coast across marsh and tidal creeks. The berm becomes vegetated over time until the next major storm event when the shoreline erodes and the berm again moves landward in response. The berm generally follows the marsh shore planform. Marsh headlands and adjacent pocket beaches are indicative of much of the coast.

Figure 3.1 Shoreline of Martin NWR

The nearshore is characterized by a series of sand bars from Swan Island to just south of Noah Ridge where they in essence disappear as the depths increase. Sand bars and a shallow nearshore pick up again eastward of Fog Point and continue toward Bard Point beyond which it becomes deeper across to Fishing Point. There are intermittent tree stumps in the nearshore particularly off Noah Ridge and east. These reside in several feet of water and are likely the position of wooded uplands at a lower stand in sea level.

3.2.1.1 Sea Level Rise and Subsidence

Martin NWR faces threats from subsidence and sea level rise. Although marshes build elevation over time, primarily through plant growth, organic matter accumulation, and sediment deposition, many wetlands in the Chesapeake Bay are not able to keep pace with relative sea level rise. Thousands of years ago, Martin NWR and Smith Island were a part of a peninsula that encompassed Tangier Island to the south, and South Marsh and Bloodsworth Islands to the north. Over time, as the water level rose and erosion continued, the peninsula separated into distinct islands. The land itself has steadily changed from dry uplands to wetlands. Smith Island is currently almost all salt marsh and has lost considerable amounts of historic upland habitat, resulting in the loss of the farms that were the primary means of subsistence on the island centuries ago.

Relative sea level rise, based on tide gauges which do not separate absolute sea level from subsidence, is 3.44 + 0.49 mm/yr. for Cambridge, MD (Boon et al. 2010). The rate of sea level rise has increased since the late 19th century and is predicted to accelerate in the future. This will continue to submerge wetlands that are unable to build elevation at a sufficient rate. The Sea Level Affecting Marshes Model (SLAMM) for the area predicts most of Smith Island will convert to open water by 2050. This model is based on the estimate of sea level rising 1.03 meters by 2100. SLAMM accounts for the dominant processes of inundation, erosion, overwash, substrate saturation and vertical accretion involved in wetland conversion and shoreline modification during long-term sea level rise.

While SLAMM models are extremely useful for understanding how coastal habitats are likely to respond to sea level rise, they have limitations, particularly regarding the specific timing of the predicted habitat changes. Most importantly, the interactions between inundation, plant growth, organic matter accretion, and sediment deposition in tidal wetlands are non-linear (Kirwan et al. 2010). Where marsh platform elevation is high relative to local tides, increases in sea level can lead to an increase in plant root growth and a subsequent increase in marsh elevation, giving some marshes the ability to increase rate of elevation gain in response to rising sea levels. This important ecogeomorphic feedback is not accounted for in the current SLAMM. Additionally, the SLAMM predictions for Martin NWR allow for shoreline erosion, a condition that will be stabilized through the proposed project.

Currently, the tidal marshes of Smith Island are relatively intact and not showing widespread internal fragmentation and ponding, signs that the marshes are converting to open water. Additionally, the elevation of the existing marsh platform appears to be high relative to local tides, indicating marshes are likely to persist longer than predicted by current SLAMM models.

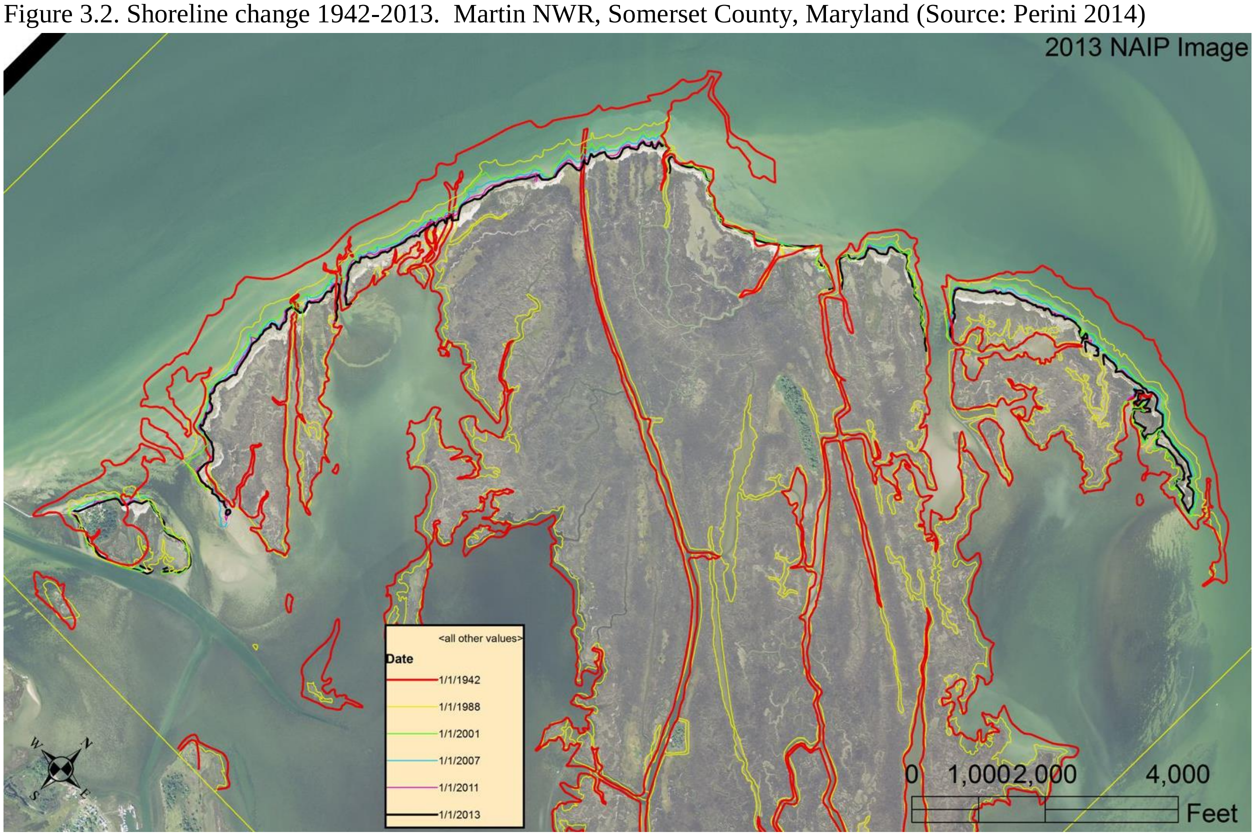
3.2.1.2 Shoreline Change

The nature of shoreline change along Martin NWR is controlled in part by the marsh peat coast. The progression of shoreline erosion depends on the depth of the nearshore adjacent to the eroding peat bank and proximity of tidal creek channels and any upland features. Fetch exposure and shore orientation are also factors related to impacts of the local wind/wave climate. Nearshore depth along the project coast is controlled by the amount/volume of littoral sediments residing there, which varies along the shoreline.

Shoreline positions from 1942 to 2013 are displayed in Figure 3.2 with the 2013 aerial image as the base. The entire project area, except for two small areas in Fog Bay, has lost a large amount of shoreline. The total area lost is about 238 acres.

The 1942 shoreline shows extensive sand spits and bars across Channel Gut with two small tidal channels present. Extensive spits occur off Fog Point and Fishing Point whose eastward morphology indicate net littoral sediment movement in that direction. From Fog Point to Swan Island sediment transport southward. By 1988 Channel Gut was very open to tidal flow while the spit off Fog Point was much reduced. Fishing Point spit was reduced and fragmented.

Figure 3.2. Shoreline change 1942-2013. Martin NWR, Somerset County, Maryland (Source: Perini 2014)



Aerial imagery from 2001 to 2013 shows the extent of the peat terraces along the shoreline. The peat terrace varies in width from 10 to 50 feet, depending on the impacts of storms. The low sandy washover berm extends from the peat terrace landward 10 to 50 feet. This sandy berm is also a function of the impinging storm waves. It is essentially an overwash feature that moves landward across marsh and tidal creeks in response to the receding marsh coast. Through time the erosion pattern maintains general planform of marsh headlands and pocket beach and evolve as a system in many cases (Perini 2014). The Lighting Knot Cove Inlet seems to have evolved to its current state between 2001 and 2007. The results of the shoreline change analysis are summarized below:

- Erosion rates vary from along the shoreline depending on substrate conditions and exposure ranging from < 1m/yr to 6 m/yr (-2 ft to -18 ft/yr).
- Between 1942 and 2013, 238 acres of marsh habitat was lost at rate of 3.3 acres/yr.
- With an average eroding bank height of 4 feet (elevation range of +1.0 to -3.0), the sediment volume eroded from 1942 to 2013 = 1,535,893 cubic yards (cy) or about 21,632 cy/yr.
- Eroded bank sediments are fine sandy silts and clays.
- Eroded bank sediments are transported southward along the west coast and eastward along the north coast.

The erosion is having a secondary effect by drastically altering the area's hydrologic connection and reducing the amount of sheltered shallow water. Tidal breaches are eroding through the marsh along the western shoreline and the northern coves, exposing the protected interior marshes, tidal guts, and coves to increased sediment loads, wave energy, and tidal currents. The result is that many of the sheltered coves that are currently productive for SAV will become threatened over the next several years. Lighting Knot Cove and Back Cove, two areas of extensive SAV and wildlife use, are particularly vulnerable.

3.2.2 Water Quality

Martin NWR is surrounded by brackish water (mesohaline) typical of the middle Bay. Salinities typically range from 11 to 19 parts per thousand, about half the salinity of ocean. The average water temperature in the area ranges from 82.4° F (27.9° C) in July to 39.2° F (4.0° C) in February. The area of the Chesapeake Bay west of Martin NWR experiences relatively little stratification and has good water clarity. Water clarity in the photic zone is required for sustained SAV growth. However, the extensive marsh erosion on the island has added considerable amounts of solids to the local area. While much of the eroded sediment may settle to the bottom or flow south, high erosion events likely cause temporary impacts to local water clarity.

3.2.3 Air Quality

The ambient air quality in Maryland is determined by measuring the ambient pollutant concentrations in the air and comparing the measurements to a corresponding standard. The Environmental Protection Agency (EPA) has designated Somerset County as an area for achieving attainment for nitrous oxides (NOx), sulfur dioxide (SO2), ozone (O3), lead particulate matter and carbon monoxide (http://www.epa.gov/reg3artd/airquality/airquality.htm#status).

3.3 Biological Environment

3.3.1 Vegetation

3.3.1.1 Intertidal Zone

Intertidal saltmarsh plant communities dominated the study area. The majority of the emergent vegetation is black needlerush (*Juncus roemerianus*). Other species located within the refuge area are smooth cordgrass (*Spartina alterniflora*), saltmeadow hay (*Spartina patens*), salt grass (*Distichlis spicata*), marsh elder (*Iva frutescens*), groundsel bush (*Baccharis halimifolia*), saltmarsh bulrush (*Schoenoplectus robustus*), waterhemp (*Amaranthus cannabinus*), and common reed (*Phragmites australis*). Common reed, an invasive wetland plant of relatively low wildlife value, is only found in limited areas on the refuge.

3.3.1.2 Uplands

Over a large portion of the study area a sandy overwash berm resides near the shoreline. Where vegetated, this berm is characterized by orache (*Atriplex patula*), seaside goldenrod (*Solidago sempervirens*), saltmarsh fleabane (*Pluchea purpurascens*), cocklebur (*Xanthium strumarium*), American beach grass (*Ammophila breviligulata*), and switchgrass (*Panicum virgatum*).

Additional upland habitat occurs on scattered isolated hammocks. These upland hammocks are characterized by shrub and tree species such as wax myrtle (*Myrica cerifera*), black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*) and hackberry (*Celtis occidentalis*). Understory vegetation is comprised of vine species such as Japanese honeysuckle (*Lonicera japonica*) and poison ivy (*Toxicodendron radicans*).

3.3.1.3 Submerged Aquatic Vegetation (SAV)

Submerged aquatic vegetation is among the most valuable aquatic natural resources in the Chesapeake Bay. The Bay provides extensive areas conducive to SAV growth. Two species, eelgrass (*Zostera marina)* and widgeongrass (*Ruppia maritima)*, are the dominant SAV species of Smith Island and adjacent Tangier Sound. These two species have been recognized by the scientific community and Chesapeake Bay Program as extremely important to the overall ecology of the Chesapeake Bay. Primary production, fisheries habitat, nutrient uptake, wave attenuation, reduction in current velocity and sediment stabilization are just a few functions that SAV provides the Bay.

The Bay-wide decline in SAV has been linked to eutrophication and an increase in total suspended solids. SAV abundance may be limited by continued poor water quality, particularly high nutrient concentrations in the Chesapeake Bay. The Tangier Sound survey segment, which includes Smith Island, showed a 13% decline in SAV between 1984 and 2006 (Orth et al. 2010).

Within the general project area, the predominant SAV species is widgeon grass, but occasional populations of eelgrass are present (Maryland DNR, unpublished data). The Virginia Institute of Marine Science (VIMS) conducts annual surveys for SAV throughout the Chesapeake Bay region. The most recent SAV map for Smith Island (2013) published by VIMS shows distinct regions of SAV beds within the Big Thorofare, Lighting Knot Cove, Fog Point Cove, Bridge Creek, Back Cove, and adjacent to Swan Island (Orth et al. 2014; see Figure 3.3). Estimated densities in these beds range from <10% to up to 100%.

3.3.2 Aquatic Species

3.3.2.1 Finfish and Shellfish

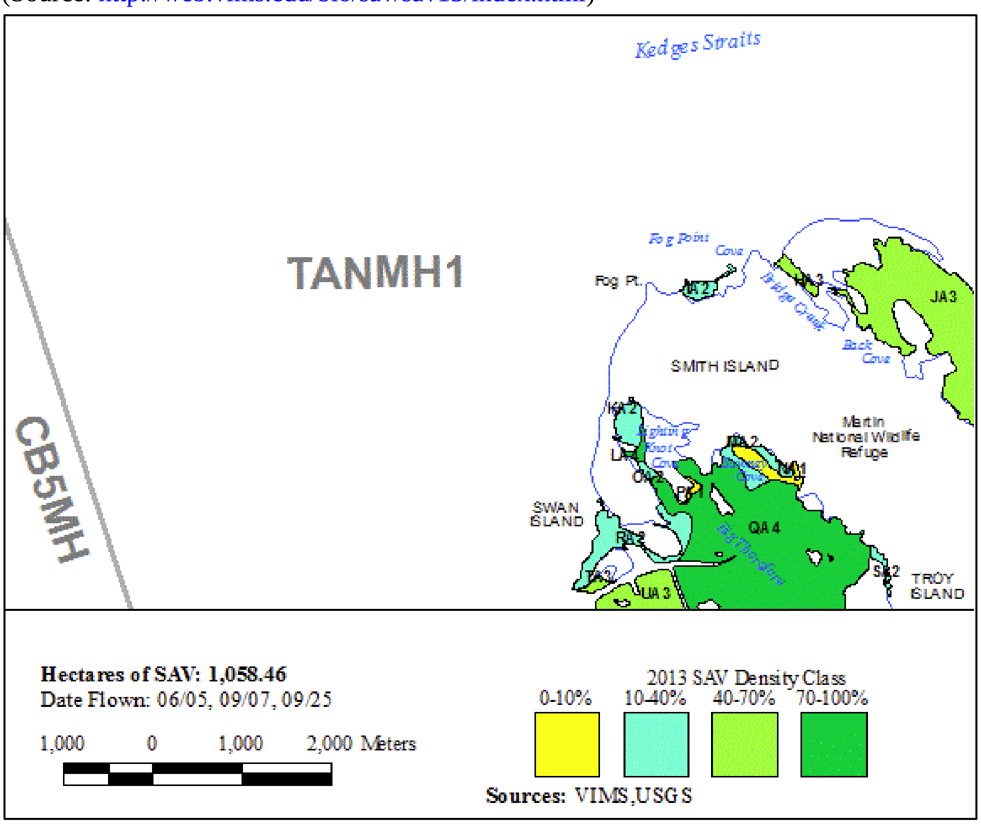
The marshes of Martin NWR are permeated with tidal creeks and shallow ponds, which provide spawning, nursery, and/or feeding habitat for an abundance of finfish and shellfish. The contiguous waters of Chesapeake Bay and Tangier Sound also support extensive fishery stocks. Shallow waters near Martin NWR are likely to support various species of minnows, killifish, and silversides. Mummichogs (*Fundulus heteroclitus*) stay close to shore during the warmer months, entering marshes to feed with the tides. Bay anchovies (*Anchoa mitchilli*) and silversides are some of the most plentiful fishes in the Bay. Needlefish (*Strongylura nuvina*), as well as larger predatory fishes such as striped bass (*Morone saxatilis*) and bluefish (*Pomatomus saltatrix*), prey on these small fish close to shore (Lippson and Lippson 2006). A thorough discussion of key fish species can be found in the Essential Fish Habitat section (Section 3.3.3).

Many fish species find extensive food resource and protection in the SAV and tidal creeks that channel through the marsh. Wetlands are especially important during juvenile life stages, when the fish are most vulnerable to predation from larger organisms. In addition, the protection provided by the grasses makes SAV and wetlands an important spawning area. The larvae make an attractive food source for larger fish. The result is an environment that supports large fish populations, and impacts to these areas result in wide-spread impacts. Thus, SAV and wetland losses in Martin NWR may have Bay-wide implications.

One of the most important species within the Martin NWR area is the blue crab (*Callinectes sapidus*), which seeks the protection of the moderately dense SAV during the molting season. Smith Island and Tangier Sound are centrally located for the blue crabs annual migrations, making the SAV beds one of the most productive blue crab areas in the Chesapeake Bay. The commercial harvest of blue crabs is a major source of income for island residents.

The general Smith Island/Tangier Sound area also supports other commercial shellfish operations including the harvest of oysters and clams. As with the rest of the Chesapeake Bay, the oyster diseases MSX and Dermo have impacted populations in the vicinity of Smith Island.

Figure 3.3 Section of the VIMS 2013 SAV map showing the project area along the northern portion of Smith Island (Source: http://web.vims.edu/bio/sav/sav13/index.html)



3.3.2.2 Benthos

Benthos are bottom dwelling organisms in aquatic ecosystems and provide important functional processes of energy transfer and carbon sequestration. Although some benthos and other larger invertebrates are commercially valuable, the ecological significance of most benthic communities lies in their contributions to the food web. While benthic populations have a high degree of natural population variability from year to year, many of these organisms are found in dense concentrations within the SAV beds surrounding Martin National Wildlife Refuge.

3.3.3 Essential Fish Habitat

The Magnuson-Stevens Fishery Management and Conservation Act requires that Essential Fish Habitat (EFH) be identified for each fishery management plan and that all federal agencies consult NOAA Fisheries on all federal actions that may adversely affect EFH. The EFH areas have been designated by the Fishery Management Councils and were published in March 1999 by NOAA Fisheries as the "Guide to Essential Fish Habitat in the Northeastern United States, Volume V: Maryland and Virginia." A federal agency must identify the species of concern and prepare an analysis of the effects of the proposed action. The agency must also give its views regarding the effects of the proposed action and propose mitigation if applicable. This section serves as our EFH analysis and determination for consultation purposes.

The area of the Chesapeake Bay to the west, south, east, and northeast of Martin NWR is defined as EFH for the following species: bluefish (*Pomatomus saltatrix*), summer flounder (*Paralichthys dentatus*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*S. maculatus*), cobia (*Rachycentron canadum*), red drum (*Sciaenops ocellatus*), dusky shark (*Carcharhinus obscurus*), sandbar shark (*C. plumbeus*), clearnose skate (*Raja eglanteria*), little skate (*R. erinacea*), and winter skate (*R. ocellata*). In addition, the following species have EFH designated in the mainstem of the Chesapeake Bay: red hake (*Urophycis chuss*), windowpane flounder (*Scophthalmus aquosus*), Atlantic sea herring (*Clupea harengus*), bluefish (*Pomatomus saltatrix*), Atlantic butterfish (*Peprilus triacanthus*), scup (*Stenotomus chrysops*), and black sea bass (*Centropristis striata*; NOAA 1999). Many of these species are primarily found in deeper water, well offshore of Martin NWR. This applies to king mackerel, Spanish mackerel, cobia, red drum, dusky shark, sandbar shark, red hake, Atlantic sea herring, Atlantic butterfish, scup, and black sea bass. These fish predominately inhabit waters deeper than those found around the refuge and the proposed project area which has and average depth of -4' MLW. No impacts to any of these species are expected to occur as a result of the proposed project. No impacts to spawning, egg, or larvae habitat is expected as these areas are not in the proposed project footprint. Any juvenile and adults species in the area will be able to easily swim away and relocate to adjacent areas to avoid direct detrimental impacts. Alterations of bottom habitat are unlikely to impact these species because of the minor scale of impact compared to abundant bottom in the area.

The three skate species are believed to have adult and juvenile ranges in the area of Martin NWR and the proposed project area (Reid et al., 1999). Clearnose skates are a southern species, occurring primarily in the inshore Middle Atlantic and inshore Southern New England. North of Cape Hatteras, it moves inshore and northward along the continental shelf during the spring and early summer, and offshore and southward during autumn and early winter (Bigelow and Schroeder 1953b). Clearnose skate has been found in Chesapeake Bay from April to December (Geer 2002). They were most abundant near the Bay mouth during spring and summer, but appeared throughout the Bay during all four seasons, and rarely appeared in the tributaries (Geer 2002). The little skate range extends from southern New England and down the Mid-Atlantic Bight to Cape Hatteras (Packer et al., 2003). Little skate have been found in lower Chesapeake Bay in December and in March while more recently they were mostly found around the Bay mouth in high salinity waters during April and May (Geer 2002). The winter skate range extends from southern New England and down the Mid-Atlantic Bight to northern North Carolina (Bigelow and Schroeder 1953). It has also been reported from Chesapeake Bay from December to April (Geer 2002). Generally, invertebrates such as decapod crustaceans and amphipods are the most important prey items, followed by polychaetes for the three named skate species (Bigelow and Schroeder 1953). Other important prey items include isopods, bivalves, and fishes (McEachran 1973). No impacts are expected to adults or juveniles during the proposed activities. These species tend to be found south of the refuge near the mouth of the Chesapeake Bay and out into the ocean waters and are not of main concern with this project for any expected impacts. Juveniles and adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts.

The species of primary concern within the shallow waters near Martin are windowpane flounder, summer flounder, and bluefish.

Windowpane Flounder

Juveniles and adults occur nearshore in the Middle Atlantic Bight (< 40 m) throughout the year. Adults may migrate to nearshore or estuarine habitats in the southern Middle Atlantic Bight during spring through autumn (Chang et al., 1999). Both inhabit areas with bottom substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. They prey on polychaetes, small crustaceans, and various fish larvae (Chang et al., 1999). No impacts are expected to adults or juveniles during the proposed activities. No impacts to spawning or eggs will occur since spawning occurs during the offshore Atlantic Ocean migration. The eggs sink to the bottom, cling together, and do not relocate outside the spawning grounds. Larvae begin to migrate into the Bay in October, usually overwintering and growing in the southern portion of the Bay.

Summer Flounder

Summer flounder enter the Bay in the spring and summer and typically move offshore with the onset of winter. Summer flounder spawn as they migrate offshore from late summer to midwinter (Murdey et al., 1997). Juvenile summer flounder use a variety of estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas. All native species of macroalgae, seagrasses, and tidal macrophytes in the Chesapeake Bay are considered Habitat of Particular Concern for juvenile and adult summer flounder. Summer flounder average between 3-6 pounds and are 15"-22" long (MDDNR). Summer flounder is a valuable food fish in the Bay and is caught from March until November. Adults feed mainly on fish, shrimp, squid, and polychaetes. Summer flounder prefer sandy substrate and are frequently seen near shores, partly buried in the sand. Color adaptation is developed to a very high degree. No impacts are expected to adults or juveniles during the proposed activities. No impacts to spawning or Summer flounder eggs will occur since spawning occurs during the offshore Atlantic Ocean migration. The eggs sink to the bottom, cling together, and do not relocate outside the spawning grounds. Larvae begin to migrate into the Bay in October, usually overwintering and growing in the southern portion of the Bay. Juveniles and adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts.

Bluefish

The bluefish travels in schools, especially in deeper water, entering the Chesapeake Bay from April through October and then moving offshore into deeper water during the winter. Bluefish spawn offshore mainly in the spring but some summer and fall spawning does take place offshore of Maryland in the coastal waters (MDDNR). Bluefish are caught mostly by recreational anglers from April to October near the mouth of the Chesapeake Bay. Bluefish are most prevalent just off the coast during the summer (MDDNR). They feed predominantly on menhaden, herring, and mackerel. The fish has a voracious appetite and often pursues schools of small fish. Most bluefish weigh from 2 to 15 pounds. Bluefish, especially juveniles, follow herring, menhaden, and other small fish into the middle and upper Chesapeake Bay. The waters of the Eastern Shore of Maryland are especially important to the juveniles. There may be late summer populations of bluefish near Smith Island. No impacts to spawning, egg, or larvae habitat of the Bluefish are projected because spawning does not occur in the Chesapeake Bay and the eggs and larvae do not occur in the area. Juveniles prefer shallow waters but any juveniles and adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts.

3.3.4 Wildlife

Martin NWR's combination of expansive wetlands and scattered upland hammocks provide premier habitat for a wide variety of avian species. The mix of undisturbed wetlands and scattered uplands provides an ample food supply that makes the refuge an attractive habitat for colonial waterbirds and dozens of migratory bird species. Cherry Island and the Lookout Tower are two of the largest and most diverse wading bird nesting colonies in Maryland. Nesting species include glossy ibis (*Plegadis falcinellus*), great blue heron (*Ardea herodias),* great egret (*Casmerodius albus),* snowy egret (*Egretta thula),* tricolored heron (*Hydranassa tricolor),* little blue heron (*Egretta caerulea),* cattle egret (*Bubulcus ibis),* black-crowned night-heron (*Nycticorax nycticorax),* and yellow-crowned night-heron (*Nyctanassa violacea).* Smaller isolated ridges on the refuge support smaller and less diverse colonies. Great black-backed gull (*Larus marinus)* and herring gull (*Larus argentatus)* are common nesting species in the project area.

Numerous species of shorebirds utilize refuge habitats during the non-breeding season, including black-bellied plover (*pluvialis squatarola*), dunlin (*Calidris alpina*), semipalmated plover (*Charadrius semipalmatus*), pectoral sandpiper (*Calidris melanotos*), least sandpiper (*Calidris minutilla*), semipalmated sandpiper (*Calidris pusilla*), greater and lesser yellowlegs (*Tringa melanoleuca* and *T. flavipes*), and sanderling (*Calidris alba*). Willet (*Tringa semipalmata*) and American oystercatchers (*Haematopus palliatus*) are common breeding shorebirds on the refuge.

Martin NWR combines extensive undisturbed shallow-water habitats, SAV beds, tidal mudflats, and miles of fringing marsh edge. Each of these habitats provides important wintering forage for a variety of waterfowl. Collectively, they make the refuge an important area for a variety of migratory waterfowl. Black ducks (*Anas rubripes*), and to a lesser extent mallards (*A. platyrhynchos*), are common nesting species on the refuge. Additionally, American wigeon (*Anas americana*), pintail (*A. acuta*), gadwall (*A. strepera*), Canada goose (*Branta canadensis*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*), bufflehead (*Bucephala albeola*), black scoter (*Melanitta nigra*), surf scoter (*M. perspicillata*), long-tailed duck (*Clangula hyemalis*), brant (*Branta bernicla*) and tundra swan (*Cygnus columbianus*) join the nesting species during the non-breeding season.

Nesting species of raptors include northern harrier (*Circus cyaneus*), osprey (*Pandion haliaetus*), barn owl (*Tyto alba*), peregrine falcon (*Falco peregrinus*), and bald eagle (*Haliaeetus leucocephalus*). Two nesting towers were constructed for peregrine falcon on the refuge. These towers were constructed in the 1980s to support recovery efforts for the species. The tower near Lighting Knot Cove has not been used in many years, but the Anderson Creek tower is still in use.

The extensive wetland habitats on the refuge support many wetland dependent mammal species such as muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), and river otters (*Lutra canadensis*). Red fox (*Vulpes vulpes*) and raccoons (*Procyon lotor*) are also common mammals.

Martin NWR is notably free of nutria (*Myocastor coypus*), an invasive species that has caused extensive damage to other marshes on the Eastern Shore of Maryland. As a result, the marsh on the refuge is in better health than many comparable marshes on the mainland.

The diamondback terrapin (*Malaclemys terrapin*), northern water snake (*Natrix sipedon*), and rough green snake (*Opheodrys aestivus*) are common species of reptile found on Martin NWR . Of these species, the most vulnerable is the diamondback terrapin, which inhabits salt and brackish water within the tidal marshes and creeks of the refuge. In late summer, the adult diamondback terrapin generally inhabits the deep portions of creeks and tributaries, avoiding nearshore waters. Juvenile terrapins inhabit shallow creeks and coves adjacent to salt marshes as nursery areas. During June and July, female terrapins cross the intertidal zone and seek nest sites in open sandy areas, particularly in the protected coves of Martin NWR.

3.3.5 Threatened and Endangered Species

Martin NWR may provide habitat for several federally listed threatened and endangered species. The species known to visit Martin NWR or the surrounding waters are listed in Table 3.1. The sea turtle species are found occasionally in the waters surrounding Smith Island. These instances are rare and the sightings are transient individuals, rather than resident populations. Loggerhead is the most frequently observed species of sea turtle. None of the sea turtles nest on the refuge. Both Atlantic and shortnose sturgeon have been recorded in the deeper waters adjacent to Martin NWR. There are no permanent populations of any of the state or federally listed species within the project area.

Northern harrier and bald eagle are state rare species that occur on the refuge. At least one pair of bald eagle nest on the refuge. Northern harriers are a common species on the refuge during the breeding season. Bald eagles are restricted to wooded ridges for nesting habitat, a very limited habitat on the refuge, while northern harriers nest in the extensive salt marshes.

Table 3.1 Federally Listed Threatened and Endangered Species Known to Visit Martin National Wildlife Refuge

Species	**Status**
Atlantic sturgeon (*Acipenser oxyrinchus*)	Endangered
Shortnose sturgeon *(Acipenser brevirostrum*)	Endangered
Leatherback turtle *(Dermochelys coriacea coriacea*)	Endangered
Hawksbill turtle *(Eretmochelys imbricata imbricata*)	Endangered
Kemp's Ridley turtle *(Lepidochelys kempi*)	Endangered
Loggerhead turtle *(Caretta caretta caretta*)	Threatened
Atlantic green turtle *(Chelonia mydas mydas*	Threatened

3.4 Cultural Resources

Before about 8000 years ago, Smith Island was an upland area west of the paleochannel of the Susquehanna River. The changes in the environment of the refuge through time mean that prehistoric people used the refuge for different purposes at different periods. Prehistoric hunters may have hunted on the refuge, and campsites at former ridge saddles and stream mouths may still exist in today's marshes and upland inclusions.

Smith Island is thought to have been settled by colonists in 1657 (Cronin 2005). Early settlers used the island for grazing livestock and growing vegetables. By 1820, New England had so depleted its oyster beds that the Chesapeake Bay became a profitable source to harvest and market oysters in the North (Horton 2008). This activity peaked in Maryland in 1886. The refuge shore may contain evidence of early oyster processing operations from this period.

The Maryland Historic Trust records nine known archeological sites along the shoreline between Swan Island and Fishing Point. The sites include seven scatters of historic artifacts dating from the 19th and 20th centuries, and the remains of two late 19th or 20th century wharves. The significance or current condition of these sites is currently under investigation.

3.5 Socio-Economic Resources and Environmental Justice

The tidal wetlands, shallow waters and SAV beds within the project area provide essential habitat for commercially and recreationally important fishes and shellfishes. Nearly all of the residents of Smith Island are dependent on the seafood industry for their livelihood. Seafood is harvested in nearby waters and either processed locally or packed for shipment. There is a crab-picking cooperative located in Tylerton that processes crabmeat for commercial shipment or local consumption by the families participating in the cooperative. While there is no other significant industry on the island, tourism provides some income to residents.

Although exact historic population statistics for Smith Island are unavailable, anecdotal information indicates that the population peaked at about 800 residents early in the twentieth century. By 1960, the population had declined to about 650 residents. By 1990, the Smith Island population had declined to 459 residents and by 2010 it only has 276 people. The downward spiral in population on Smith Island contrasts with an upturn in the Somerset County population.

Per capita income and poverty data as reported in the 2010 census are presented in Table 3.2. The table shows that per capita income in Somerset County and on Smith Island falls below the national average. Per capita income in Somerset County is 35 percent below the national average and 56 percent below the state level, while income levels on Smith Island trailed the national level by 42 percent and the state level by 63 percent. Also, the proportion of families below the poverty level in Somerset County exceeds the national average.

According to 2010 census information, there were 35 persons, or 13 percent of the total Smith Island population, identified as having incomes below the poverty level. Although these monetary income data appear to present a bleak economic picture, the profile they represent is incomplete. Because of the high degree of community cohesion and cooperation on Smith Island, and the partial subsistence provided by the consumption of seafood harvested by Smith Island watermen, the quality of life of the Island's residents is probably not comparable to that of low-income residents in urban centers.

Table 3.2: Per Capita Income (2010)

	Income ($)	**Families below Poverty (%)**
USA	$40,163	14.90%
Maryland	$50,044	9.90%
Somerset	$28,570	19.30%
Smith Island	$26,118	13.30%

3.6 Transportation

Smith Island residents rely on the water for their transportation, income, and, in some cases, subsistence. Because almost all of Smith Island is marsh, settlement is concentrated on the three towns that inhabit the large pockets (over 20 acres) of upland. While most residents have at least one boat, there are also a number of private ferries that make daily trips to Crisfield, which takes approximately 45 minutes each way. A schoolboat takes the children to school in Crisfield each morning, and carries mail and supplies for Smith Island residents. On Smith Island, the residents use a combination of automobiles, golf carts, and bicycles.

Once on the mainland, U.S. Route 13 and Maryland State Highway 413 provide access to major interstate routes. The Norfolk/Hampton Roads metropolitan area is 95 miles south, the highway distance to Baltimore, Maryland is 119 miles, and to Washington, D.C. is 133 miles. There are no commercial aircraft landing facilities on Smith Island. The existing transportation network makes Smith Island one of the most difficult areas in Maryland to access from the Washington/Baltimore metropolitan area.

3.7 Noise

Martin NWR is closed to the public and is undeveloped, a sanctuary for wildlife. However, Smith Island has a small portion of its upland area developed. Despite the decline in year-round population, there has been an increase in part-time and summer residents, many of whom seek the solitude of Smith Island life, making it a popular tourist destination. There is frequent noise that occurs out along the docks of Smith Island and surrounding waters of Martin's from both recreational boating and commercial fisheries (crabbing) activities.

3.8 Recreation and Tourism

Recreation and tourism opportunities on Smith Island are shaped by its history, its location in the Bay, and its environmental resources. The Island's unique culture and relative isolation continue to be strong influences on the recreation activities of its residents. Fishing, waterfowl hunting, and crabbing are some of the primary reasons people visit the island, as well as to experience the unique culture and history of the island. The Smith Island–Tangier Sound area does have a substantial recreational fishery, with sea trout, croaker, spot, bluefish, striped bass, and summer flounder commonly being taken.

The vast system of meandering tidal creeks provide high quality recreational kayaking opportunities. A marked water trail system is maintained on the island to facilitate this use (http://www.paddlesmithisland.com).

The Smith Island Cultural Center, located in Ewell, serves as a museum and orientation center for visitors. The museum offers a variety of exhibits depicting the history, economic and social life on the island.

Chapter 4 Environmental Consequences and Cumulative Impacts

4.1 Physical Environment

4.1.1 Geologic Setting, Shoreline Change, Sea Level Rise and Subsidence

Erosion is the overriding environmental factor affecting the island in the near-term. The shorelines, particularly western facing shorelines, are receding at remarkable rates. The Proposed Action would directly address this immediate concern. Breakwaters would alter the prevailing wave energy, reducing the force of waves against the marsh edge. The Proposed Action would be expected to prevent tidal breaching of marshes and protect interior coves and waterways from scour and sedimentation, thereby promoting the conditions favorable for SAV establishment and growth.

Under the Proposed Action, sea level rise and subsidence would continue at regional rates. The headland control structures would not interfere with storm surges, regular tidal flooding, or other events that bring needed sediments to refuge marshes. The ability of the marsh to keep pace with relative sea level rise is not expected to be impacted by the Proposed Action. Currently, the tidal marshes of Smith Island are relatively intact and not showing internal fragmentation and ponding, signs that the marshes are converting to open water. Additionally, the elevation of the existing marsh platform appears to be high relative to local tides, indicating marshes are likely to persist longer than predicted by current SLAMM models.

It is estimated that approximately 21,632 cy of sediment is currently being eroded from the shoreline each year. This material is likely transported southward along the west coast and eastward along the north coast. Some of this material likely makes its way into adjacent tidal marshes. Reducing shoreline erosion could reduce the amount of sediment being transported into adjacent marshes, potentially reducing accretion rates. It is unlikely that any negative consequence of limiting this sediment transport would outweigh wetland loss rates currently impacting the island.

If the Proposed Action is not implemented the current process of shoreline erosion, loss of tidal marsh and SAV habitats would continue. This mosaic of island habitats, and the associated fish, wildlife and human benefits, would be lost.

4.1.2 Water Quality

The Proposed Action will likely cause minor temporary turbidity in the immediate vicinity of the construction area due to the physical disturbance associated with the construction process. However, the resulting stable shoreline is expected to provide long-term benefits to water quality by reducing shoreline erosion and removing a major source of turbidity in the area. The construction process will follow best management practices to ensure no water quality standards are violated. A Water Quality Certification from Maryland Department of the Environment will be obtained before construction work takes place.

If the Proposed Action is not conducted, shoreline erosion would continue at historic rates. An estimated 21,632 cy of sediment is currently being eroded from the shoreline each year (Perini 2014).

4.1.3 Air Quality

Aside from emissions generated by construction equipment, no impacts on air quality are expected. The vehicle emissions are expected to be minor and temporary. Following construction, the structures will be passive and will not generate any additional air pollutants.

4.2 Biological Environment

4.2.1 Vegetation

The Proposed Action would prevent the loss of 3.3 acres of tidal marsh per year, create approximately 8 acres of dune and intertidal habitat, and protect extensive stands of SAV within the refuge. The shoreline is currently eroding at 2-18 feet per year, depending on the substrate conditions and exposure of the site. This represents 3.3 acres of tidal marsh habitat per year being lost to erosion. The Proposed action would prevent this loss of valuable wetland habitat.

Clean sandy material would be placed behind the headland breakwaters to connect the structures to the shoreline, forming a series of tombolos and open embayments. The slope and elevation of the placed material, as reworked by coastal processes, would create approximately 8 acres of dune and intertidal habitats. The quality of the marsh edge along the Bay shoreline, now a 2-4 foot vertical peat escarpment, would improve. The gradual slope of the expected shoreline within the embayments would increase the amount of intertidal habitat.

Scattered patches of invasive common reed are found along the project area. These patches would have to be monitored and controlled as necessary to prevent spreading as a result of construction related soil disturbances.

The Proposed Action would maintain or increase the amount of sandy overwash berm/dune habitat found along the project area shoreline. Establishment of controlling headlands along the shoreline allows for the evolution of stable embayments between these breakwater features. These embayments are characterized by beaches and tidal flats upon which tidal marsh vegetation and sandy beach/dune features will develop or persist. This approach allows these critical habitat features to establish a dynamic equilibrium with the evolving landforms, further allowing colonization by marsh and dune vegetation.

One of the most profound impacts of the Proposed Action would be the protection of extensive stands of SAV within the refuge. Large beds of SAV, primarily widgeongrass, are currently found within the Big Thorofare, Lighting Knot Cove, Bridge Creek, and Back Cove. Each of these populations is currently protected from wind and wave action by the western and northwestern shorelines of Martin NWR. Without the Proposed Action, continued shoreline erosion would cause the breach of these protective tidal marsh barriers and loss of the sheltered conditions conducive to the growth and establishment of SAV.

There is evidence that some shoreline protection structures can cause unintended declines in adjacent SAV (Patrick et al. 2014). Within the project area, SAV is only found channelward of the Bay shoreline within Fog Point Cove, and adjacent to Swan Island and southern Silver Island. Because of low erosion rates found along Swan Island and southern Silver Island, no structures are proposed for those shorelines. Four breakwaters are proposed for Fog Point Cove.

Placement of breakwaters within the cove is only proposed where necessary to secure key headlands. Because of the limited extent of breakwaters in that cove, no negative interaction with SAV is expected.

The placement of breakwaters as headland control structures, as well as sand places for wetland restoration, would permanently prevent the growth of SAV within the footprint. Footprint acreage would be minimal, compared to the acreage of existing SAV protected by the Proposed Action. Breakwaters would be sited to avoid building on top of existing SAV beds.

If the Proposed Action is not conducted, the loss of valuable habitats to erosion would continue unabated. Values associated with wetlands, such as habitat, detrital production and export, and wave buffering would decline as 3.3 acres of wetland continues to be lost per year. Erosion would continue to release sediments into estuarine waters. The high quality SAV habitat protected by the existing shoreline would be lost.

4.2.2 Aquatic Species

4.2.2.1 Finfish and Shellfish

The Proposed Action would reduce wave energy along the Bay shoreline, preventing further erosion of tidal wetlands, protect interior SAV beds, and create approximately 8 acres of tidal wetland and dune habitats. Habitat tradeoffs would be a consequence of converting shallow water to tidal marsh, as well as some beach and dune habitats. During construction activities, localized and temporary adverse impacts associated with additional turbidity would be expected. Long-term turbidity would be reduced through the stabilization of the shoreline, benefitting aquatic resources and aquatic habitats. Construction and its resulting disturbance would cause the temporary relocation of aquatic resources and the permanent displacement of some species within the footprint of fill material and structures. The use of stone breakwaters would provide hard surfaces as an additional habitat type for epiphytic attachment. Because the project is designed to protect and restore SAV and tidal marsh, we expect overall beneficial consequences for aquatic resources.

If the Proposed Action were not conducted, tidal marsh habitat would continue to convert to shallow water through erosion, resulting in a net increase in shallow open water habitat. However, this increase in shallow open water would be at the expense of tidal marsh and SAV. Because shallow water is common throughout the area, and increasing all the time, the net gains to plentiful habitat types would come at the expense of limiting habitat types to aquatic resources (tidal marsh and SAV).

4.2.2.2 Benthos

The Proposed Action would result in the conversion of benthic habitat to other habitat types. In addition, benthic organisms occurring under proposed breakwater structures and wetland restoration area would be displaced, and construction activities would have temporary impacts associated with turbidity. Because of the benefits to SAV, decreases in erosion-generated turbidity, and the reduction in marsh loss and maintenance of detrital production, overall positive impacts on the benthic community would be expected.

If the Proposed Action were not conducted, the island would continue to erode. Former marshlands converted to shallow water would result in a net increase in potential benthic habitat. Continuing erosion and associated sediment load would negatively impact adjacent benthic habitats. Benthic organisms associated with SAV beds would suffer as beds are reduced in size.

4.2.3 Essential Fish Habitat

The Proposed Action would result in a habitat tradeoff for fish habitats. This tradeoff would be a consequence of converting shallow water to emergent tidal marsh, as well as some beach and dune habitats. During construction activities, localized and temporary adverse impacts associated with additional turbidity would be expected. Long-term turbidity would be reduced through the stabilization of the shoreline, benefitting aquatic resources and aquatic habitats. Construction and its resulting disturbance would cause the temporary relocation of aquatic resources and the permanent displacement of some shallow water habitat within the footprint of fill material and structures. Because the project is designed to protect and restore SAV and tidal marsh, we expect overall beneficial consequences for aquatic resources.

Many of the species that have EFH designated in the area are primarily found in deeper water, well offshore of Martin NWR. This applies to king mackerel, Spanish mackerel, cobia, red drum, dusky shark, sandbar shark, red hake, Atlantic sea herring, Atlantic butterfish, scup, and black sea bass. These fish predominately inhabit waters deeper than those found within the proposed project area. No impacts to any of these species are expected to occur as a result of the proposed project. No impacts to spawning, egg, or larvae habitat is expected as these areas are not in the proposed project footprint. Any juvenile and adults species in the area will be able to easily swim away and relocate to adjacent areas to avoid direct detrimental impacts. Alterations of bottom habitat are unlikely to impact these species because of the minor scale of impact compared to abundant bottom in the area.

No significant impacts from the Proposed Action are expected to adults or juvenile clearnose skate, little skate, or winter skate. These species tend to be found south of the refuge near the mouth of the Chesapeake Bay and out into the ocean waters. They are not of main concern with this project for any expected impacts. Juveniles and adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts.

No significant impacts are expected to windowpane or summer flounder by the Proposed Action. Adults or juveniles present during construction are able to relocate unharmed. There will be some permanent displacement of shallow water habitat within the footprint of fill material and headland breakwaters. Additionally, the proposed action will prevent 3.3 acres of shallow water habitat from being created each year by the loss of tidal marsh to erosion. No impacts to spawning or eggs will occur for these species since spawning occurs well offshore. Eggs sink to the bottom, cling together, and do not relocate outside the spawning grounds.

No significant impacts from the Proposed Action are expected for bluefish. Juveniles prefer shallow waters but any juveniles and adults that are present in the project area during construction can easily relocate unharmed. Displacement of adults and juveniles would be temporary and localized, only coinciding with construction activities. No impacts to spawning, egg, or larvae habitat of the Bluefish are projected because spawning does not occur in the Chesapeake Bay and the eggs and larvae do not occur in the area.

If the Proposed Action were not conducted, tidal marsh habitat would continue to convert to shallow water through erosion, resulting in a net increase in shallow open water habitat. However, this increase in shallow open water would be at the expense of tidal marsh and SAV. Because shallow water is common throughout the area, and increasing all the time, the net gains to plentiful habitat types would come at the expense of limiting habitat types to aquatic resources (tidal marsh and SAV).

4.2.4 Wildlife

The Proposed Action is specifically designed to protect habitat that benefit many species of wildlife including migratory and resident waterfowl, shorebirds, wading birds, reptiles, and furbearers. The mosaic of sandy berms, intertidal marsh and mudflats, submerged aquatic vegetation, and isolated wooded ridges would continue to provide high-quality habitat for the species that depend on them.

Short-term impacts from noise and disturbance associated with construction activities may cause localized and temporary displacement of some wildlife species. Avoidance of the immediate area while construction is taking place will cause no significant long-term adverse impacts to wildlife. By preventing the loss of 3.3 acres of habitat per year, as well as the extensive populations of SAV within the refuge, the long-term benefits of this project will outweigh the problem of disturbance associated with construction work.

American oystercatchers and diamondback terrapin utilize sandy habitats above the high tide line for nesting purposes. The Proposed Action should maintain or increase this important habitat component on the refuge. Establishment of controlling headlands along the shoreline allows for the evolution of stable embayments between these breakwater features. These embayments are characterized by beaches and tidal flats upon which tidal marsh vegetation and sandy beach/dune features will develop or persist. This strategy should provide shoreline protection in the high wave energy environment of Smith Island, protecting valuable tidal marsh and SAV habitat, while maintaining nesting habitat for American oystercatcher and diamondback terrapin.

While there would be no disturbance to wildlife from construction activities under the No Action Alternative, the continued loss of marsh and submerged aquatic vegetation to shoreline erosion would reduce habitat values for a variety of wildlife species. The many ducks, rails, wading birds and other wetland-associated birds that utilize the marsh, marsh edge, and submerged aquatic vegetation for food and cover would be negatively impacted, as would mammals and reptiles.

4.2.5 Threatened and Endangered Species

Although a few transient threatened and endangered species are known to visit Martin NWR, no impacts are expected under the Proposed Action. The sea turtle species are found occasionally in the waters surrounding Smith Island. These instances are rare and the sightings are transient individuals, rather than resident populations. None of the sea turtles nest on the refuge. Both Atlantic and shortnose sturgeon have been recorded in the deeper waters adjacent to Martin NWR and are unlikely to be found in the shallow water areas where the proposed project would be constructed. The Proposed Action would protect valuable nesting and foraging habitat for bald eagles and northern harriers, both state rare species found on the refuge.

If the Proposed Action is not conducted, the island would continue to erode, losing valuable habitat for bald eagles and northern harriers.

4.3 Cultural Resources

The Maryland Historic Trust records nine known archeological sites along the shoreline between Swan Island and Fishing Point. The sites include seven scatters of historic artifacts dating from the 19th and 20th centuries, and the remains of two late 19th or 20th century wharves. The significance and condition of these sites is currently under investigation. The Service will work with the Maryland Historic Trust and appropriate Tribes to ensure any significant sites are not impacted. Generally speaking, shoreline protection measures will serve to protect the island's cultural resources, as well as valuable habitats, from loss to erosion.

4.4 Socio-Economic Resources and Environmental Justice

The Proposed Action is expected to have no negative impacts to the socio-economic resources of the island. Some positive benefits may be realized through the protection of productive habitats. Maintaining these habitats will provide productive commercial fishing opportunities, as well as recreational fishing, wildlife observation and other tourism attractions.

There are no segments of the population being preferentially singled out by the Proposed Action. There are no minorities or low-income neighborhoods in the vicinity that could be affected by shoreline protection. It does not preferentially benefit any demographic group to the detriment of any other. It is anticipated that all of the island's residents will benefit from the proposed projects through the economic opportunities from increased natural resources.

If the Proposed Action is not conducted, the island would continue to erode, losing valuable fish and wildlife habitat. Commercial fisheries that depend on SAV beds (e.g., soft-crabs, and nursery areas for juvenile, commercially valuable fish species) would continue to decline.

4.5 Transportation

No adverse impacts to transportation are expected by the Proposed Action. The breakwaters will be located near the existing shoreline in shallow waters and are not expected to be a navigational hazard. The structures are not expected to impact access to the channels within Big Thorofare and are not expected to have any negative impacts within the interior of the island. Some positive benefits may be realized through the maintenance of sheltered waters and limiting wave action and shoaling of navigation channels within the Big Thorofare.

If the Proposed Action is not conducted, continued breaching of the western shoreline will lead to an increase in wave action and shoaling with the Big Thorofare and interior navigation channels.

4.6 Noise

Some noise will be generated during the construction stage of the Proposed Action. This noise will be associated with construction related equipment such as excavators, trucks, and tugs. Noise directly related to construction activities may temporarily force some wildlife to relocate. However, these impacts are expected to be temporary and minor.

4.7 Recreation and Tourism

No adverse impacts to recreation and tourism are expected. The Proposed Action will likely maintain existing recreation and tourism opportunities adjacent to the refuge. Primary recreational fishing locations along the western shoreline, such as Lighting Knot inlet, will not be negatively impacted by this project. This inlet will be left open and will continue to provide high quality recreational fishing opportunities.

If the Proposed Action is not conducted, continued erosion will cause a decline in tidal marsh and SAV habitats, likely reducing recreation and tourism opportunities.

4.8 Cumulative Impacts

The cumulative impacts of the Proposed Action are expected to be beneficial to the island ecosystem, providing direct and incidental benefits to the SAV, emergent marsh, and upland areas, and to the associated fish and wildlife that reside within these habitat areas. Potential negative impacts of the Proposed Action include localized and temporary disturbance to fish and wildlife resulting from construction activities, as well as the loss of nearshore shallow water habitat because of the footprint of the headland breakwaters and restored tidal marsh. While these impacts need to be carefully considered, they are outweighed by the overall positive impacts to area flora, fauna, and adjacent human communities. The Proposed Action will ensure the greatest potential for a diverse mosaic of habitat conditions that will be both resilient and resistant to stressful changes over time, with long-term benefits for the inhabiting flora and fauna within the ecological setting.

The impacts of the current Proposed Action must be weighed to determine whether the additive effects of these actions will result in a significant cumulative impact on the natural and human environment of the area. During the investigation conducted for the preparation of this EA, it was established that two other projects are being considered on Smith Island. The first project being considered is a navigation project near Rhodes Point. This project may involve the dredging of a navigation channel, beneficial reuse of dredged material, establishment of jetties, and/or shoreline protection measures for Rhodes Point. The Rhodes Point project is approximately 1.75 miles south of the Proposed Action discussed in this EA, separated by the jetties protecting the western entrance to the Big Thorofare. Though the details of the Rhodes Point project are still under development, it will likely include some amount of placement of materials for jetties and/or shoreline protection, resulting in the loss of shallow water.

The second potential project involves maintenance dredging of the Twitch Cove and Big Thorofare navigation channels. The potential for beneficial reuse of dredged material has been discussed. Potential placement sites include southern Silver Island and Swan Island. These beneficial use projects could be designed to increase the width of the sandy overwash berm features at these two locations, as well as support any deteriorating marsh in the area.

The cumulative impacts of these actions are likely to be negligible considering the rapid rate of shoreline erosion seen elsewhere on Smith Island, resulting in the creation of new shallow water habitat every year. Overall, it is unlikely that the interaction between these projects will have any cumulative negative effects upon the natural or human environment.

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Two documents served as the foundation for this Environmental Assessment. The Study Report and Conceptual Design prepared by Perini Management Services, with contributions from Coastline Design, P. C., Vanasse Hangen Brustlin, Inc., Coastal Design and Construction, Inc., and Sustainable Science LLC, developed the proposed project design and provided descriptions of the affected environment (Perini 2014). Additionally, the proposed project was previously addressed by the U. S. Army Corps of Engineers in their EA and Feasibility Report for shoreline protection on Smith Island (USACE 2001). Much of the Affected Environment section was provided by this document.