DRAFT REPORT

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR GODDARD SPACE FLIGHT CENTER'S WALLOPS FLIGHT FACILITY, SHORELINE RESTORATION AND INFRASTRUCTURE PROTECTION PROGRAM

Prepared for

National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337

May 2007

URS Group, Inc.
200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878
15299035

PREFACE

This *Programmatic Environmental Assessment for Wallops Flight Facility, Shoreline Restoration and Infrastructure Protection Program* has been developed by URS Group, Inc. (URS) and EG&G Technical Services (EG&G) for the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (GSFC) Wallops Flight Facility (WFF).

URS/EG&G have prepared this report for the exclusive use of WFF in accordance with NASA Procedural Requirements (NPR) 8580.1, *Implementing the National Environmental Policy Act and Executive Order 12114* (NASA, 2001).

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT
WALLOPS ISLAND SHORELINE RESTORATION AND
INFRASTRUCTURE PROTECTION PROGRAM
WALLOPS FLIGHT FACILITY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA 23337

Lead Agency: National Aeronautics and Space Administration

Proposed Action: Wallops Island Shoreline Restoration and Infrastructure Protection Program

For Further Information: Joshua A. Bundick
NEPA Program Manager
Code 250.W
Goddard Space Flight Center's Wallops Flight Facility
National Aeronautics and Space Administration
Wallops Island, VA 23337
(757) 824-2319

Date: May 20, 2007

ABSTRACT

The land areas comprising Goddard Space Flight Center's Wallops Flight Facility (WFF) have been under NASA's jurisdiction since 1959. WFF's launch sites are located on the Eastern Shore of Virginia facing the Atlantic Ocean, on the barrier island known as Wallops Island, which is subject to shoreline retreat along its coast. The ocean has encroached substantially toward launch pads, infrastructure, and test and training facilities belonging to NASA, the U.S. Navy, and the Mid-Atlantic Regional Spaceport (MARS). Currently, assets on Wallops Island are valued at over $800 million and are increasingly at risk from larger than normal storm events, storm waves, and flooding damages. The island's shoreline retreat could cause the interruption of missions supported by the facility and/or permanent loss of capabilities supported by the facility. The proposed project would help reduce the risk to infrastructure on Wallops Island by restoring the shoreline or providing flood protection for infrastructure on the island.

PURPOSE AND NEED FOR THE ACTION

The purpose and need of the proposed Shoreline Restoration and Infrastructure Protection Program is to reduce the potential for damage to, or loss of, millions of dollars of existing NASA, U.S. Navy, and MARS assets on Wallops Island, which are at risk due to extensive shoreline retreat. The shoreline retreat on Wallops Island has been caused by several natural and man-induced processes that are proposed to be corrected through a range of shoreline restoration or infrastructure protection measures.

This Programmatic Environmental Assessment (PEA) has been prepared to describe the potential impacts from the Proposed Action and a range of reasonable alternatives, including the No Action Alternative. After the PEA is completed, a determination will be made whether NASA must prepare an Environmental Impact Statement (EIS) or issue a Finding of No Significant Impact (FONSI). If this PEA results in a FONSI, individual action alternatives and options selected for implementation would be further evaluated to determine whether action-specific Supplemental EAs (SEAs) should be prepared. If an SEA is required, it would identify and address environmental issues related more specifically to the action. The SEAs will tier off the PEA and will only be required to address any new action-specific project information or new data for the resource area being affected.

ALTERNATIVE DESCRIPTIONS

No Action Alternative

Under the No Action Alternative, the Shoreline Restoration and Infrastructure Protection Program would not be conducted on Wallops Island; however, maintenance and emergency repairs to existing structures would continue.

Proposed Action

The Proposed Action is to implement a Shoreline Restoration and Infrastructure Protection Program to slow shoreline retreat and allow NASA and its customers to continue to utilize Wallops Island safely and complete their missions without interruptions. The Proposed Action is comprised of two alternatives – Alternative 1, Shoreline Restoration Measures and Alternative 2, Flood Protection Measures, each of which contains various options for implementation.

Alternative 1 – Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

The Optimum Shore Protection Plan is a phased approach which would include the flexibility to alter the actions taken under this option according to the natural changes in the environment. NASA would construct sand retention structures (detached offshore breakwaters, T-head groins, or a combination of the two) along portions of unprotected shoreline along Wallops Island. The size, composition, spacing, and offshore placement of the breakwater structures would be determined during engineering design and discussed more specifically in an SEA. Once the breakwaters are constructed, NASA would obtain sand from offshore sand deposits and place it along the shoreline. Once the Optimum Shore Protection Plan is completed, continued monitoring and additional beach nourishment would be conducted as necessary.

Option 2 - Shore Protection: Beach Fill Only

Under this option, a shoreline restoration project would be conducted to reduce shoreline retreat and protect the facilities on the island from storm waves by moving the zone of wave breaking well away from the vulnerable infrastructure. The work would be phased over several years; during this time, NASA would continue shoreline monitoring, and adjust programs as needed to adapt to changing conditions. This method would require repeated episodes of beach nourishment; monitoring of the beach's topography and bathymetry would be required indefinitely. The frequency of beach nourishment would be determined by the amount of fill placed each time and by the number and severity of storm events as the project continues.

Option 3 - Sand-Retention Structures Only

Under this option, NASA would construct sand retention structures (detached offshore breakwaters, T-head groins, or a combination of the two) along any portion of Wallops Island (island) as the need is identified. The size, composition, spacing, and offshore siting of the breakwater structures would be determined during engineering design and discussed more specifically in an SEA.

Option 4 - Emergency Actions

Under this option, NASA would continue to conduct emergency actions to prevent infrastructure from being damaged during storms. Emergency actions may include hauling in additional rock to add to the existing seawall, hauling and placing sand on the beach or behind existing shoreline protection, or installing sheet pile in or near the high tide mark. The quantities of material required for each method are unknown at this time and would be discussed in detail in an SEA, if necessary.

Option 5 - Installation of Geotextile Tubes

Under this option, NASA would place geotextile tubes (geotubes) on shore to slow down the transportation of sand off the beach and help protect onshore assets from wave action. Geotubes are composed of durable textile material formed into long cylinders that are filled with sand. The tubes, which are used instead of hard structures such as riprap, are normally placed in the back beach parallel to the shore. Temporary staging areas for sand and slurry would be located in open areas near the beach; these staging areas would be restored after the project is complete.

Option 6 - Sand Dunes with Various Cores

Under this option, NASA would create vegetated sand dunes with a core (rock core, semi-rigid containers filled with rock or sand, geotextile tubes filled with sand or grout, or a clay core). The core would help stabilize and strengthen the dunes during larger than normal storm events. At this time it is not known where the sand dunes would be created; however, the existing seawall could be used as a core material.

Alternative 2 – Flood Protection Measures

Option 1 - Critical Structure Ring Levees

Under this option, NASA would construct levees around critical facilities on the island, beginning with the most vulnerable structures. At this time it is not known how high the levees would need to be. Pumps would need to be installed within each levee zone to pump rain water out of the system. While these structures would protect critical infrastructure during floods, they may become isolated and possibly inaccessible until flood waters retreat. In addition, long-term maintenance would be required to maintain the structural integrity of the levees.

Option 2 - Elevation of Critical Structures and Roadways

Some of NASA's existing island infrastructure is elevated to 3.0 meters (9.8 feet) National Geodetic Vertical Datum (NGVD). Under this option, NASA would raise the elevation of new structures by filling their foundations. The elevation of new buildings would be above 3.0 meters (9.8 feet) NGVD and roadways would be raised to maintain accessibility to infrastructure during floods.

Option 3 - Elevate the Island and Structures by Pumping Sand

Under this option, NASA would pump sand onto the island to raise portions of the island's elevation to a predicted future rise in sea level or storm strength. The amount of sand needed to complete this process is currently unknown. This process would not be practical for the entire island, or where structures already exist; however, it would be possible to pump sand onto portions of the island as NASA's mission changes or new portions of the island are utilized.

Option 4 - Build a Levee around the Entire Island

Under this option, NASA would construct a levee around the entire island and leave existing critical infrastructure intact. This levee structure would need to be large enough to withstand strong storms. At this time, the size or location of the levee is unknown. The structure would require long-term maintenance to maintain its integrity.

SUMMARY OF ENVIRONMENTAL IMPACTS

Summarized below are potential environmental impacts resulting from the No Action Alternative and the Proposed Action (implementation of the Shoreline Restoration and Infrastructure Protection Program). Only the alternatives with the potential to have an impact (negative or beneficial) on a resource are discussed below. All potential impacts from all alternatives are discussed in further detail within Section 4.

Topography and Drainage

Under the No Action Alternative, impacts to topography and drainage would occur because shoreline retreat would continue and drainage patterns may shift. Topography and drainage would not be adversely impacted by any of the Proposed Action's alternatives and options. Alternative 1 Options 1, 2, 4, and 6 would have beneficial impacts to topography associated with the return of the shoreline to its natural slope. Alternative 2 Options 3, 4, and 5 would have a beneficial impact on topography by retaining sand along the shoreline.

Geology and Soils

Under the No Action Alternative, minor impacts to soils would occur because loss of soils would continue as the shoreline retreats and vehicles and equipment would disturb soils during maintenance and emergency repair activities. Temporary, minor impacts to soils would occur under all of the Proposed Action's alternatives and options because of vehicles and equipment that would disturb surface soils on the beach and around the facilities during construction activities. The six options under Alternative 1 would beneficially impact the island's soils because they would mitigate the rate of shoreline retreat that is currently taking place.

Atlantic Ocean Substrate

Under the Proposed Action, the three options that include dredging, Alternative 1 Options 1 and 2 and Alternative 2 Option 3, could modify the substrate at and near an offshore borrow site in several ways. Potential changes in the nearshore bathymetry due to movement of finer fill material transported from the newly placed beach sand via tidal wave action may occur. Over several months of wave and tidal action, however, the nearshore substrate elevations and slopes would naturally return to pre-placement conditions. The impact, then, to the Atlantic Ocean substrate as a result of dredging would be temporary.

Surface Water

Under the No Action Alternative and all alternatives and options under the Proposed Action, except Alternative 1 Option 3, temporary impacts to surface water would occur from the use of construction equipment and heavy machinery on the beach, which may result in the introduction of petroleum products, heavy metals, or other contaminants to nearshore waters.

Alternative 1 Options 1 and 2 and Alternative 2 Option 3 would cause temporary impacts to surface water from the disposal of dredged material on the beach, and Alternative 1 Option 5 would cause temporary impacts on surface water from the slurry mix flowing through the geotubes and onto the beach. The placement of dredged material on the beach or the flow of slurry mix onto the beach would result in turbidity and suspended solids concentrations that are elevated over normal background levels of the surf zone in the immediate area of operation.

Marine Waters

Minor, temporary impacts to marine waters could occur as a result of implementation of all options under Alternative 1 and Alternative 2 Option 3 during dredging activities or the construction of sand-retention structures. Dredging at borrow sites, placement of dredged material, and the construction of sand-retention structures will result in turbidity and suspended solids concentrations that are elevated over normal background levels of the surf zone in the immediate area of operation.

Wetlands

The emergency actions associated with the No Action Alternative and Alternative 1 Option 4 and all four options under Alternative 2 would temporarily impact wetlands depending on the location and scope of project activities.

Coastal Zone Management

Project activities associated with the No Action Alternative and all of the Proposed Action's alternatives and options would occur within the coastal zone and would have temporary, minor impacts on coastal resources.

Air Quality

The No Action Alternative and all of the Proposed Action's alternatives and options would have short-term, minor impacts to air quality during the construction period. Impacts to air quality would be from construction equipment and vehicle emissions and would depend on the length and frequency of the activity, but no significant increases in criteria pollutants are anticipated.

Noise

The No Action Alternative and all of the Proposed Action's alternatives and options would have temporary, minor impacts to noise during the construction period. Impacts to noise would be dependent on the type, length, and frequency of the activity, but are not anticipated to be significant.

Hazardous Materials and Hazardous Waste

The No Action Alternative could impact hazardous materials and hazardous waste because storage areas or accumulation points would be subject to flooding; the impact is not anticipated to be significant. Alternative 1 Options 1 and 2 and Alternative 2 Option 3 would have a beneficial impact on hazardous materials and hazardous waste by restoring the shoreline and increasing the distance between the wave breaking area and critical storage areas and accumulation points. Alternative 1 Options 3, 4, 5, and 6 and Alternative 2 Options 1, 2, and 4 would have a lesser beneficial impact because the zone of wave breaking would not be moved further away from accumulation points or storage areas.

Vegetation

Construction activities associated with the No Action Alternative, Alternative 1 Option 4, 5, and 6, and Alternative 2 Options 1, 2, and 4 would have minor, temporary impacts on vegetation; vegetated areas disturbed by activities would be revegetated. Over time, because these alternatives and options would not prevent shoreline retreat, vegetation on the northern and southern portions of the island may be negatively affected.

Alternative 1 Options 1 and 2 and Alternative 2 Option 3 would have a beneficial impact on vegetative species associated with dune and swale systems because beach habitat would increase. Beach fill would reduce inundation from storms and dissipate wave energy. This would help prevent overtopping of the seawall and inland flooding and would prevent further loss of sand from the backside of the seawall. It would also restore the beach, allowing grasses to repopulate the upper dune areas.

Terrestrial Wildlife and Migratory Birds

Alternative 1 Options 1 and 2 and Alternative 2 Option 3 would have a beneficial impact on terrestrial wildlife and migratory birds. Under these alternatives and options, the shoreline would be restored and shoreline retreat slowed, thereby protecting facilities on the island by moving the zone of wave breaking well away from vulnerable infrastructure. An increase in the intertidal and upper beach habitat would benefit shorebirds that are known to forage in these

areas and the raptor species that prey on them. Additionally, coastal invertebrates and mammals known to rely on these habitats for shelter and foraging would benefit. Species of birds, mammals, reptiles and amphibian species occupying shrub and thicket habitats would benefit from decreased shoreline retreat and associated habitat loss pressures.

Construction associated with all four options under Alternative 2 would temporarily impact terrestrial wildlife and migratory birds. Areas that are disturbed during construction activities would be revegetated after construction.

Threatened and Endangered Species

It is anticipated that Alternative 1 Options 1 and 2 and Alternative 2 Option 3 may adversely impact sea turtles, are not likely to adversely impact whales, and will beneficially impact the piping plover.

A Biological Assessment was completed to analyze potential impacts to threatened and endangered species from activities associated with the implementation Shoreline Restoration and Infrastructure Protection Program. Entrainment in hopper dragheads during dredging operations in the borrow areas is the primary risk to sea turtles. Whales may traverse near or through dredging areas during migration. As such, there exists a small potential for incidental take of a whale should a collision with a dredge occur.

As a result of the work associated with Alternative 1 Options 1 and 2 and Alternative 2 Option 3, the amount of intertidal and upper beach habitat would increase, with a beneficial impact on the piping plover.

Marine Mammals and Essential Fish Habitat

Alternative 1 Options 1, 2, 3 and Alternative 2 Option 3 would result in short-term, minor impacts to essential fish habitat (EFH) due to increases in suspended sediment concentration associated with construction activities.

Employment and Income

Under the No Action Alternative, damage and/or loss of WFF assets could occur and it is anticipated that impacts to employment and income would result; however, these impacts would not be significant because WFF comprises only 5 percent of the labor force in Accomack County.

Cultural Resources

Alternative 1 Option 1 and Alternative 2 Option 3 would most effectively safeguard the island's cultural resources, which would be a long-term beneficial impact. Alternative 1 Options 2, 3, 5, and 6 and Alternative 2 Options 1, 2, and 4 would provide the same beneficial impact for the short term.

Summary

The Proposed Action of implementing the Shoreline Restoration and Infrastructure Protection Program would not have a significant impact on environmental or socioeconomic resources.

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°C	Degrees Celsius
°F	Degrees Fahrenheit
µ/m3	Micrograms per cubic meter
ACHP	Advisory Council on Historic Preservation
amsl	Above mean sea level
APE	Area of Potential Effect
BA	Biological Assessment
BMP	Best Management Practice
CAA	Clean Air Act
CBRA	Coastal Barrier Resources Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMA	Coastal Management Area
CO	Carbon monoxide
CO_2	Carbon dioxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	Decibel
dBA	Decibel weighted to the A-scale
DCR	Department of Conservation and Recreation
DEQ	Department of Environmental Quality
DNL	Day-Night Level
EA	Environmental Assessment
EFH	Essential Fish Habitat
EG&G	EG&G Technical Services
EIS	Environmental Impact Statement
EJCC	Environmental Justice Coordination Committee
EJIP	Environmental Justice Implementation Plan
EMS	Environmental Management System
EO	Executive Order
EPA	Environmental Protection Agency
ERD	Environmental Resources Document
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FMP	Fisheries Management Plan

GSFC	Goddard Space Flight Center
ICP	Integrated Contingency Plan
L_{01}	Sound level exceeded 1 percent of the time
L_{10}	Sound level exceeded 10 percent of the time
L_{90}	Sound level exceeded 90 percent of the time
L_{eq}	Time-averaged sound level
MAFMC	Mid-Atlantic Fisheries Management Council
MARS	Mid-Atlantic Regional Spaceport
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MRFSS	Marine Recreational Fisheries Statistics Survey
MSC	Marine Science Consortium
MSDS	Material Safety Data Sheet
N_2	Nitrogen gas
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NCA	Noise Control Act
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act, as amended (1966)
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPR	NASA Procedural Requirements
NPS	National Park Service
NRHP	National Register of Historic Places
O_3	Ozone
OSHA	Occupational Safety and Health Administration
Pb	Lead
PEA	Programmatic Environmental Assessment
PM_{10}	Particulate matter less than or equal to 10 microns
ppb	Parts per billion
ppm	Parts per million
ppt	Parts per thousand
SCS	Soil Conservation Service
SEA	Supplemental Environmental Assessment
SHPO	State Historic Preservation Officer

SIP	State Implementation Plan
SO_2	Sulfur dioxide
TCP	Traditional Cultural Projects
THPO	Tribal Historic Preservation Officer
TSDF	Treatment, Storage, and Disposal Facility
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded Ordnance
VAC	Virginia Administrative Code
VACAPES OPAREA	Virginia Capes Operating Area
VCRMP	Virginia Coastal Resources Management Program
VDHR	Virginia Department of Historic Resources
VMRC	Virginia Marine Resources Commission
VOC	Volatile organic compound
VPDES	Virginia Pollutant Discharge Elimination System
WFF	Wallops Flight Facility

1.1 WALLOPS FLIGHT FACILITY MISSION

During its early history, the mission of the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) Wallops Flight Facility (WFF) was primarily to serve as a test site for aerospace technology experiments. Over the last several decades, the WFF mission has evolved toward a focus of supporting scientific research through carrier systems (i.e., airplanes, balloons, rockets, and uninhabited aerial vehicles) and mission services. WFF is a NASA facility under the management of GSFC. NASA is the land owner with multiple tenants, including the U.S. Navy, U.S. Coast Guard (USCG), Mid-Atlantic Regional Spaceport (MARS), and National Oceanic and Atmospheric Administration (NOAA). Each tenant partially relies on NASA for institutional and programmatic services, but also has its own missions. WFF is a national resource with the facilities, personnel, core competencies, and low cost of operations to provide world-class, end-to-end services for small to medium-sized missions. It is a fully capable launch range for rockets and balloons, and a research airport. In addition, Wallops personnel provide mobile range capabilities, range instrumentation engineering, range safety, flight hardware engineering, and mission operations support.

NASA is committed to carrying out research and projects at WFF in an environmentally sustainable manner. The Wallops Environmental Office (Code 250) ensures that the facility obtains the appropriate environmental permits, prepares documentation for the National Environmental Policy Act (NEPA) and other environmental regulations and Executive Orders (EO), conducts employee and supervisor training, and implements the facility's Environmental Management System (EMS). EMS is a coherent, integrated approach to environmental management. WFF manages environmental risks through the application of the WFF EMS, which covers such topics as pollution prevention, energy and water management, maintenance of natural (green) infrastructure, and sustainable building practices. The strategic vision for WFF is that "Wallops Flight Facility will be a national resource for enabling low-cost aerospace-based science and technology research" (NASA, 2005).

1.2 BACKGROUND

WFF is located in the northeastern portion of Accomack County, Virginia, on the Delmarva Peninsula, and is comprised of the Main Base, Wallops Mainland, and Wallops Island (Figure 1). Wallops Island is bounded by Chincoteague Inlet to the north and Assawoman Inlet to the south, which is currently filled in. Chincoteague Inlet is currently a federal navigation project and is dredged annually to a depth of 3.7 meters (12 feet) to keep the channel open for commercial fishing activities leaving the town of Chincoteague. The predominant direction of longshore sediment movement is from north to south. This longshore movement of sediment has caused sand spits to grow south of Assateague Island, forcing the inlet to curve southward. The large recurved sand spit at the south end of Assateague Island, known as Fishing Point, is evidence of the dominant southward transport of sand. The growing spit and the ebb and flood shoals of Chincoteague Inlet are an efficient sediment trap, allowing only about 5 percent of the littoral sand transport to bypass to the south (M&N, 1992). The consequence of this sand trap is that Wallops Island and the barrier islands to the south have been deprived of sediment and their shorelines have eroded, drastically in some cases.

Insert Figure 1 – Vicinity Map

From 1857 (the date of the first U.S. Coast and Geodetic Survey's shoreline survey) to 1994, the southern part of Wallops Island has retreated approximately 400 meters (1,312 feet); the average rate of retreat is 3.7 meters (12 feet) per year (Figure 2). Assawoman Island to the south has been impacted even more, with a shoreline retreat rate of between 4.9 and 5.2 meters (16 and 17 feet) per year. Several factors have been identified as catalysts for the shoreline retreat. In 1934, jetties were installed at Ocean City, Maryland, trapping sand north of the jetty and keeping the sand from reaching the beaches north of Wallops Island. Since the construction of the jetty, Assateague Island's shoreline has retreated approximately 1 kilometer (0.6 mile), depriving Wallops Island of its source of natural sand replenishment from the north.

In the early 1960s and 1970s, NASA made several attempts to keep sand on the Wallops Island beach and prevent shoreline retreat by installing wooden groins. These wooden groins were almost completely gone by the mid-1980s; their failure has been linked to the lack of replenishing sand (either natural or fill). In 1992, NASA obtained a permit from the Virginia Marine Resources Commission (VMRC) to construct a stone seawall for approximately 4,840 meters (15,879 feet) along the center of the island where most infrastructure is located. The seawall was thought to be a solution to the high rate of shoreline retreat and does currently serve as protection from storm surge. However, this structure is highly permeable because of large voids; these voids allow scouring on the landward side and the additional loss of sand. Because of shoreline retreat, currently a large portion of the seawall is actually in the ocean and waves continually break on it.

1.3 TENANTS AND OTHER ON-SITE ORGANIZATIONS

NASA has several tenants and customers that use WFF facilities, ranges, and airspace. The U.S. Navy and MARS both have facilities on Wallops Island that are also in jeopardy from storm surges and shoreline retreat.

U.S. Navy Surface Combat Systems Center

The U.S. Navy Surface Combat Systems Center is WFF's largest partner. Wallops Island is home to the unique replica of an AEGIS cruiser and its destroyer combat systems as well as the experimental radar deck of the DD(G) 1000 class destroyer. These systems are used to train naval officers and enlisted personnel in the operation and maintenance of sophisticated equipment used by the fleet onboard their AEGIS cruisers and destroyers. The systems are also used to test concepts and solve operational problems. Other technical missions include Lifetime Support Engineering, In-Service Engineering, Systems Level operations, and maintenance training. The Surface Combat Systems Center supports the AEGIS Training Unit by providing equipment on which replacement crew training is held. The U.S. Navy Ship Self Defense System Facility on Wallops Island conducts research, development, testing, and evaluation elements of shipboard systems, integration, and demonstrations of new shipboard systems. WFF also provides missile launch support for the U.S. Navy. Drone vehicles are used for target tracking and are engaged by both the Aegis facility and operational naval forces.

Mid-Atlantic Regional Spaceport

The Virginia Space Flight Authority is responsible for the development and operation of the MARS, a Federal Aviation Administration (FAA)-licensed commercial spaceport on Wallops Island. MARS operates the orbital Launch Complex 0, which includes both Pads 0-A and 0-B, and provides facilities and services for commercial launches of payloads into space.

Insert Figure 2 – Historic Shoreline

1.4 PURPOSE AND NEED

NASA has occupied WFF since the 1940s, and Wallops Island has experienced shoreline retreat, caused by natural and man-induced processes, along the coast since that time. The ocean has encroached substantially toward launch pads, infrastructure, and test and training facilities belonging to NASA, the U.S. Navy, and the MARS. Currently, assets on Wallops Island are valued at over $800 million and are increasingly at risk from larger than normal storm events, storm waves, and flooding damages (Figure 3). The risks to WFF could cause the interruption of missions and/or permanent loss of capabilities supported by the facility.

The purpose and need of the proposed Shoreline Restoration and Infrastructure Protection Program is to reduce the potential for damage to, or loss of, millions of dollars of existing NASA, U.S. Navy, and MARS assets on Wallops Island, which are at risk due to extensive shoreline retreat. The U.S. Army Corps of Engineers has been tasked with the Shoreline Restoration and Infrastructure Protection design, as well as the hiring of contractors to carry out the actual construction. NASA has been tasked with ensuring environmental compliance with the National Environmental Policy Act (NEPA).

1.5 SCOPE OF THE PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

This Programmatic Environmental Assessment (PEA) has been prepared to describe the potential impacts from the Proposed Action and a range of reasonable alternatives, including the No Action Alternative. The No Action Alternative provides a baseline for comparing the Proposed Action with the existing conditions. This PEA has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] Parts 1500 through 1508), and the NASA Policy Requirements (NPR) for implementing NEPA (NPR 8580.1).

Approach

Pursuant to NEPA, as implemented by the CEQ regulations and NASA's NPR, NASA has prepared this PEA for the shoreline restoration program. After the PEA is completed and the environmental and socioeconomic impacts have been analyzed, a determination will be made whether NASA must prepare an Environmental Impact Statement (EIS), or issue a Finding of No Significant Impact (FONSI). If this PEA results in a FONSI, individual alternatives selected for implementation would be further evaluated to determine whether action-specific Supplemental EAs (SEAs) should be prepared. If an SEA is required, it will identify and address environmental issues related more specifically to the action. In accordance with CEQ and NASA regulations, the SEAs will tier off the PEA and will only be required to address any new action-specific project information or new data for the resource area being affected For example, an SEA would be completed for Alternative 1 Option 1: Optimum Shore Protection Plan and would analyze new data on specific borrow areas once they are identified. If a FONSI can be issued (based on the findings of the SEA), then site-specific work would commence.

Section 7.6.6 of the NASA NPR states, "Programmatic documents are broad in scope, or big picture (i.e., address an entire program or a broad action). They may be followed by site- or mission-specific documents. The follow-on NEPA documents do not have to provide detailed

Insert Figure 3 – Wallops Island Facilities

analyses of the shared environmental concerns addressed in the programmatic documents. Those concerns and relevant analyses are treated by the programmatic document and are grandfathered to the extent that the analyses remain accurate. The site- or mission-specific documents, for those environmental concerns, reference the programmatic document and only summarize the programmatic analyses. The time, effort, and resources for the document can, thus, focus principally on the individual program sub-element or specific action of concern."

This PEA analyzes the No Action Alternative and the Proposed Action, which includes various feasible actions that meet the purpose and need for the shoreline restoration and infrastructure protection program. The identification of a range of action alternatives provides various options by which NASA can implement the Proposed Action. The PEA discusses impacts from the Proposed Action which is comprised of two Alternative Measures (Shoreline Restoration or Flood Protection). Each Alternative Measure has several options for slowing shoreline retreat on Wallops Island or protecting valuable infrastructure. When specific details of individual action alternatives are developed, SEAs can be written to determine the specific impacts of those actions.

1.6 RELATED ENVIRONMENTAL DOCUMENTATION

Beach Erosion Mitigation and Sediment Management Alternatives at Wallops Island, VA. Coastal and Hydraulics Laboratory, U.S. Army Corps of Engineers Norfolk District. September 2006.

Final Site-Wide Environmental Assessment and Finding of No Significant Impact, Wallops Flight Facility, Goddard Space Flight Center. Prepared by URS-EG&G. January 2005.

Environmental Resources Document (ERD). NASA GSFC WFF, Wallops Island, Virginia. Prepared by Occu-Health, Inc. October 1999.

Environmental Assessment for Range Operations Expansion at the National Aeronautics and Space Administration Goddard Space Flight Center Wallops Flight Facility. Prepared by Computer Science Corporation. October 1997.

In addition to the No Action Alternative, NASA has identified two Alternatives to implement the Proposed Action on Wallops Island. Each alternative is presented below.

2.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the Shoreline Restoration and Infrastructure Protection Program would not be conducted on Wallops Island, but maintenance and emergency repairs to existing structures would continue. Over $800 million in NASA, U.S. Navy, and MARS equipment, buildings, and infrastructure would continue to be at risk. Maintenance and emergency repairs to structures and the seawall would continue to be required. Shoreline retreat would continue. Operations at facilities may be disrupted during severe storm events from wave overtopping and flooding. The danger to the MARS facility in the southern portion of the island would increase due to the rapidly retreating shoreline in that area.

2.2 PROPOSED ACTION

The Proposed Action is to implement a Shoreline Restoration and Infrastructure Protection Program to allow NASA and its customers to continue to utilize Wallops Island safely and complete their missions without interruptions. The Proposed Action is comprised of two Alternative Measures, Shoreline Restoration or Flood Protection. Each Alternative Measure has several options for protecting valuable infrastructure or slowing shoreline retreat on Wallops Island.

2.2.1 Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

The Optimum Shore Protection Plan is a phased approach which would include the flexibility to alter the project and monitoring and maintenance according to the natural changes in the environment. NASA would construct sand retention structures (detached offshore breakwaters, T-head groins, or a combination of the two) along a maximum of 6,800 meters (22,309 feet) of unprotected shore of Wallops Island. Nearshore breakwater structures reduce the amount of wave energy reaching a protected area. The reduction in wave energy would reduce sediment transport to the south and therefore produce sediment deposition and a shoreline bulge, known as a tombolo, in the sheltered area behind the breakwater (See photograph below). The tombolo may be built during construction to produce a headland breakwater and block normal longshore sediment transport behind the structure. The size, composition, spacing, and placement of the breakwater structures would be determined during engineering design and discussed more specifically in an SEA. It is anticipated that no more than 20 structures would be required for the 6,800 meters (22,309 feet) of shoreline. Construction and placement of the breakwaters would take place in the water using barges and heavy lifting equipment.

Photograph of breakwaters and tombolos forming behind them in Fort Story, VA (USACE, 2006).

Once the breakwaters are constructed, NASA would fill 6,800 meters (22,309 feet) of beach from offshore sand deposits. Beach fill would be placed along the shoreline from Assawoman Inlet to the northern end of the NASA seawall (Figure 4). The dredging would be accomplished using one or more hopper dredges. A hopper dredge is a ship which is capable of dredging material, storing it onboard, transporting it to the disposal area, and dumping it. A hopper dredge fills its hoppers as it dredges the bottom. The dredge then moors to a buoy located near shore. Hoses connected to a pipeline extending to shore are attached to the hopper dredge discharge manifold. The dredge then mixes the dredged material with water to form a slurry and pumps the slurry from its discharge manifold through the hoses and pipeline to a designated discharge location on Wallops Island. It may take 6 months to complete the beach fill. The off-shore borrow site from which to obtain sand has not been identified; however, due to known historic World War II area ranges off of Wallops Island (See Section 3.2.6, Unexploded Ordnance) an area known as Sector 1 has been identified as the most suitable area to find a borrow site. Sector 1 is approximately 24 square kilometers (15 square miles) in size and is within 4.8 kilometers (3 miles) of shore (Figure 5). NASA and the U.S. Army Corps of Engineers (USACE) may also decide to look outside this preliminary location for a suitable borrow site.

Once the Optimum Shore Protection Plan is completed, it will require continued monitoring and additional beach nourishment as necessary.

Option 2 - Shore Protection: Beach Fill Only

Under Option 2, a shoreline restoration project would be conducted to slow shoreline retreat and protect the facilities on the island from storm waves by moving the zone of wave breaking well away from the vulnerable infrastructure. The work would be phased over several years. A hopper dredge would be used to place beach fill.

In the first year of construction, NASA would add beach fill from NASA's property boundary north of Assawoman Inlet to about half of the length of Wallops Island (approximately 3,400 meters or 11,154 feet) (Figure 6). In the second year of construction, NASA would continue the beach fill for another 3,400 meters (11,154 feet) to the northern end of the NASA seawall (to the zone where the shoreline curves east toward Chincoteague Inlet).

Insert Figure 4 – Proposed Beach Fill

Insert Figure 5 – Dredging Areas

Insert Figure 6 – Phased Beach Fill Area

NASA would continue monitoring, and adjust programs as needed to adapt to changing conditions. Two factors must be anticipated for this method. This method will require regular beach nourishment and monitoring of the topography and bathymetry of the beach would be required indefinitely. The frequency of beach nourishment would be determined by the amount of fill placed each time and by the number and severity of storm events as the project continues.

Option 3 – Sand-Retention Structure Construction Only

Under Option 3, NASA would construct sand retention structures (detached offshore breakwaters, T-head groins, or a combination of the two) along any portion of Wallops Island as the need was identified. Near shore breakwater structures reduce the amount of wave energy reaching a protected area. The size, composition, spacing, and offshore siting of the breakwater structures would be determined during engineering design and discussed more specifically in an SEA. It may take one month to build a single breakwater and NASA would construct them as funding is available. Construction would take place in the water using a barge and heavy lifting equipment. Sand may have to be trucked in and dumped over the existing seawall to introduce sand into the system.

Option 4 - Emergency Actions

Under Option 4, NASA would continue emergency actions to prevent infrastructure from being damaged during storms. This may include hauling in additional rock to add to the existing seawall, hauling and placing sand on the beach or behind existing shoreline protection, or installing sheet piling in or near the high tide mark. The quantities of material required for each method are unknown at this time and would be discussed in detail in an SEA, if necessary.

Option 5 - Installation of Geotextile Tubes

Under Option 5, NASA would place geotextile tubes (geotubes) on shore to slow down the transportation of sand off the beach and help protect onshore assets from wave action. Geotubes are composed of durable textile material formed into long cylinders that are filled with sand. The tubes, which are used instead of hard structures such as riprap, are normally placed in the backbeach parallel to the shore. Current plans consist of installing approximately 1,402 meters (4,600 feet) of geotubes from the southern terminus of the seawall to the camera station at the southern end of NASA property (Figure 7). These geotubes would be approximately 4.2 meters (14 feet) wide and 1.8 meters (6 feet) high (Figure 8). Temporary staging areas for sand (trucked in from inland borrow pits) and slurry would be located in open areas near the beach; these areas would be restored after the project is complete. Water would be pumped to the slurry pits by one temporary pipe extending to Hog Creek and one temporary pipe extending to the Atlantic Ocean.

Option 6 - Sand Dunes with Various Cores

Under Option 6, NASA would create vegetated sand dunes with one of the following cores: rock core, semi-rigid containers filled with rock or sand, geotextile tubes filled with sand or grout, or a clay core. The core would help stabilize and strengthen the dunes during larger than normal storm events. At this time locations for the sand dunes have not been identified; however, a practical option would be to utilize the existing seawall as a core material.

Insert Figure 7 – Geotextile Tube Project Location

Insert Figure 8 – Geotextile Tube Design

Typical construction vehicles may be used under Option 6. Sand may also be either trucked from inland borrow sites or dredged from the ocean.

2.2.2 Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees

Under Option 1, NASA would construct levees around critical facilities on Wallops Island, beginning with the most vulnerable structures. At this time it is not known how high the levees would need to be. Pumps would need to be installed within each levee zone to pump rain water out of the system. While these structures would protect critical infrastructure during floods, they would also become isolated and possibly inaccessible until flood waters retreat. Long-term maintenance would be required to maintain the structural integrity of the levees. Typical construction vehicles would be used for this option.

Option 2 - Elevation of Critical Structures and Roadways

Some of NASA's existing island infrastructure is elevated to 3.0 meters (9.8 feet) National Geodetic Vertical Datum (NGVD). Under this alternative, NASA would raise the elevation of new structures by filling their foundation. The elevation of new buildings would be above 3.0 meters (9.8 feet) NGVD and roadways would be raised to maintain accessibility to infrastructure during floods. Typical construction vehicles would be used for this option.

Option 3 - Elevate the Island and Structures by Pumping Sand

Under Option 3, NASA would pump sand onto Wallops Island to raise portions of the island's elevation to a predicted future rise in sea level or storm strength. The amount of sand needed to complete this process is currently unknown. Sand would likely be obtained through dredging the Atlantic Ocean or the dredging of the Chincoteague Inlet by the USACE. This process would not be practical for the entire island, or where structures already exist; however, it would be possible to pump sand onto portions of the island as NASA's mission changes or new portions of the island are utilized. The dredging would be accomplished using one or more hopper dredges. A hopper dredge, as described in Alternative 1, Option 1, is a ship which is capable of dredging material, storing it onboard, transporting it to the disposal area, and dumping it. Typical and heavy construction vehicles would be used for this option.

Option 4 - Build a Levee Around the Entire Island

Under Option 4, NASA would construct a levee around the entire island and leave existing critical infrastructure intact. This levee structure would need to be large enough to withstand strong storms. At this time the size or location of the levee is unknown. The structure would require long-term maintenance to ensure its integrity. Large construction equipment would be used for this option.

2.3 ALTERNATIVES CONSIDERED AND DISMISSED

Permeable Sill Modules

This alternative would involve placing pre-cast concrete triangular beach prisms or triangular open-lattice beach berms along the Wallops Island shoreline. However, beach prisms and beach berms tend to be knocked over and are proven to sink during larger than normal storm events. Because this alternative is likely to fail during storm events, conditions under this alternative would be no different from the existing conditions on the island and critical infrastructure would remain at risk; therefore, this alternative does not meet NASA's purpose and need.

Reconstruction of Seawall System

This alternative consists of reconstructing the original seawall system. The USACE's GENSIS computer model calculated that, under this alternative, erosion rates would not be decreased but would remain similar to historic erosion rates; therefore, this alternative would result in no change from existing conditions and critical infrastructure would remain at risk. This alternative would not meet NASA's purpose and need.

Sinking of Old Railroad Cars or Ships

This alternative consists of sinking old railroad cars or ships filled with sand near the shoreline which would theoretically reduce wave action and release sand gradually into the system. Over time, corrosion and wave action nearshore would cause pieces of these vehicles to break off, thus creating safety hazards if large pieces of metal are carried by wave action to tourist beaches. The vehicles would also create obstructions underwater that cannot be seen by watercraft. Typically, this method is more successful in deeper waters as a method of constructing artificial reefs. This alternative is not considered to be feasible for the shallow waters along the Wallops Island shoreline.

3.1 INTRODUCTION

Section 3 presents information regarding existing resources at Wallops Island that may be affected by the proposed alternatives. This section contains discussions on resources under the three main categories of Physical Environment, Biological Environment, and Social and Economic Environment.

3.2 PHYSICAL ENVIRONMENT

3.2.1 Land Resources

This section is based on information taken from the 1994 soil survey for Accomack County, Virginia, and the 1999 Environmental Resource Document completed by NASA. Resources discussed in this section are Topography and Drainage, Geology and Soils, Land Use, and the Atlantic Ocean substrate within Wallops Island and the adjacent Atlantic Ocean.

3.2.1.1 Topography and Drainage

Wallops Island is a barrier island approximately 11 kilometers (7 miles) long and 807 meters (2,650 feet) wide; it is bordered by Chincoteague Inlet to the north, Assawoman Inlet to the south, the Atlantic Ocean to the east, and marshland to the west. Assawoman Inlet is often filled in and open only intermittently during and after storm events; the silt effectively connects Wallops Island to Assawoman Island south of Wallops Island under most conditions. Much of the Atlantic shoreline of Wallops Island has been lined with an armor stone seawall to protect critical NASA, U.S. Navy, and MARS infrastructure. The beach has nearly or completely eroded in areas armored with the seawall. The unarmored shoreline segments at the north and south ends of the island consist of low sloping sandy beaches. The sandy portion of Wallops Island has an elevation of about 2.1 meters (6.9 feet) above mean sea level (amsl) (Morang, et al. 2006). The highest elevation on Wallops Island is approximately 4.6 meters (15 feet) amsl (NASA, 2006). Most of the island is below 3 meters (10 feet) amsl (NASA, 2006).

Wallops Island is separated from the mainland by a marshy bay. The marshes flood regularly with the tides and are drained by an extensive system of meandering creeks. Surface water on Wallops Island flows east through numerous tidal tributaries which subsequently flow to the Atlantic Ocean. Additionally, Wallops Island has storm drains that divert the water flow to several individual discharge locations.

Barrier islands are dynamic geologic features. They migrate, erode, and accrete in response to physical processes such as waves, tides, and wind. The Atlantic shoreline of Wallops Island has experienced erosion throughout the six decades that NASA has occupied the site. On the southern portion of the island, near the MARS facility, shoreline retreat averaged about 3.7 meters (12 feet) per year from 1857 to the present (Morang, et al. 2006). Further south, adjacent to Assawoman Inlet, shoreline retreat exceeded 5 meters (16.4 feet) a year during that same time period (Morang, et al. 2006).

As is typical of barrier islands, Wallops Island exhibits environmental zonation related to changes in topography across the island profile. Generally, dunes and maritime forest are found at the highest elevations, and beaches and marshes are found at the lowest. On Wallops Island, hardened structures such as groins, weirs, beach beams and beach prisms have disturbed natural

sediment transport processes, thereby changing the island's structure. The seawall that was constructed to protect critical infrastructure on the island has fixed the shoreline position, but has resulted in complete erosion of the beach seaward of the wall and has prevented long-term natural maintenance of the gently sloping nearshore and beach systems that would be expected to exist under natural conditions. In addition, without a beach to provide a source of sand, the island's ability to create and maintain natural dunes is restricted.

3.2.1.2 Geology and Soil

Located within the Atlantic Coastal Plain Physiographic Province, WFF is underlain by approximately 2,133 meters (7,000 feet) of sediment. The sediment lies atop crystalline basement rock. The sedimentary section, ranging in age from Cretaceous to Quaternary, consists of a thick sequence of terrestrial, continental deposits overlain by a much thinner sequence of marine sediments. These sediments are generally unconsolidated and consist of clay, silt, sand, and gravel.

The regional dip of the soil units is eastward, toward the ocean. The two uppermost stratigraphic units at WFF are the Yorktown Formation and the Columbia Group, which is not subdivided into formations. The Yorktown Formation is the uppermost unit in the Chesapeake Group and was deposited during the Pliocene epoch of the Tertiary Period. The Yorktown Formation generally consists of fine to coarse, glauconite quartz sand, which is greenish gray, clayey, silty, and in part, shelly. The Yorktown Formation occurs at depths of 18 to 43 meters (60 to 140 feet) in Accomack County (NASA, 1999).

The soil classifications for Wallops Island (Table 3-1) are based on the 1994 Accomack County Soil Conservation Service preliminary soil classification map. The Coastal Plain soils of the Eastern Shore are generally very level soils and many soil types are considered to be prime farmland by the U.S. Department of Agriculture (USDA). The dominant agricultural soils are high in sand content, which results in a highly leached condition, an acidic pH, and a low natural fertility (Accomack County SCS, 1994). Adequate artificial drainage improves productivity for poorly drained soils. Prime and unique farmlands in Accomack County include the following soils:

- Bojac fine sandy loam soils;
- Bojac loamy sand soils;
- Munden fine sandy soil;
- Munden loamy sand;
- Dragston fine sandy loam, if adequately drained; and
- Nimmo fine sandy loam, well drained.

No prime and unique soils are found on Wallops Island; therefore, the Farmland Protection Policy Act does not apply to this project and will not be discussed further.

Table 3-1 Predominant Soil Types at Wallops Flight Facility			
Location	**Soil Type**	**Typical Slopes**	**Description**
Wallops Island – eastern portion	Chincoteague silt loam	0-1 percent	Nearly level, very deep, very poorly drained hydric soils. This soil provides a suitable wildlife habitat.
Wallops Island – east of Chincoteague silt loam	Udorthents and Udipsamments	0-35 percent	Nearly level to steep, very deep, and range from well-drained to somewhat poorly drained.
Wallops Island – southern end	Fisherman Assateague fine sands complex	0-35 percent	Nearly level to steep, very deep, moderately well-drained, to excessively drained. This soil is used mainly for wildlife habitat and recreation.
Wallops Island – depressions and areas associated with dunes and salt marshes	Fisherman Comacca fine sands complex	0-6 percent	Very poorly to moderately well-drained.
Wallops Island – central and western portions in depressions and on flats associated with dunes and marshes	Comacca fine sand	0-2 percent	Nearly level, very deep, very poorly drained. The soil is used mainly for wildlife habitat and recreation.
Wallops Island – eastern portion	Assateague fine sand	2-35 percent	Gently to steeply sloping, very deep, excessively drained. This soil is rarely flooded and is used primarily for wildlife and recreation.
Wallops Island – eastern portion	Beaches		Moderately sloping and used mainly for wildlife habitat.

Source: NASA, 1999

3.2.1.3 Atlantic Ocean Substrate

The Atlantic Ocean substrate located within the project area lies in the Mid-Atlantic Bight with Baltimore Canyon bounding the north and Washington Canyon bounding the south. The depth of water in the continental shelf averages 75 meters (246 feet); however, the majority of the offshore project area is at an average depth of 16.7 meters (55 feet). Sediment texture varies from gravel patches and a fine sand mixture inshore, to medium sand offshore extending to the shelf edge (Figure 9). Fine sandy silt characterizes the edge of the shelf from 200 to 400 meters (656 to 1,312 feet). The sediments in the project area are typical of the offshore to shelf-edge area, consisting of fine quartz sand with a patchy veneer of shells (NASA, 1999).

Insert Figure 9 – Sediment Classifications

3.2.1.4 Land Use

WFF is located in the northeastern portion of Accomack County, Virginia, on the Delmarva Peninsula. WFF has its own land use classification based on operational areas at WFF (Figure 1).

Wallops Island consists of 1,680 hectares (4,600 acres), most of which is marshland, and includes launch and testing facilities, blockhouses, rocket storage buildings, assembly shops, dynamic balancing facilities, tracking facilities, U.S. Navy facilities, and other related support structures. Wallops Island is zoned for industrial use by Accomack County. The marsh area between Wallops Mainland and Wallops Island is classified as marshland in the County's plan. The area surrounding WFF consists of rural farmland and small villages and is regulated by local County government and several town councils.

The Town of Chincoteague is located across Chincoteague Inlet, approximately 8 kilometers (5 miles) north of Wallops Island on Chincoteague Island, Virginia. The Town of Chincoteague is the largest of the surrounding communities with approximately 4,317 residents, and attracts a large tourist population during the summer months because of the beaches and the annual Assateague Island pony swim and round-up. Hotels and motels as well as other summer season tourist businesses can be found on Chincoteague Island. Under an easement agreement with NASA, the Town of Chincoteague operates a series of drinking water production wells to the east of Runway 04-22 of the Wallops Airfield. WFF also has an agreement with the Town of Chincoteague to allow the Town to draw treated water from NASA during high use periods.

The Marine Science Consortium (MSC) is a consortium of 17 colleges which established and maintain classrooms, wet and dry laboratories, a computer laboratory, residence buildings, faculty and staff residences, a cafeteria, library, recreational facilities, and an administrative building adjacent to WFF. The MSC uses the Chincoteague National Wildlife Refuge, Assateague Island National Seashore, the Wallops Island National Wildlife Refuge, and WFF for access to salt and freshwater marshes, estuaries, and barrier island beaches and dunes. The Chincoteague National Wildlife Refuge is under the jurisdiction of the U.S. Department of Interior, Fish and Wildlife Service (USFWS) and is located 9.6 kilometers (6 miles) to the northeast of WFF. Assateague Island National Seashore is under the jurisdiction of the National Park Service (NPS) and is located north of Chincoteague National Wildlife Refuge, both of which attract a multitude of seasonal tourists.

The Wallops Island National Wildlife Refuge is located adjacent to the Wallops Visitors Center and is under the jurisdiction of the USFWS. This refuge is not open for use by the general public; however, in 2002 the refuge was opened to public hunting to reduce overgrazing by deer and to reduce the potential for vehicular collisions with deer along state highway 175 (USFWS, 2006).

3.2.2 Water Resources

WFF is located in the Chincoteague and Eastern Lower Delmarva watersheds. The portion of Wallops Island north of Route 803 is part of the Chincoteague watershed. The portions of Wallops Island south of Route 803 and all along the eastern edge of the island are part of the Eastern Lower Delmarva watershed.

3.2.2.1 Surface Waters

Numerous inlets, marshes, bays, creeks, and tidal estuaries are found in and around all three installation areas of WFF. A section of the Virginia Inside Passage is located west of Wallops Island. Other surface waters west of the island include; Bogues Bay, Hog Creek, Cat Creek, and an extensive marsh and tidal creek system that separates Wallops Island from the mainland. The Atlantic Ocean lies to the east of Wallops Island. Chincoteague Inlet lies to the north and Assawoman Inlet lies to the south of the island. No natural perennial streams or ponds exist on the island; however, intermittent waterbodies may form after storms or in response to other physical forces such as tides. One man-made stormwater detention pond is located north of building V-20 adjacent to the Navy AEGIS building.

Surface waters in the vicinity of WFF are saline to brackish and are influenced by the tides. The Virginia Department of Environmental Quality (DEQ) has designated the surface waters in the vicinity of WFF as Class II – Estuarine Waters (NASA, 1999). The Atlantic Ocean is designated as Class I – Open Ocean. Surface waters in Virginia must meet the water quality criteria specified in 9 Virginia Administrative Code (VAC) 25-260-50. This set of criteria establishes limits for minimum dissolved oxygen concentrations, pH, and maximum temperature for the different surface water classifications in Virginia. In addition, Virginia surface waters must meet the surface water criteria specified in 9 VAC 26-260-140. This set of criteria provides numerical limits for various potentially toxic parameters. For the Class I and II waters in the vicinity of WFF, the saltwater numerical criterion is applied. Both sets of standards are used by the Commonwealth of Virginia to protect and maintain surface water quality.

3.2.2.2 Stormwater

Wallops Island has storm drains that divert stormwater flow to several individual discharge locations. The northern portion of Wallops Island drains by overland flow to Bogues Bay and Chincoteague Inlet via Sloop Gut and Ballast Narrows. The central portion of the island drains primarily to the west toward Bogues Bay. Cross-culverts under the Island Road drain stormwater collected by culverts and ditches. Flap gates have been installed west of Island Road to convey stormwater to Bogues Bay via Hog Creek.

National Pollutant Discharge Elimination System (NPDES) regulations require permits for stormwater discharges associated with industrial activities. The Virginia DEQ is authorized to carry out NPDES permitting under the Virginia Pollutant Discharge Elimination System (VPDES). WFF currently holds VPDES permit number VA0024457 for 12 outfalls located on the Main Base and Wallops Mainland. There are no stormwater outfalls located on Wallops Island.

3.2.2.3 Marine Waters

WFF is located on a barrier island on the Atlantic Ocean. Within the potential dredging area, the Atlantic Ocean's depth ranges from less than 1 meter (3 feet) to 18 meters (60 feet). The Atlantic seaboard of Wallops Island and south to the Chesapeake Bay is relatively undeveloped.

Continental slope waters in the project area maintain a fairly uniform salinity range (32 to 36 ppt) throughout the year, with pockets of high salinity water (38 ppt) found near the Gulf Stream in the fall (NASA, 2003a). There are distinct differences in stratification of the mid-Atlantic Ocean water column between summer and winter. In the winter, the water column is vertically

well-mixed, with water temperatures averaging 14° Celsius (C) (57° Fahrenheit [F]) at the surface and 11° C (52° F) at depths greater than 20 meters (656 feet). In summer, the water column is vertically stratified with 25° C (77° F) water near the surface and 10° C (50° F) water at depths greater than 200 meters (656 feet) (NASA, 2003a).

3.2.2.4 Groundwater

Hydrogeology

The Virginia DEQ has identified four major aquifers on the Eastern Shore of Virginia: the Columbia aquifer and the three aquifers comprising the Yorktown-Eastover aquifer system. The water table aquifer, known as the Columbia aquifer, primarily consists of Pleistocene sediments of the Columbia Group (Richardson, 1992). It is unconfined and typically overlain by wind-deposited beach sands, silts, and gravel. The aquifer occurs between depths of 1.5 to 18.3 meters (5 to 60 feet) below the ground surface. The water table ranges from depths of 0 to 9.1 meters (0 to 30 feet) below the ground surface. Groundwater flow is generally east and north toward nearby creeks and the marsh area that separates Chincoteague Island from the mainland. The Yorktown-Eastover aquifer system is a multiaquifer unit consisting of late Miocene and Pliocene deposits and is composed of the sand of the Yorktown and Eastover Formations (Meng and Harsh, 1988). The top of the shallowest confined Yorktown-Eastover aquifer at WFF is found at depths of approximately 30.5 meters (100 feet) below the ground surface. It is separated from the overlying Columbia aquifer by a 6.1- to 9.1-meter (20- to 30-foot) confining layer (aquitard) of clay and silt. The Yorktown-Eastover aquifers are classified as the upper, the middle, and the lower Yorktown-Eastover aquifers. Correspondingly, each Yorktown-Eastover aquifer is overlain by the upper, middle, and lower Yorktown-Eastover aquitards. In the Wallops Island area, the Lower Yorktown-Eastover aquifer contains the freshwater/saltwater interface, which occurs at a depth of approximately 91.4 meters (300 feet) below mean sea level. In general, the water table (Columbia) aquifer on the Delmarva Peninsula is recharged by surface waters or infiltration of precipitation. The confined aquifers are recharged by the same process, but from more distant areas located beyond the immediate vicinity of WFF.

Groundwater Appropriation

WFF contains 17 water supply wells that are screened in the Columbia and Yorktown-Eastover Multiaquifer System, which is protected by the Environmental Protection Agency (EPA) as a sole source aquifer (EPA, 2003). A sole source aquifer is a drinking water supply located in an area with few or no alternative sources to the groundwater resource, and where if contamination occurred, using an alternative source would be extremely expensive. The designation protects an area's groundwater resource by requiring the EPA to review any proposed projects within the designated area that are receiving Federal financial assistance. All proposed projects receiving Federal funds are subject to review to ensure they do not endanger the water source. NASA operates five supply wells on the Main Base and two on Wallops Mainland, NOAA operates one additional well, and eight wells are operated under easement by the Town of Chincoteague. Most of the supply wells are several hundred feet deep and are constructed to withdraw water from one of the Yorktown Aquifers. No supply wells are located on Wallops Island and all potable water is piped from wells on Wallops Mainland.

Groundwater Quality

Past contamination at three sites on the Main Base has impacted groundwater quality at WFF. Chemical releases at the Former Fire Training Area, Waste Oil Dump, and Old Aviation Fuel Tank Farm resulted in contaminant plumes that have affected only the immediate groundwater quality in the Columbia Aquifer beneath the site. Water quality in the underlying Yorktown Aquifer has not been affected due to the presence of the intervening aquitard, which prevents impacted groundwater from flowing down from the Columbia Aquifer. The principal chemicals in the plumes include components of fuels and oils (in all three plumes) and solvents (chiefly in the Former Fire Training Area plume) (NASA, 2004b).

The water supply wells located on the Main Base have not been affected by the contaminant plumes. Most of the supply wells are located in the Yorktown-Eastover Aquifer, which is protected from the plumes by an aquitard. The wells that are located in the Columbia Aquifer have not been impacted because the plumes are not large enough to reach them. NASA regularly samples the supply wells and the area groundwater to ensure that the plumes are not expanding and that there is no impact on the drinking water supply. The results of comprehensive investigations indicate that each of the plumes is either at steady state or possibly receding, but none is continuing to expand. NASA has imposed institutional controls (restriction zones), intrinsic and engineered remediation, and long-term monitoring to mitigate the adverse impact of contaminants on groundwater. NASA is working with Federal and State environmental agencies to ensure that plumes do not expand and to restore groundwater to natural conditions (NASA, 2004b).

Contamination of wells on Wallops Mainland has not occurred.

3.2.2.5 Wetlands

Executive Order (EO) 11990 (Wetland Protection) directs Federal agencies to minimize the destruction, loss, and degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetland communities. Wallops Island has nontidal freshwater emergent wetlands and a few small freshwater ponds in its interior, freshwater forested/shrub wetlands and maritime forests on the western edge. Figure 10 provides further details on the types and locations of wetland communities present at WFF. In accordance with the Clean Water Act (CWA) (33 U.S.C. §1251 *et seq*.), projects at WFF involving dredging or filling of tidal or nontidal wetlands require Section 404 permits from the USACE.

3.2.2.6 Floodplains

EO 11988 (Floodplain Management) requires Federal agencies to take action to minimize occupancy and modification of the floodplain. Specifically, EO 11988 prohibits Federal agencies from funding construction in the 100-year floodplain unless there are no practicable alternatives. As shown on the Flood Insurance Rate Maps (FIRMs) produced by the Federal Emergency Management Agency (FEMA), the 100-year floodplain designates the area inundated during a storm having a 1 percent chance of occurring in any given year. The 500-year floodplain designates the area inundated during a storm having a 0.2 percent chance of occurring in any given year. FIRM Community Panels 5100010070B and 5100010100C indicate that Wallops Island is located entirely within the 100-year floodplain.

3.2.2.7 Coastal Zone Management

Wallops Island is one of a limited number of barrier islands along the Atlantic Coast of the United States. Barrier islands are elongated narrow landforms that consist largely of unconsolidated and shifting sand, and lie parallel to the shoreline between the open ocean and the mainland. Barrier islands provide protection to the mainland, prime recreation resources, important natural habitats to unique species, and valuable economic opportunities to the country. Wallops Island also contains coastal primary sand dunes that serve as protective barriers from the effects of flooding and erosion caused by coastal storms (NASA, 1999). The Coastal Barrier Resources Act (CBRA [P.L. 97-348]), enacted in 1982, designated various undeveloped coastal barrier islands as units in the Coastal Barrier Resources System. Designated units are ineligible for direct and indirect Federal financial assistance programs that could support development on coastal barrier islands; exceptions are made for certain emergency and research activities.

Insert Figure 10 – Wetlands

Wallops Island is not included in the Coastal Barrier Resources System; therefore, CBRA does not apply and will not be discussed further in this document.

The Virginia DEQ is the lead agency for the Virginia Coastal Resources Management Program, which is authorized by the National Oceanic and Atmospheric Administration (NOAA) to administer the Coastal Zone Management Act (CZMA) of 1972. Any Federal agency development in Virginia's Coastal Management Area (CMA) must be consistent with the enforceable policies of the Virginia Coastal Resources Management Program. Although Federal lands, including WFF, are excluded from Virginia's CMA, any activity on Federal land that has reasonably foreseeable coastal effects must be consistent with the Virginia Coastal Resources Management Program (Virginia DEQ, 2003). Enforceable policies of the Virginia Coastal Resources Management Program that must be considered when making a Coastal Zone Consistency Determination include:

- **Fisheries Management**. Administered by the Virginia Marine Resources Commission (VMRC), this program stresses the conservation and enhancement of shellfish and finfish resources and the promotion of commercial and recreational fisheries;
- **Subaqueous Lands Management.** Administered by the VMRC, this program establishes conditions for granting permits to use State-owned bottomlands;
- **Wetlands Management.** Administered by the VMRC and the DEQ, the wetlands management program preserves and protects tidal wetlands;
- **Dunes Management.** Administered by the VMRC, the purpose of this program is to prevent the destruction and/or alteration of primary dunes;
- **Non-point Source Pollution Control.** Administered by the Virginia Department of Conservation and Recreation (DCR), the Virginia Erosion and Sediment Control Law is intended to minimize non-point source pollution entering Virginia's waterways;
- **Point Source Pollution Control.** Administered by the DEQ, the NPDES permit program regulates point source discharges to Virginia's waterways;
- **Shoreline Sanitation.** Administered by the Department of Health, this program regulates the installation of septic tanks to protect public health and the environment;
- **Air Pollution Control.** Administered by the DEQ, this program implements the Federal Clean Air Act (CAA) through a legally enforceable State Implementation Plan (SIP); and
- **Coastal Lands Management.** Administered by the Chesapeake Bay Local Assistance Department, the Chesapeake Bay Preservation Act guides land development in coastal areas to protect the Chesapeake Bay and its tributaries.

3.2.3 Air Quality

The Clean Air Act (CAA), as amended, requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The CAA established two types of NAAQS. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set to limits to protect public welfare,

including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

The EPA has set NAAQS for six principal pollutants, which are called "criteria" pollutants. They include: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), lead (Pb), particulate matter less than or equal to 10 microns (PM_{10}), and sulfur dioxide (SO_2). The Ambient Air Quality Standards published by the Commonwealth of Virginia must be equal to, or more stringent than the NAAQS. The Commonwealth promulgates air quality standards through the State Air Pollution Control Board, which is overseen by the Virginia DEQ.

Section 176(c) of the CAA requires Federal agencies to ensure that actions undertaken in non-attainment or maintenance areas are consistent with the CAA and with federally enforceable air quality management plans. WFF is located in an attainment area for the Commonwealth's Ambient Air Quality Standards, therefore, is not required to complete the CAA conformity process (EPA, 2006). The Commonwealth standards are contained in Section 9 VAC 5-30 for the Control and Abatement of Air Pollution. Primary standards for protection of human health, and secondary standards for protection of public welfare, are included in Section 9 VAC 5-30 for criteria pollutants.

The Virginia DEQ does not currently perform ambient air quality monitoring in the vicinity of WFF. The Virginia DEQ considers the Eastern Shore of Virginia to be an attainment area for ozone, indicating compliance with primary and secondary standards. Accomack County is not designated as an Air Quality Maintenance Area. An Air Quality Maintenance Area is defined as "any area which, due to current air quality or projected growth rate or both, may have the potential for exceeding any ambient air quality standard (for criteria pollutants) within a subsequent 10-year period" (Commonwealth of Virginia, 1999). WFF has an air permit from the Virginia DEQ that allows it to maintain emissions for criteria pollutants and hazardous air pollutants below major source thresholds.

3.2.4 Noise

In EPA's Noise Control Act (NCA) of 1972 and as amended by the Quiet Communities Act of 1978, Congress declares that it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare.

Significant noise sources associated with NASA's activities at WFF include vehicular traffic, aircraft traffic, and rocket launches. In general, vehicular traffic on Wallops Island is minimal, and rocket launches are infrequent. NASA and Navy air traffic from the Main Base flies over Wallops Mainland and Island. Air traffic varies from month to month depending on NASA programs and Navy training schedules. Wind, wildlife, and wave action are the predominant sources of naturally occurring noise on Wallops Island.

Noise Standards and Criteria

Noise is defined as any loud or undesirable sound. The standard measurement unit of noise is the decibel (dB), generally weighted to the A-scale (dBA), corresponding to the range of human hearing. Since sounds in the outdoor environment are usually not continuous, a common unit of measurement is the L_{eq}, which is the time-averaged sound energy level. The L_{10} is the sound level exceeded 10 percent of the time and is typically used to represent peak noise levels. Similarly, the L_{01} and L_{90} are the noise levels exceeded 1 percent and 90 percent of the time,

respectively. The 1-hour L_{eq} is the measurement unit used to describe monitored baseline noise levels in the vicinity of WFF. It conforms to the requirements in 23 CFR, Part 772, and is a descriptor recommended by the Federal Highway Administration (FHWA) for describing noise levels during peak traffic periods.

EPA guidelines, and those of many other federal agencies, state that outdoor sound levels in excess of 55dB day night level (DNL) are "normally unacceptable" for noise-sensitive land uses such as residences, schools, or hospitals. There are no noise-sensitive land uses within 4.5 miles of the proposed project area.

3.2.5 Hazardous Materials and Hazardous Waste

In May 2001, Virginia DEQ issued its formal approval of WFF's Integrated Contingency Plan (ICP). The ICP, developed by the Environmental Office in accordance with 29 CFR 1910, Subpart H (Hazardous Materials), includes the following procedures for hazardous materials management at the entire NASA facility, including Wallops Island:

- WFF labels each container of hazardous material in English with the following minimal description: name of the chemical and all appropriate hazard warnings;
- WFF has on file in each work area Material Safety Data Sheets (MSDS) for each hazardous material used onsite. Each MSDS is in English and contains all required information. WFF utilizes an online electronic chemical inventory (MSDS-Pro) that contains links to appropriate MSDSs and is accessible to all WFF personnel through the GSFC intranet;
- Individual WFF support contractor offices train their personnel in the applicable hazardous communication pertinent to the requirements for each employee; and,
- WFF prepares and implements spill contingency and response procedures.

The WFF Environmental Office manages hazardous waste generation, including inspection, onsite transportation, storage, and shipment of all hazardous waste for Wallops Island. This office is responsible for tracking manifests and certificates of disposal for hazardous wastes that leave the facility. The Environmental Office also provides annual Hazardous Waste and Integrated Contingency Plan (ICP) training to all contractor and civil service employees who handle hazardous materials and wastes.

Approximately 11.2 kilometers (7 miles) of public roadway separate the Main Base from Wallops Island and Wallops Mainland. To prevent unauthorized transportation of hazardous waste, the EPA has assigned a hazardous waste generator number for both the Wallops Mainland and Wallops Island (VA7800020888). WFF is classified as a Large Quantity Hazardous Waste Generator because it generates more than 1,000 kilograms (2,205 pounds) of hazardous waste per month. In 2006, 3,137 kilograms (6,918 pounds) of hazardous waste were generated on Wallops Island and Wallops Mainland combined.

The regulations that govern hazardous waste management are 40 CFR 260-270 (Federal) and 9 VAC 20-60 (Commonwealth of Virginia). Wallops Island hazardous waste generators are responsible for the following:

- Properly containerizing waste;

- Properly labeling waste containers with information pertaining to the contents and with the words “Hazardous Waste”;
- Ensuring that less than 208 liters (55 gallons) of hazardous waste or less than 1 liter (1.05 quart) of acute hazardous waste are accumulated at or near the point of generation; and
- Properly completing and transferring a disposal inventory sheet to the Environmental Office.

Hazardous wastes generated on Wallops Island are stored on the Mainland at Building U-081, a less-than-90-day accumulation area. Hazardous waste may be stored at an accumulation area for up to 90 days from the date of initial accumulation. WFF uses a licensed hazardous waste transporter to transport hazardous waste to a licensed Treatment, Storage, and Disposal Facility (TSDF).

Table 3-2 lists the satellite accumulation areas on Wallops Island; the majority of which are located on the southern portion of the island. Those waste streams considered hazardous are denoted in the “HW” column. The remaining wastes are considered regulated, non-hazardous waste streams.

Table 3-2 Satellite Accumulation Areas

Bldg.	Type of Area					Waste Codes	Waste Description
	HW	Oil/Oily Rags	Universal	Project	Parts Washer		
V-010	•	•				Various, D001, D035, F003, F005, Non	Various expired chemicals, oily rags, paint rags
V-024		•				Non	Oily rags and oily condensate
W-015		•				Non	Used oil
W-040	•					Non, D001	Used oil, JP10 mixed with hydraulic fluid
W-065				•			Drones and special projects
X-030	•					D001, F003, F005, D035	Paint thinner
X-035		•				Non	Used oil and oily rags
Y-055				•		Non	Antenna oil changes

3.2.6 Unexploded Ordnance

Unexploded ordnance (or UXOs) are explosive munitions (bombs, shells, grenades, etc.) that did not explode when they were employed and still pose a risk of detonation. According to a map of

historic Ordnance and Explosives Impact Areas (Figure 11) dated September 2006, there are nine known historic live fire and bombing areas off of Wallops Island; none of these are currently active. On the northernmost portion of the island, there was a target center, active between 1946 and 1959, and a gunboat point bombing area, used in 1952, with a firing line that extended approximately 3.2 kilometers (2 miles) southeast into the ocean. Along this firing line, there was also a sea target, utilized in the late 1940s and early 1950s, located approximately 1.6 kilometers (1 mile) out to sea. A machine gun and rocket firing area, used in the 1950s, was located on the northern portion of the island with a line of fire that extends approximately 5 miles southeast into the ocean. An explosive ammunition test facility was located on the central portion of the island shoreline with a firing line that extends approximately 8 kilometers (5 miles) east-southeast into the ocean. A strafing target, used to test aircraft machine guns was located on land on the northeastern tip of Wallops Island.

A map of Borrow Site Recommendations (Figure 5), dated September 2006, delineates three proposed borrow sites (Sector 1, 2, and 3) for the impending shoreline restoration project. Sectors 2 and 3 parallel the northern two-thirds of the island and extend 4.8 kilometers (3 miles) southeast into the Ocean. All of the historic firing areas and sea targets are located within Sectors 2 and 3; these areas have the potential for many live or chemically dangerous UXOs.

Insert Figure 11 – Location of Potential UXOs

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 Vegetation

Wallops Island is a barrier island that contains various ecological succession stages, including beaches, dunes, swales, maritime forests, and marsh. These natural vegetative zones form a series of finger-like stands that merge or grow into each other. The northern and southern dune vegetation on Wallops Island directly borders salt marshes.

The dune system from east to west includes the sub-tidal zone, inter-tidal zone, and upper beach zone. The inter-dune swale zone includes the area located between the westernmost portion of the dune zone and the maritime zone. The dune and swale zone is an extremely harsh environment. Biotic resources in this zone must be very adaptable to contend with high temperatures, high winds, salt, sandblasting, drought, and low nutrient levels in the sandy soil medium (NASA, 1999). Dominant species within the dune system include seabeach orach (*Atriplex arenaria*), common saltwort (*Salsola kali*), sea rocket (*Cakile edentula*), American beachgrass (*Ammonphila breviligulata*), and seaside goldenrod (*Solidago sempervirens*).

The sub-tidal zone on the eastern side of Wallops Island extends from the lower limit of low tide to the seaward-most limit of wave action. Because of the dynamics of wave action, few plants exist in the sub-tidal zone. Phytoplankton are prevalent, as well as macroalgae, algae attached to substructure, and eelgrass (*Zostera marina*) in areas of diminished wave action.

The inter-tidal zone is a transition zone exposed during low tide and totally submerged at high tide. The inter-tidal zone is an extremely dynamic area. Plant species are virtually nonexistent in the inter-tidal zone located on the eastern portion of Wallops Island because of the deleterious effects of wave action on the stability of the zone. Microscopic plants and animals exist in the minute spaces between individual sand grains in the eastern inter-tidal zone.

The upper beach zone extends from the high-tide mark to the crest of the easternmost dune. On Wallops Island this zone is found on the northern and extreme southern sections of the island. The remaining eastern section of the island is a developed, operational area that is protected by an extensive seawall built where the upper beach zone would normally exist. Vascular plant life maintains a tenuous foothold in this area. Plants such as sea rocket and beach grass are scattered on the northern part of the island.

On the southern part of Wallops Island, the dune and swale zone extends to the tidal marsh on the western side of Wallops Island with no maritime forest present. In the middle and northern areas, the dune and swale zone extends to the maritime zone that starts where the secondary dune line once existed. The northern part of Wallops Island within the dune and swale zone is in an almost natural state, and is dominated by northern bayberry (*Morella pensylvanica*), wax myrtle (*Morella cerifera*), groundsel-tree (*Baccharis halimifolia*), and American beachgrass.

The central portion of Wallops Island is dominated by common reed (*Phragmites australis*) and maintained lawn areas. Common reed is invasive and has the ability to grow in areas with very low habitat value; it is considered by many to be an undesirable plant. Due to its successful competition with many other plant species, the common reed has virtually taken over much of the area in the center of Wallops Island.

A small area of maritime forest zone exists on the central portion of the island, with an expansive thicket zone on the northern part. The thicket zone is dominated by extensive clusters of northern bayberry, wax myrtle, and groundsel-tree. The thicket zone in some areas is virtually impenetrable due to dense stands of poison-ivy (*Toxicodendron radicans*) and greenbriar (*Smilax* spp.), which is also pervasive on other areas of Wallops Island. The northern maritime forest zone is dominated by loblolly pine (*Pinus taeda*) and cherry trees (*Prunus* spp.), with an understory of northern bayberry, wax myrtle, and groundsel-tree.

Between Wallops Island and Wallops Mainland extends 461.3 hectares (1,140 acres) of tidal marsh. A tidal marsh is an area of low-lying wetlands that is influenced by the tides. The marsh is interlaced with small streams known locally as "guts." The marsh itself can be divided into the low marsh and the high marsh – each a distinctive community. The low marsh, which is inundated at high tide, is dominated by saltmarsh cordgrass (*Spartina alterniflora*). The high marsh, which is flooded by approximately 50 percent of the high tides, is dominated by salt meadow cordgrass (*S. patens*). The marshes are of tremendous importance to marine life and to the terrestrial and avian species that depend on the marshes for their existence.

3.3.2 Terrestrial Wildlife and Migratory Birds

Wallops Island hosts both terrestrial and aquatic forms of fauna that comprise its biotic communities. Terrestrial and aquatic species are particularly concentrated in the tidal marsh areas, which provide abundant habitat.

3.3.2.1 Invertebrates

Wallops Island, particularly the tidal marsh area, has an extensive variety of invertebrates. Salt marsh cordgrass marshes have herbivorous insects such as the salt marsh grasshopper (*Orchelium fidicinium*) and the tiny plant hopper (*Megamelus* spp). Plant hopper eggs are in turn preyed upon by a variety of arthropods. The tidal marshes are inhabited by a number of parasitic flies, wasps, spiders, and mites. The spiders prey mostly on herbivorous insects, and mites prey primarily on microarthropods found in dead smooth cordgrass. Salt marsh mosquitoes (*Ochlerotatus sollicitans*) and greenhead flies (*Tabanus nigrovittatus*) are prevalent insects at WFF.

Particular species inhabit different areas of the marsh depending on their ability to adapt to the fluctuating tides. Many insects and arachnids can tolerate lengthy submersions. Insects that cannot sustain long submersions tend to move up the marsh vegetation during high tide. For example, periwinkle snails (*Littorina irrorata*) and mud snails (*Ilyanassa obsoleta*) can withstand lengthy submersions and are found mainly on the marsh surface, while the majority of the predatory spiders, which are unable to withstand submersions, live within the vegetation above the mean high water level.

Coastal invertebrates in the Wallops Island area include ghost crabs (*Ocypode quadrata*), calico crabs (*Ovalipes ocellatus*), fiddler crabs (*Uca* spp.), sand shrimp (*Cragon septemspinosa*), moon jelly (*Aurelia aurita*), and coffee bean snails (*Melampus bidentatus*). Crab distributions are limited by high salinities. Squid (*Lolliguncula brevis*) are prevalent during the winter.

3.3.2.2 Amphibians and Reptiles

Amphibians and reptiles use the dune and swale zones of Wallops Island for foraging. Fowler's toad (*Bufo woodhoussei*) can be found under stands of bayberry. The green tree frog (*Hyla cinerea*) can be found in the wetter areas in the northern portion of Wallops Island. Some species of reptiles such as the black rat snake (*Elapha obsoleta*), hognose snake (*Heterodon platyrhinos*), snapping turtle (*Chelydra serpentina*), box turtle (*Terrapene carolina*), and northern fence lizard (*Sceloporus undulatus*) can be found in low-lying shrubby areas. Diamondback terrapin (*Malaclemys terrapin*) can be found in saltmarsh estuaries, tidal flats, and lagoons.

3.3.2.3 Mammals

Mammals such as white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis marsupialis*), raccoon (*Procyon lotor*), and grey squirrel (*Sciurus carolinensis*) are plentiful at WFF. Raccoon and red fox (*Vulpes vulpes*) are occasionally found in the upper beach zone and the inter-tidal zone. The grey squirrel and opossum make their homes in the maritime forest along with other mammals that use other sections of the island for forage and shelter.

Mammals such as raccoon, red fox, white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), rice rat (*Oryzomys palustris*), white-tailed deer, and Eastern cottontail rabbit (*Sylvilagus floridanus*) are found in the dune and swale zone.

3.3.2.4 Avifauna

During spring and fall migrations, approximately 15 species of shorebirds feed on microscopic plants and animals in the inter-tidal zone. Abundant among these are the sanderling (*Calidris alba*), semi-palmated plover (*Charadrius semipalmatus*), red knot (*Calidris canutus*), short-billed dowitcher (*Limnodromus griseus*), and dunlin (*Calidris alpina*). The willet (*Catoptrophorus semipalmutus*) is very common during the breeding season. Royal tern (*Sterna maxima*), common tern (*S. antillarum*), and least tern (*S. hirundo*) can be observed during the summer months. In addition, the piping plover (*Charadrius melodus*), a federally threatened, state endangered species, and Wilson's plover (*Charadrius wilsonia)*, a state threatened species, sometimes nest on the northern and southern ends of Wallops Island.

Laughing gulls (*Larus atricilla*), herring gulls (*L. argentatus*), and great black-backed gulls (*L. marinus*) commonly forage in the upper beach zone and the intertidal zone. Forster's terns (*S. foresteri*) are common in the marshes and on occasion may winter in the WFF area. Birds that use the shrub zones include various species of sparrows, red-winged blackbirds (*Agelaius phoeniceus*), boat-tailed grackles (*Quiscalus major*), and fish crows (*Corvus ossifragus*). Birds common in the shrub zone include the song sparrow (*Melopiza melodia*), gray catbird (*Dumetella carolinensis*), yellowthroat (*Geothlypis trichas*), and mourning dove (*Zenaida macroura*). Resident Canadian geese (*Branta canadensis*) are found year-round in open uplands portions of the property.

Raptors, including State endangered peregrine falcons (*Falco peregrinus*), northern harriers (*Circus cyaneus*), and osprey (*Pandion haliaetus*), inhabit the marsh areas west of Wallops Island. Great horned owls (*Bubo virginianus*) can be found in the maritime forest, and the federally threatened bald eagles (*Haliaeetus leucocephalus*) can often be seen flying over the

facility although they do not nest on Wallops Island. There is an active bald eagle nest just north of the WFF Main Base; this nest is located more than 8 miles away from Wallops Island.

Threatened and endangered species are addressed in Section 3.3.3 (Threatened and Endangered Species).

3.3.2.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) was enacted to ensure the protection of shared migratory bird resources. The MBTA prohibits the take and possession of any migratory bird, their eggs, or nests, except as authorized by a valid permit or license. A migratory bird is any species that lives, reproduces, or migrates within or across international borders at some point during its annual life cycle. The Atlantic Flyway route is of great importance to migratory waterfowl and other birds during the spring and fall. The coastal route of the Atlantic Flyway, which in general follows the eastern seaboard, is a regular avenue of travel for migrating land and water birds that winter on the waters and marshes south of Delaware Bay. Ducks, geese, shorebirds, songbirds, and raptors pass through the Atlantic Flyway. Some species use Wallops Island as a stopover point while others use the island and surrounding habitats as an overwintering area.

3.3.3 Threatened and Endangered Species

The Endangered Species Act (ESA) (16 USC 1531 et seq.) provides a legal mechanism to protect species that are in danger of extinction. As stated in the ESA, an endangered species is "any species which is in danger of extinction throughout all or a significant portion of its range" and a threatened species is "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." NASA is obligated to protect any federally listed species present on facility grounds. Table 3-3 lists Federal endangered and endangered species that may exist on or in the vicinity of Wallops Island.

Table 3-3 Federally Endangered and Threatened Species

Scientific Name	Common Name	Status
Megaptera novaeangliae	Humpback Whale	Endangered
Balaeanoptera physalus	Fin Whale	Endangered
Eubalaena glacialis	Right Whale	Endangered
Dermochelys coriaces	Leatherback Sea Turtle	Endangered
Eretmochelys imbricate	Hawksbill Sea Turtle	Endangered
Lepidechelys kempi	Kemp's Ridley Sea Turtle	Endangered
Caretta caretta	Loggerhead Sea Turtle	Threatened
Chelonia mydas	Atlantic Green Sea Turtle	Threatened
Haliaeetus leucocephalus	Bald Eagle	Threatened
Charadrius melodus	Piping Plover	Threatened

The three federally endangered whale species are transient to the waters off Wallops Island. The Leatherback, Hawksbill, Kemp's Ridley, Loggerhead, and Atlantic Green sea turtles are known to migrate along east coast beaches. Sea turtle nests have not been discovered on Wallops Island; however, sea turtle crawl tracks, a sign of potential nesting activity, have been found infrequently.

An active bald eagle nest exists across the northern border of WFF Main Base, more than 8 miles away from Wallops Island; therefore, it is not considered within the project area and will not be discussed further. Piping plover nesting habitat has been delineated on Wallops Island dunes. Figure 12 shows the known locations of protected species on Wallops Island.

The ESA also regulates the critical habitat of threatened and endangered species. Critical habitat is defined as the geographical area essential to the survival and recovery of a species. The piping plover is known to breed on Wallops Island, and therefore, portions of the island are protected as critical habitat (Figure 12). The northern and southern beaches have been closed to vehicle and human traffic during the plover's nesting season (March 15th through September 1st) since 1986. Biologists from the Chincoteague National Wildlife Refuge and the Virginia Department of Game and Inland Fisheries monitor piping plover nesting activities and provide advice to WFF on protection and management of the species (NASA, 2003a). Biologists from the USDA Wildlife Service aid with predator control.

Marine Mammals and Fish

3.3.3.1 Marine Mammals

The Marine Mammal Protection Act of 1972 (MMPA) prohibits the taking of marine mammals on U.S. seas. The statutory definition of "take" is "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill." Section 101(a)(5) of the MMPA directs the Secretary of the Department of Commerce to allow, upon request, the incidental (but not intentional) take of marine mammals. There are 23 marine mammal species within the project area (NASA, 2003a). Included are cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals). See Table 3-4 for a list of the most common marine mammals found in the project area.

Table 3-4 Marine Mammals in the Project Area

Common Name	Scientific Name		Common Name	Scientific Name
Pygmy Sperm Whale	*Kogia breviceps*		Atlantic White-Sided Dolphin	*Lagenodelphis acutus*
Dwarf Sperm Whale	*Kogia simus*		Risso's Dolphin	*Grampus griseus*
True's Beaked Whale	*Mesoplodon mirus*		Striped Dolphin	*Stenella coeruleoalba*
Blainville's Beaked Whale	*Mesoplodon densirstris*		Spinner Dolphin	*Stenella longirostris*
Sowerby's Beaked Whale	*Mesoplodon bidens*		Clymene Dolphin	*Stenella clymene*
Cuvier's-Beaked Whale	*Ziphius cavirostris*		Melon-Headed Whale	*Peponocephala crassidens*
Northern Bottlenose Whale	*Hyperoodon ampullantus*		Short-Finned Pilot Whale	*Globicephala macrorhynchus*
Rough-Toothed Dolphin	*Steno bredanensis*		Long-Finned Pilot Whale	*Globicephala melas*
Bottlenose Dolphin	*Tursiops truncates*		Harbor Porpoise	*Phocoena phocoena*
Atlantic Spotted Dolphin	*Stenella frontalis*		Harbor Seal	*Phoca vitulina*
Pantropical Spotted Dolphin	*Stenella attenuata*		Gray Seal	*Halichoerus grypus*
Common Dolphin	*Delphinus* spp.			

Source: NASA, 2003a

Insert Figure 12 – Known Endangered and Threatened Species Locations

3.3.3.2 Fish

Common fish in the waters near WFF include the Atlantic croaker (*Micropogonias undulatus*), sand shark (*Carcharias taurus*), smooth dogfish (*Mustelus canis*), smooth butterfly ray (*Gymnura micrura*), bluefish (*Pomatomidae saltatrix*), spot (*Leiostomus xanthurus*), and flounder (*Paralichthys dentatus*) (NASA, 1999). Salinity and water depths play a major role in determining if a coastal fish species is present in the bays and inlets near the island. An example of this is the sandbar shark (*Carcharhinus plumbeus*), which is one of the most common sharks in the coastal and estuarine waters near Wallops Island. If the channels located between Wallops Mainland and Wallops Island are at least 3.7 meters (12 feet) deep and the salinity is at least 30 ppt, then the sandbar shark can thrive in the channels (NASA, 1999).

The tidal marsh areas of WFF act as nursery grounds for a variety of fish species due to the protection the marsh grasses provide and the abundance of food (NASA, 1999). Eelgrass, for example, provides protection to the spot (*Leiostomus xanthurus*), the northern pipefish (*Syngnathus fuscus*), the dusky pipefish (*Syngnathus floridae*), and bay anchovy (*Anchoa mitchilli*) (NASA, 1999).

There are no fish species within the project area that are listed as threatened or endangered under the ESA.

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act), as amended, gives the United States exclusive management authority over fisheries, except for highly migratory species of tuna, within a fishery conservation zone of 5 to 322 kilometers (3 to 200 miles) offshore. The Mid-Atlantic Fisheries Management Council (MAFMC) is responsible for managing fisheries in Federal waters off the Atlantic Coast, including the project area fisheries, in accordance with the Magnuson-Stevens Act. To promote the long-term health and stability of managed fisheries, the MAFMC utilizes Fishery Management Plans (FMPs) for the following species or species complexes: mackerel, squid and butterfish; bluefish; dogfish; surf clam and ocean quahog; summer flounder, scup, and sea bass; and tilefish. The Magnuson-Stevens Act also mandates the identification of Essential Fish Habitat (EFH) for managed species. EFH is defined as the waters or substrate necessary for fish to spawn, breed, feed, or grow to maturity. Table 3-5 provides a list of species with designated EFH for areas of the Atlantic Ocean potentially affected by the Proposed Action. The project area also features intermittent floating *Sargassum* habitat, which is considered EFH. Live/hard EFH communities are not known to occur naturally in the project area, except for those that exist on man-made structures such as shipwrecks and artificial reefs.

Table 3-5 Species with Designated Essential Fish Habitat in the Project Area				
Species Common (Scientific) Name	**Eggs**	**Larvae**	**Juveniles**	**Adults**
red hake (*Urophycis chuss*)	X	X	X	
witch flounder (*Glyptocephalus cynoglossus*)	X	X		
winter flounder (*Pleuronectes americanus*)	X	X	X	X
yellowtail flounder (*Pleuronectes ferruginea*)		X		
windowpane flounder (*Scopthalmus aquosus*)	X	X	X	X
Atlantic sea herring (*Clupea harengus*)				X
monkfish (*Lophius americanus*)	X	X		
bluefish (*Pomatomus saltatrix*)		X	X	X
Atlantic butterfish (*Peprilus triacanthus*)			X	X
summer flounder (*Paralicthys dentatus*)	X	X	X	X
scup (*Stenotomus chrysops*)			X	X
black sea bass (*Centropristus striata*)		X	X	X
surf clam (*Spisula solidissima*)			X	
spiny dogfish (*Squalus acanthias)*			X	X
king mackerel (*Scomberomorus maculates*)	X	X	X	X
Spanish mackerel (*Scomberomorus maculates*)	X	X	X	X
cobia (*Rachycentron canadum*)	X	X	X	X
red drum (*Sciaenops occelatus*)	X	X	X	X
sand tiger shark (*Odontaspis taurus*)		X		X
Atlantic angel shark (*Squatina dumerili*)		X	X	X
Atlantic sharpnose shark (*Rhizopriondon terraenovae*)				X
dusky shark (*Charcharinus obscurus*)		X	X	
sandbar shark (*Charcharinus plumbeus*)		X	X	X
scalloped hammerhead shark (*Sphyrna lewini*)			X	
tiger shark (*Galeocerdo cuvieri*)		X		

3.4 SOCIAL AND ECONOMIC ENVIRONMENT

The following sections provide background information on the social and economic characteristics of Wallops Island and the surrounding area. The majority of the data presented was collected from the U.S. Department of Commerce Bureau of Census 2000 data, with supplemental information gathered from WFF and local sources.

3.4.1 Population

The study area chosen for this Programmatic EA includes Accomack County in Virginia. WFF is located in Accomack County, Virginia, which is the northernmost of the two Virginia counties on the southern end of the Delmarva Peninsula.

WFF is located in a rural area, and year-round densities of neighboring areas are low. In 2000 the U.S. Census Bureau reported that Accomack County's population was 38,305 and the population density was of 52.3 people per square kilometer (84.1 people per square mile) (U.S. Census Bureau, 2004).

Chincoteague Island, Virginia, is approximately 8 kilometers (5 miles) east of the Main Base. It is the largest densely populated area near WFF, with a resident population of 4,317 people. Area populations fluctuate seasonally. During the summer months, the population increases due to tourism and vacationers who visit the nature reserve and beaches of Assateague Island. Daily populations often reach up to 15,000 in the summer months. Special events, such as the Assateague annual pony swim and roundup/auction, sponsored by the Chincoteague Volunteer Fire Department in July, draw crowds of up to 40,000. Table 3-6 lists the 2000 U.S. Census population of nearby towns in Accomack County.

Table 3-6 Town Population and Housing Units in Accomack County

Location	Population	No. of Housing Units
Accomac Town	547	235
Atlantic	539	272
Belle Haven Town	421	213
Bloxom Town	395	175
Chincoteague Town	4,317	3,970
Hallwood Town	290	121
Keller Town	173	90
Melfa Town	450	205
Onancock Town	1,525	733
Onley Town	496	271
Painter Town	246	117
Parksley Town	837	405
Saxis Town	337	193
Tangier Town	604	270
Wachapreague Town	236	225

Source: U.S. Census Bureau, 2004

3.4.2 Recreation

Wallops Island is located on Virginia's Eastern Shore, which is a popular tourist destination. However, Wallops Island, including Wallops Beach, is not open to the public for recreational purposes.

The coast of Virginia is a popular area for recreational and sport fishing. The Marine Recreational Fishery Statistics Survey (MRFSS) conducted by the National Marine Fisheries Service (NMFS) provides estimates of fishing effort, catch, and participation by recreational anglers in the marine waters of the U.S. According to the MRFSS estimates, almost 1.9 million people participated in recreational, marine fishing in waters off the coast of Virginia in 2004 (MRFSS, 2004).

3.4.3 Employment and Income

This section provides general background information on employment and income data for the WFF region. This includes Census 2000 data on the employment, unemployment, income, and poverty characteristics of the region, as well as statistics for WFF itself.

Accomack County is approximately average in the Delmarva region in terms of unemployment rates. The total labor force of Accomack County is 18,116 people, 133 of whom are employed by the armed forces. The percentage of the county unemployed is 5.1% The average weekly wage is $512.00 (VEC, 2006). It is also notable that employment fluctuates seasonally in this region, with lower unemployment during the months of June through October. Unemployment typically ranges between 4 and 6 percent during these months (NASA, 2003a).

Table 3-7 lists the distribution by broad occupational categories for Accomack County as reported by the 2000 Census.

Table 3-7 Accomack County Employee Distribution

Category	Accomack Employees (percent)
Management, professional, and related occupations	24
Service occupations	17
Sales and office occupations	22
Farming, fishing, and forestry occupations	6
Construction, extraction, and maintenance occupations	11
Production, transportation, and material moving occupations	20

Source: U.S. Census Bureau, 2004

NASA employed 263 permanent, full-time civil service personnel at WFF in 2006. Navy and NOAA personnel also work at the facility. At the WFF site, there were approximately 1,100 employed personnel, including civil service and contractor employees in 2006. WFF is the second largest employer in Accomack County. Other large employers on the Eastern Shore are Perdue Farms (1,900 employees) and Tyson Foods (950 employees) (ESVEDC, 2004).

3.4.4 Health and Safety

3.4.4.1 Health Facilities

Three local emergency health services are located in the vicinity of WFF. WFF has its own health unit with a full-time nursing staff and a full-time physician to provide first aid and immediate assistance to patients in emergency situations. The Health Unit operates from 0800 hours to 1630 hours. After-hours emergency medical care is provided by Emergency Medical Services staff of the WFF Fire Department. The Chincoteague Medical Center on Chincoteague Island and the Atlantic Medical Center in Oak Hall, Virginia, also provide emergency assistance, and both are located within 8 kilometers (5 miles) of WFF. Four hospitals are also located in the region, all within 64 kilometers (40 miles) of WFF. These hospitals include:

- Atlantic General Hospital in Berlin, Maryland;
- McCready Memorial Hospital in Crisfield, Maryland;
- Peninsula Regional Medical Center in Salisbury, Maryland; and
- Shore Memorial Hospital in Nassawadox, Virginia.

The Peninsula Regional Medical Center in Salisbury serves as the regional trauma center for the Delmarva Peninsula. If additional trauma care is needed, Sentara Norfolk General Hospital is 19 minutes away (by helicopter) from the Shore Memorial Hospital in Nassawadox, Virginia. Accomack and Northampton County Health Departments offer clinical services. Worcester, Somerset, and Wicomico Counties also have health departments. Five nursing homes on Virginia's Eastern Shore and eight nursing homes on Maryland's Lower Eastern Shore are available to the surrounding communities.

3.4.4.2 Fire and Police Protection

Wallops Island houses one of two buildings utilized by WFF fire company personnel. There is 24-hour fire and protection services, and personnel are trained as first responders for hazardous materials, waste, and oil spills. The WFF Fire Department has a Mutual Aid Agreement with the Accomack-Northampton Fireman's Association for any outside assistance needed at the facility (NASA, 1999). There are 21 existing Fire and Rescue stations in Accomack County. The local fire companies nearest WFF are in the towns of Atlantic, Chincoteague, and New Church, Virginia.

WFF maintains a security force that is responsible for the internal security of the base. The force provides 24-hour-per-day protection services for 2,428 hectares (6,000 acres) of real estate, 513 buildings and structures, and approximately 1,100 employees and 34,000 visitors per year (NASA, 1999). Two entrance gates to the WFF are used to control and monitor daily employee and visitor traffic. Other services provided by the security force include security patrols, employee and visitor identification, mail delivery, after-hours security checks, and police services.

Police protection for the surrounding areas is supplied by town, county, and State personnel. The Commonwealth of Virginia's police force employs 23 officers in the area, while the Accomack County Sheriff's Office has approximately 34 officers. Several towns also have their own police forces, including: Bloxom, Cape Charles, Chincoteague, Exmore, Ocean City, Onancock, Onley,

Parksley, Pocomoke, Salisbury, Saxis, and Tangier (Eastern Shore Chamber of Commerce, 2004).

3.4.5 Cultural Resources

In November 2003, WFF prepared a *Cultural Resources Assessment of Wallops Flight Facility, Accomack County, Virginia* that examined each of the three areas of the facility: Wallops Main Base, Wallops Mainland, and Wallops Island (URS/EG&G, 2003). The study was completed to assist NASA and WFF in meeting its obligations under Section 106 and Section 110 of the National Historic Preservation Act (NHPA) of 1966, as amended. Based on the NHPA, the age criterion for consideration of a historic structure is 50 years. For planning purposes, this study used the 1955-2005 date range as the youngest applicable 50-year. Additionally, it established a predictive model for understanding the archaeological potential at WFF.

As a continuation of the Section 106 process following the initial 2003 reconnaissance survey task, an intensive historic site and structure survey was conducted in conjunction with historic research to develop a historic context for WFF that would provide the necessary information with which to make National Register eligibility determinations for above-ground buildings and structures. Those findings were presented in the *Historic Resources Survey and Eligibility Report for Wallops Flight Facility* (URS/EG&G, 2004) which was submitted to the Virginia Department of Historic Resources (VDHR), which acts as the State Historic Preservation Office (SHPO) for review and comment. The historic context developed for the report, in conjunction with field observations, served as the basis of evaluation for the buildings and structures determined to be (or soon to be) 50 years or older at WFF. Of the 124 buildings assessed that pre-date 1956, 25 still exist on Wallops Island (Figure 13). It was determined that two resources—the Wallops Coast Guard Lifesaving Station (VDHR #001-0027-0100; WFF# V-065) and its associated Coast Guard Observation Tower (001-0027-0101; WFF# V-070)—are eligible for listing in the National Register and Virginia Landmarks Register (Appendix D). The other surveyed resources were determined not to be National Register-eligible because they lack the historical significance and/or integrity necessary to convey significance.

In a letter dated November 4, 2004, the VDHR concurred with the survey findings and eligibility determinations, recommending that the Wallops Coast Guard Lifesaving Station, located on Wallops Island, is potentially eligible for the National Register, with the Observation Tower as a contributing structure (Appendix D).

The *Cultural Resources Assessment* also determined that the cultural resources at WFF consist of six archaeological sites, two of which are historic sites on Wallops Island (Figures 14 and 15); and a total of 166 structures that are at least 55 years old, 25 of which are located on Wallops Island. Comments from VDHR were received in a letter dated December 4, 2003 (Appendix D). The letter concurred with the recommendations of the Assessment. VDHR accepted the predictive model for archaeology at WFF, noting that many of the areas with moderate to high archaeological potential are unlikely to be disturbed by future construction or site use.

Figure 13 – Wallops Island Historic Resources Survey Sites

Figure 14 – Wallops Island Prehistoric Archaeological Site Sensitivity

Figure 15 – Wallops Island Historic Archaeological Site Sensitivity

In anticipation of the need for shoreline restoration measures, NASA conducted an archaeological survey of 6.2 kilometers (3.85 miles) of beach/coastline on Wallop's Island on September 18, 2006 (Appendix D). The purpose of the archaeological survey was to identify any potentially significant cultural resources, including both above ground resources, i.e., historic structures, and archaeological sites, which may contribute to knowledge of the archaeological heritage of Accomack County. During the survey, field archaeologists were searching for all significant cultural materials within the project area. No significant cultural remains or archaeological sites were discovered during this evaluation. Based upon this information, no further archaeological evaluation of this beachfront is merited or recommended, a finding which was submitted to the VDHR for their comment and concurrence on January 26, 2007. To date no response has been received from VDHR.

In anticipation of the need for slurry pits for the geotube portion of the restoration program, NASA conducted a small archaeology and historic structure survey. A total of 2.98 kilometers (1.85 miles) of beach line was traversed during the archaeological survey on January 22, 2007; this included a portion of beachfront which was found to be moderately sensitive to potential historic archaeological sites (Figure 14). During the survey, field archaeologists were searching for all significant cultural materials within the geotube project area. No significant cultural remains or archaeological sites were discovered during this evaluation. Based upon this information, no further archaeological evaluation of this beachfront is merited or recommended, a finding which was submitted to the VDHR for their comment and concurrence on January 24, 2007.

To address the potential for off-shore archaeological resources that could be affected by the proposed beach restoration, a Phase I remote sensing survey of one or more sand borrow areas and off-shore construction sites was suggested once the exact locations of potential areas are identified by the Army Corps of Engineers, Norfolk District. The findings of this remote sensing survey would be submitted to VDHR for their comment and reviewed further under separate 106 and NEPA documentation.

3.4.6 Environmental Justice

The goal of environmental justice from a Federal perspective is to ensure fair treatment of people of all races, cultures, and economic situations with regard to the implementation and enforcement of environmental laws and regulations, and Federal policies and programs. EO 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low Income Populations," (and the February 11, 1994 Presidential Memorandum providing additional guidance for this EO) requires Federal agencies to develop strategies for protecting minority and low-income populations from disproportionate and adverse effects of Federal programs and activities. The EO is "…intended to promote non-discrimination in Federal programs substantially affecting human health and the environment."

WFF has prepared an Environmental Justice Implementation Plan (EJIP) to comply with EO 12898. The Census 2000 average household income for Accomack County is $30,250. The EJCC has also defined minority communities as exceeding a 50 percent minority population. A review of Accomack County Census data provided the baseline for the facility's EJIP.

A review of updated Census data is provided in Table 3-8.

Table 3-8 Environmental Justice Concerns – by Census Tract, Accomack County, VA				
Tract	**Location**	**Percent Minority 2000**	**Percent Low Income 2000**	**Percent Poverty 2000**
9901	MD/VA line south including Fisher's Point.	1.97 percent	51.53 percent	12.80 percent
9902	MD/VA line south including Wallops Island to Assawoman Inlet.	41.75 percent	49.96 percent	16.38 percent
9903	West of 9902 and 9904, MD/VA line south to Ann's Cove Road.	24.66 percent	55.94 percent	19.28 percent
9904	East of Mears Station Road, South of 9902 south to Horseshoe Lead.	59.14 percent	51.61 percent	27.14 percent

Source: U.S. Census 2004

Chincoteague Island is the closest populated area to the seaward side of Wallops Island. No minority or low-income communities exist on the portion of Chincoteague Island that lies within a 4-kilometer (2.5-mile) radius of Wallops Island.

EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks," encourages Federal agencies to consider the potential effects of Federal policies, programs, and activities on children. Consistent with NEPA, this and other EOs concerned with impacts to the human environment have been analyzed in this document. The closest day care centers, schools, camps, nursing homes, and hospitals are addressed within the EJIP.

Low-income and minority populations do not occur in the vicinity of WFF. No nursing homes, hospitals, or schools are located in close proximity to WFF. One public campground, Trail's End, is located approximately 1.48 kilometers (0.92 mile) northeast of the Magazine Storage Area (M-Area) which is on the Main Base. One day care center, Three Bears, is located approximately 2.51 kilometers (1.56 miles) south-southwest of the M-Area. Neither of these facilities is near the project area.

Accomack County is on the lower end of income measures in the region, however. As a result, the county is also on the higher end of poverty levels in the region based on Census 2003 and 2004 data reports. The per capita income in Accomack County in 2004 was reported to be $22,256 with an estimated 15.4% of people below the poverty level (http://www.fedstats.gov/, last accessed on January 28, 2007). In the Commonwealth of Virginia, the average rate of individuals in 2005 below the poverty level is 10% with a per capita income of $29,148 statewide (U.S. Census Bureau, 2004).

3.4.7 Transportation

The Main Base and Wallops Mainland are connected by approximately 10 kilometers (6 miles) of the paved, two-lane Route 679. A NASA-owned road, bridge, and causeway link Wallops Mainland to Wallops Island. Hard surface roads provide access to all buildings on WFF. NASA maintains all roads within the facility.

NASA and most organizations at WFF own and maintain a variety of vehicles ranging from sedans and vans to trucks. There is no public transportation on base.

Commercial air service to the area is provided through the Norfolk International Airport, about 145 kilometers (90 miles) to the south, and the Salisbury Regional Airport, about 64 kilometers (40 miles) to the north. Air service is also available through the Accomack County Airport in Melfa, which normally provides flights during daylight hours. Surface transportation from the airports to WFF is by private rental vehicles, government vehicles, and commercial bus or taxi. In addition, ground transportation to the Salisbury Airport is occasionally provided by a WFF Shuttle Bus for NASA employees.

Chartered and private aircraft that have the appropriate clearance may land at WFF Airport for business purposes. Air-freight services are available from the Salisbury Regional Airport and are provided by U.S. Air and Butler Air Freight.

Rail freight service is provided to the Delmarva Peninsula by the Eastern Shore Railroad. No rail passenger service is available to WFF. Eleven motor freight carriers that serve the eastern United States are authorized to provide service to the Accomack-Northampton District.

Ocean cargo shipments are off-loaded at the Port of Baltimore, Maryland, or Cape Charles, Virginia, and transferred to commercial trucks or rail for transport to Wallops Flight Facility. There are numerous small harbors located throughout Accomack and Northampton Counties, which are used primarily for commercial or recreational fishing and boating.

4.1 INTRODUCTION

Section 4 presents the potential impacts to existing resources at Wallops Island that may be affected by the alternatives described in Section 2. This section contains discussions on potential impacts to resources under the three main categories of Physical Environment, Biological Environment, and Social and Economic Environment.

4.2 PHYSICAL ENVIRONMENT

4.2.1 Land Resources

4.2.1.1 Topography and Drainage

No Action Alternative

Only maintenance and emergency repairs to existing structures would occur under this alternative. Due to the dynamic nature of barrier island environments, the topography of the island would continue to shift in response to physical processes such as waves, wind, and tides. It is anticipated that under the No Action Alternative, shoreline retreat at Wallops Island would continue. Emergency actions by NASA may slow shoreline retreat; however, scouring along the base of the seawall could weaken the structure, causing it to fail and putting facilities and infrastructure on Wallops Island at greater risk from storm and flood damage. It is anticipated that under the No Action Alternative, impacts to topography and drainage would occur because shoreline retreat on the island would continue and drainage patterns may shift.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Under Alternative 1 Option 1, minor changes to topography would occur. The topography of the shoreline would be restored to a more natural condition through the placement of sand seaward of the existing seawall, thus creating a gently sloping beach that would extend out into the surf zone. It is unknown at this time how wide the created beach would be. Sand retention structures placed offshore would be used to reduce wave action at the shoreline and help keep sand on the beach. The reduction in wave energy would slow the southward transportation of sand and, therefore, produces sediment deposition and a shoreline bulge in the sheltered area behind the breakwater (Morang et al. 2006). It is anticipated that Alternative 1 Option 1 would not have any adverse impacts on topography or drainage; however, it would have a beneficial impact on topography by returning the shoreline to a natural slope.

Option 2 - Shore Protection: Beach Fill Only

Under Alternative 1 Option 2, minor changes would occur to the topography of the shoreline, which would be restored to a more natural condition. Sand would be placed seaward of the existing seawall to create a gently sloping beach that would extend out into the surf zone. It is unknown at this time how wide the created beach would be. It is anticipated that Alternative 1 Option 2 would not have any adverse impacts on topography or drainage; however, it would have a beneficial impact on topography by returning the shoreline to a natural slope.

Option 3 - Sand-Retention Structures Construction Only

Under Alternative 1 Option 3, project activities would occur entirely offshore and effects on topography would be minor. If the breakwaters are successful, they will result in the slow creation of beach in front of the seawall as wave energy is reduced and sediment is deposited along the shoreline. This would restore the topography of the nearshore area to more natural conditions. It is anticipated that Alternative 1 Option 3 would not have any adverse impacts on topography or drainage; however, it would have a beneficial impact on topography by retaining sand along the shoreline.

Option 4 - Emergency Actions

Emergency actions implemented under Alternative 1 Option 4 could change the nearshore topography along the affected segments of shoreline. Impacts to topography and drainage would differ depending on the specific actions undertaken by NASA (adding rock to the existing seawall, placing sand on the beach, or installing sheet piling at or near the high tide mark). These specific actions could have a beneficial impact on topography by returning the shoreline to its natural slope or retaining sand along the shoreline. Should this option be selected and additional impacts not covered under this PEA are anticipated, NASA would prepare an SEA to describe the proposed project activities, evaluate the potential environmental consequences, and recommend any necessary mitigation measures. It is anticipated that Alternative 1 Option 4 would not have an adverse impact on topography or drainage when mitigation measures such as BMPs are implemented.

Option 5 - Installation of Geotextile Tubes

The installation of geotubes along the shoreline may result in minor topographic changes to the Atlantic coastline of the island. The tubes are designed to help retain sand on the beach, which would help to restore the natural sloping beach profile along the coast. It is unknown how much sand would be retained on the beach and how long the tubes would function. It is anticipated that Alternative 1 Option 5 would not have any adverse impacts on topography or drainage; however, it would have a beneficial impact on topography by retaining sand along the shoreline.

Option 6 - Sand Dunes with Various Cores

The installation of artificial sand dunes along the Atlantic coastline of the island would change the topography of the island. Sand dunes are a natural feature on mid-Atlantic barrier islands, but they are only present to a limited extent on Wallops Island due to the hardened shoreline and development. This option would help to restore a more natural profile to the island by establishing dunes along segments of the shoreline. It is anticipated that Alternative 1 Option 6 would not have any adverse impacts on topography or drainage; however, it would have a beneficial impact on topography by returning the shoreline to a natural slope.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees

Although a design for this option has not yet been completed, it is anticipated that a system of embankments and ditches would be created around critical structures to capture floodwaters, thus altering the existing topography and drainage patterns of the island. Should this option be chosen, an SEA would be prepared to evaluate the potential impacts of project activities and to

recommend mitigation measures where necessary. It is anticipated that Alternative 2 Option 1 would not have an adverse impact on topography or drainage when mitigation measures such as BMPs are implemented.

Option 2 - Elevation of Critical Structures and Roadways

The elevation of critical structures and roadways on Wallops Island would change the existing topographic conditions. NASA would ensure that stormwater runoff velocities are not increased as a result of the elevation, and would utilize stormwater BMPs during construction activities. It is anticipated that Alternative 2 Option 2 would not have an adverse impact on topography or drainage when mitigation measures such as BMPs are implemented.

Option 3 - Elevate the Island and Structures by Pumping Sand

The topography and drainage of the island would be changed if sand were used to elevate all or portions of Wallops Island. It is anticipated that Alternative 2 Option 3 would not have any adverse impacts on topography or drainage.

Option 4 - Build a Dike around the Entire Island

Project activities associated with this option may occur entirely offshore. Since a design for this option has not yet been completed, it is unclear whether the proposed structure would interrupt sediment transport processes. If these processes are disturbed, topographic changes to the island may result. Should this option be chosen, an SEA would be prepared to evaluate the potential impacts of project activities and to recommend mitigation measures where necessary. It is anticipated that Alternative 2 Option 4 would not have an adverse impact on topography or drainage when mitigation measures such as BMPs are implemented.

4.2.1.2 Geology and Soils

No Action Alternative

Under the No Action Alternative, the Shoreline Restoration and Infrastructure Protection Program would not be conducted on Wallops Island, but maintenance to existing structures would continue. Emergency repairs to structures and the seawall would continue to be required; impacts to soils including compaction and displacement would be caused by equipment used to reach facilities to perform emergency operations. No impacts to geology would occur. Loss of soils would continue as the shoreline continues to retreat. Therefore, the No Action Alternative would result in minor impacts to soils.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Under Alternative 1 Option 1, no impacts to geology would occur. The natural process of sediment transport and shoreline retreat would be slowed. The placement of beach fill would ‘turn back the clock’ by reconfiguring the beach to what it was years ago. Therefore, construction of sand-retention structures and placement of beach fill would mitigate the shoreline retreat and wave hazard to the beach and WFF facilities located behind the beach. This would provide a beneficial impact to soils.

Immediately following placement of fill on the beach, a temporary increase in longshore transport of sediment away from the filled beach (littoral drift) would occur. This movement may have a beneficial impact on beaches to the south of Wallops Island, but would only be temporary once the beach stabilizes and sand-retention structures are constructed. The proposed actions in Alternative 1 have been designed to be compatible with the natural processes of beach erosion and transport of sand. Local wave climates would not be changed by offshore dredging that would occur under Alternative 1 Option 1.

Potential onshore impacts of offshore dredging include the impact of beach fill using sands that are too fine or too coarse and the impact of altered offshore current patterns that affect onshore wave energy and sediment transport. Placement of the beach fill would be done so that the beach is restored to a comparable sediment type (similar percentage of sand, silt, and clay for the fill as the original beach material) and topography.

Construction activities (use of vehicles and equipment) would disturb surface soils on the beach and around the facilities under Alternative 1 Option 1. Disturbance to surface soils would also result from activities associated with the movement and transfer of existing and dredged sand and the construction of sand-retention structures. The impact of construction activities to soils is erosion. However, with implementation of erosion and sediment control BMPs, this impact would be reduced. Erosion control BMPs are designed to prevent soil particles from detaching and becoming suspended in storm water runoff and could include mulches, erosion control blankets and mats, preservation of existing vegetation, and covering stockpiles. Sediment control BMPs such as fiber rolls and silt fencing are designed to settle out soil particles that have been transported by the force of water. Other impacts to soils that may occur during construction include spills or leaks of pollutants from vehicles. BMPs including vehicle and equipment fueling and maintenance and spill prevention and control would be implemented to reduce potential impacts to soils during construction. Vegetation clearing for project activities could also result in increased erosion during construction. NASA would revegetate the site back to pre-construction cover when the project is complete.

Alternative 1 Option 1 would not negatively impact the natural rate of sand migration on Wallops Island, but would have a beneficial effect by mitigating the rate of shoreline retreat that is currently taking place. The accumulation of sand behind the breakwaters and the placement of beach fill would mitigate the rapid shoreline retreat. Therefore, it is anticipated that Alternative 1 Option 1 would have no impact on geology and temporary, minor impacts to soils on Wallops Island.

Option 2 - Shore Protection: Beach Fill Only

Under Alternative 1 Option 2, no impacts to geology would occur. The natural process of sediment transport and shoreline retreat would be slowed. The placement of beach fill would 'turn back the clock' by reconfiguring the beach to what it was years ago. Therefore, construction of sand-retention structures and placement of beach fill would mitigate the shoreline retreat and wave hazard to the beach and WFF facilities located behind the beach and provide a beneficial impact to soils.

Immediately following placement of fill on the beach, a temporary increase in longshore transport of sediment away from the filled beach (littoral drift) would occur. This movement might have a beneficial impact on beaches south of the restored beach, but would only be temporary. The proposed actions in Alternative 1 Option 2 have been designed to be compatible

with the natural processes of beach erosion and transport of littoral drift. Local wave climates would not be changed by offshore dredging that would occur under Alternative 1 Option 2.

Potential onshore impacts of offshore dredging include the impact of beach fill using sands that are too fine or too coarse and the impact of altered offshore current patterns that affect onshore wave energy and sediment transport. Placement of the beach fill would be done so that the beach is restored to a comparable sediment type (similar percentage of sand, silt, and clay for the fill as the original beach material) and topography.

Construction activities would disturb surface soils on the beach and around the facilities through the use of vehicles and equipment that would be used to implement Alternative 1 Option 2, including activities associated with the movement and transfer of existing and dredged sand. Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1.

Alternative 1 Option 2 would not negatively impact the natural rate of sand migration on Wallops Island, but would have a beneficial effect by mitigating the rate of shoreline retreat that is currently taking place. Therefore, it is anticipated that Alternative 1 Option 2 would have no impact on geology and minor, temporary impacts to soils on Wallops Island.

Option 3 - Breakwater Construction Only

Under Alternative 1 Option 3, no impacts to geology would occur. The natural process of sediment transport and shoreline retreat would be slowed. The construction of breakwater structures would moderate the shoreline retreat and protect WFF facilities by allowing sand to accumulate behind the breakwater structures and moving the wave zone further from the seawall.

If construction activities take place in the shoreline, the impacts to soils and mitigation measures would be the same as those described under Alternative 1 Option 1.

Alternative 1 Option 3 would not negatively impact the natural rate of sand migration processes on Wallops Island, but would have a beneficial effect by mitigating the rate of shoreline retreat that is currently taking place. The construction of breakwater structures would moderate the erosion hazard along the beach. Therefore, it is anticipated that Alternative 1 Option 3 would have no impacts to geology and minor, temporary impacts to soils on Wallops Island.

Option 4 - Emergency Actions

Under Alternative 1 Option 4, no impacts to geology would occur. The natural processes of sediment transport and shoreline retreat would remain similar to those experienced today. Emergency actions would provide temporary protection to WFF and may moderate the shoreline retreat by placing additional sand on the beach, adding rock to the seawall, or installing sheet piling.

Emergency actions would disturb surface soils on the beach and around the facilities. Vehicles and equipment would be used to move and transfer sand, install sheet piling, and haul and place rock on the existing seawall. Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1.

Alternative 1 Option 4 would not change the rate of shoreline retreat or sand migration on Wallops Island, but would have a beneficial effect by mitigating the immediate impacts to WFF facilities. The implementation of structures to moderate the erosion hazard along the beach

could cause erosion that may result in adverse impacts to soils. Therefore, implementation of Alternative 1 Option 4 may result in temporary impacts to soils on Wallops Island. It is anticipated that Alternative 1 Option 4 would have no impacts to geology.

Option 5 - Installation of Geotextile Tubes

Under Alternative 1 Option 5 no impacts to geology would occur. The natural processes of sediment transport and shoreline retreat would remain similar to those experienced today. The construction of geotubes would moderate the shoreline retreat by slowing the transportation of sand off the beach and by protecting the beach from wave action.

Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1.

Alternative 1 Option 5 would not change the rate of sand migration on Wallops Island, but would have a beneficial effect by slowing the impacts of the shoreline retreat that is currently taking place. The construction of geotubes would moderate the erosion hazard along the beach. Therefore, it is anticipated that Alternative 1 Option 5 would result in no impacts to geology and temporary, minor impacts to soils on Wallops Island.

Option 6 - Sand Dunes with Various Cores

Under Alternative 1 Option 6, no impacts to geology would occur. The natural rates of sediment transport to the beach and erosion of the beach would remain similar to those experienced today. The construction of sand dunes would temporarily moderate the shoreline retreat and protect WFF faculties located behind the beach, but would not be a longer-term solution unless implemented along with Alternative 1 Options 1, 2, and 5.

Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1.

Alternative 1 Option 6 alone would not change the rate of erosion processes on Wallops Island, but would have a beneficial effect by moderating the shoreline retreat with the construction of sand dunes in conjunction with implementation of Alternative 1 Options 1, 2, or 5. It is anticipated that Alternative 1 Option 6 would result in no impacts to geology and minor, temporary impacts to soils on Wallops Island.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees

Under Alternative 2 Option 1 no impacts to geology would occur. The natural rates of sediment transport to the beach and the shoreline retreat would remain similar to those experienced today. The construction of levees would moderate the hazard directly to WFF facilities, but would not mitigate the shoreline retreat and the loss of soil and sand on Wallops Island.

Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1. It is anticipated that implementation of Alternative 2 Option 1 would result in no impact to geology and minor, temporary impacts to soils on Wallops Island.

Option 2 - Elevation of Critical Structures and Roadways

Under Alternative 2 Option 2 no impacts to geology would occur. The natural rates of sediment transport to the beach and erosion of the beach would remain similar to those experienced today.

The elevation of critical structures and roadways would mitigate the hazard directly to WFF facilities, but would not mitigate the erosion hazard to the beach and the loss of soil and beach sand on Wallops Island.

Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1. It is anticipated that Alternative 2 Option 2 would result in no impacts to geology and minor, temporary impacts to soils on Wallops Island.

Option 3 - Elevate the Island and Structures by Pumping Sand

Under Alternative 2 Option 3 no impacts to geology would occur. The natural rates of sediment transport to the beach and erosion of the beach would remain similar to those experienced today. The elevation of critical structures and roadways would mitigate the hazard directly to WFF and would mitigate the erosion hazard to the beach on Wallops Island through the addition of sand.

Immediately following placement of fill on the beach, a temporary increase in longshore transport of sediment away from the filled beach (littoral drift) would occur. This movement may have a beneficial impact on beaches south of the restored beach, but would only be temporary. Local wave climates would not be changed by offshore dredging that would occur under Alternative 2 Option 3.

Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1. It is anticipated that implementation of Alternative 2 Option 3 would result in no impacts to geology and minor, temporary impacts to soils on Wallops Island.

Option 4 - Build a Levee around the Entire Island

Under Alternative 2 Option 4 no impacts to geology would occur. The natural rates of sediment transport to the beach and erosion of the beach would remain similar to those experienced today. The construction of a levee around Wallops Island would moderate the hazard to WFF facilities, but would not mitigate the erosion hazard to the beach and the loss of soil and sand on Wallops Island.

Impacts to soils from construction and mitigation measures would be the same as those described under Alternative 1 Option 1. It is anticipated that implementation of Alternative 2 Option 4 would result in no impacts to geology and minor, temporary impacts to soils on Wallops Island.

4.2.1.3 Land Use

No Action Alternative

Under the No Action Alternative, the Shoreline Restoration and Infrastructure Protection Program would not be conducted, although maintenance and emergency repairs to existing shoreline protection structures would continue to occur. No impacts to land use would occur.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

No impacts to land use would occur under any of the options under Alternative 1.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

No impacts to land use would occur under any of the options under Alternative 2.

4.2.1.4 Atlantic Ocean Substrate

No Action Alternative

Under the No Action Alternative, the Shoreline Restoration and Infrastructure Protection Program would not be conducted on Wallops Island. Maintenance and emergency repairs to structures and the seawall would be conducted as necessary, but those activities would not involve work in open water. Therefore, the No Action Alternative would have no impacts to the Atlantic Ocean substrate.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Dredging for sand would change the existing bathymetry at the borrow site. Dredging would result in a depression, pit, or trench on the ocean floor. Dredging at a shoal may result in the total removal of this topographic feature. Borrow site locations and the composition or features of the Atlantic Ocean substrate at the borrow sites are not known at this time.

The bottom substrate at and near a borrow site may be modified in several ways. A change in the hydrologic regime as a consequence of altered bathymetry may result in the deposition of fine sediments where there had been a shifting sand sheet environment. Existing substrate characteristics may also be changed by the exposure of underlying sedimentary units. The removal of surficial or subsurface sand units may expose underlying material that has different textural and compositional properties than the existing surface substrate. Each of these changes could affect depositional patterns at the borrow site. Diminished current velocities over a borrow pit may promote the deposition of fine sediments. If the sediment supply is not sufficient to fill up the pit with either; sand or fines, the depression will persist. On the other hand, changes in currents may result in the scour of pits and the removal of fine sediments.

The bottom substrate at a distance from the borrow site may also be modified by the deposition of sediments in benthic and surface plumes generated by dredging activities. Sediments contained within plumes produced from the disturbance and resuspension of bottom sediments, and from discharges of the dredging vessel and equipment, would settle out from the water column and be deposited at a distance from the dredge site.

Nearshore, the installation of breakwaters would reduce the available bottom substrate at the location of each breakwater. Additional changes may occur in the nearshore bathymetry due to movement of finer sand transported from the newly placed beach fill via tidal wave action. Over several months of wave and tidal action, which causes a redistribution of material, the nearshore substrate elevations and slopes would naturally return to pre-placement conditions, except for areas where the substrate has been covered by breakwaters. Sediment transport south would be slowed and barrier islands south of Wallops Island would benefit from the reintroduction of sand

into the natural system through the placement of beach fill. Over time the placement of beach fill may help to replenish shorelines south of Wallops Island. Therefore, it is anticipated that Alternative 1 Option 1 would have a temporary impact on the Atlantic Ocean substrate at the borrow site and long-term impacts near the shoreline.

Option 2 - Shore Protection: Beach Fill Only

Dredging activities under Alternative 1 Option 2 would be similar to dredging activities under Alternative 1 Option 1; therefore, Alternative 1 Option 2 would have the same temporary impacts to the Atlantic Ocean substrate at the borrow site and near the shoreline.

Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Since no offshore dredging or significant onshore beach replenishment activities would take place under Alternative 1 Option 3, Option 4, Option 5, or Option 6 there would be no impacts to the Atlantic Ocean substrate from sand removal or placement on the shoreline. The placement of sand-retention structures under Option 3 would not impact the Atlantic Ocean substrate. It is anticipated that the addition of sand during Option 4, Option 5, and Option 6 would not impact the Atlantic Ocean substrate because the amount of sand migrating into the ocean during construction of these options would be negligible.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways

Since no offshore dredging or onshore beach replenishment activities would take place under Alternative 2 Option 1 and Option 2, there would be no impacts to the Atlantic Ocean substrate.

Option 3 - Elevate the Island and Structures by Pumping Sand

Dredging activities under Alternative 2 Option 3 would be similar to dredging activities under Alternative 1 Option 1; therefore, Alternative 2 Option 3 would have the same temporary impacts to the Atlantic Ocean substrate at the borrow site and near the shoreline.

Option 4 - Build a Levee around the Entire Island

Although there would be no offshore dredging or onshore beach replenishment activities taking place under Alternative 2 Option 4, there may be impacts to Atlantic Ocean substrate and marsh habitats related to construction of the levee.

4.2.2 Water Resources

4.2.2.1 Surface Water

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, maintenance activities and emergency repairs would occur. It is anticipated that the No Action Alternative would have temporary impacts on surface water resources from the use of construction vehicles and heavy machinery on the beach. The heavy equipment and construction activities may result in the introduction of petroleum products,

heavy metals, or other contaminants to nearshore waters. Construction-related impacts would be temporary and are not anticipated to significantly impact water quality. No adverse impact on surface water resources would occur because BMPs would be implemented as necessary when maintenance or emergency repair activities are conducted.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Temporary impacts to surface water resources could occur during the use of construction equipment and heavy machinery, which may result in the introduction of petroleum products, heavy metals, or other contaminants to nearshore waters. Construction-related impacts would be temporary and are not anticipated to significantly impact water quality. The disposal of borrow material on Wallops Island would also have temporary impacts on surface water because placement of borrow material will result in turbidity and suspended solids concentrations that are elevated over normal background levels in the surf zone in the immediate area of disposal operation. No other water quality parameters are anticipated to be impacted significantly during shoreline disposal operations.

The proposed borrow material placement plan would be evaluated with regard to the requirements of Section 404(b)(1) of the Clean Water Act. In addition to any required USACE permits and Virginia Marine Resources Commission permit, if necessary, the applicant would obtain a Virginia Water Protection Permit/401 certification from the Virginia Department of Environmental Quality to ensure compliance with applicable laws and regulations pertaining to water quality.

Option 2 - Shore Protection: Beach Fill Only

Dredging activities under Alternative 1 Option 2 would be similar to dredging activities under Alternative 1 Option 1; therefore, Alternative 1 Option 2 would have the same temporary impacts to surface water resources and the same permits.

Option 3 - Breakwater Construction Only

Breakwater construction would occur at a distance great enough offshore that no impacts to surface waters are anticipated. Impacts to marine waters are discussed in Section 4.2.2.3.

Option 4 - Emergency Actions

Emergency actions could include construction or soil disposal activities that would impact water quality. The nature and extent of water quality impacts would be dependent on the types of actions undertaken by NASA and their proximity to surface waters. Likely impacts associated with emergency actions could include increased turbidity or suspended solids concentrations and the introduction of petroleum products, heavy metals, or other contaminants associated with heavy machinery and construction activities. NASA would ensure that appropriate BMPs are used and that project activities comply with the CWA and Virginia water quality standards. An SEA would be prepared to document specific project activities, potential impacts to surface waters, and proposed mitigation measures. It is anticipated that Alternative 1 Option 4 would have no adverse impacts on surface waters when mitigation measures such as BMPs are implemented.

Option 5 - Installation of Geotextile Tubes

Under Alternative 1 Option 5, heavy machinery or construction equipment would be used in close proximity to the nearshore environment. Water would be pumped to the slurry pits by one temporary pipe extending to Hog Creek and one temporary pipe extending to the Atlantic Ocean. The amount of water removed from Hog Creek would be insufficient to cause adverse impacts to the ecosystem. The use of construction equipment, heavy machinery, and the slurry mix flowing through the geotubes and onto the beach would result in turbidity and suspended solids concentrations that are elevated over normal background levels in the surf zone in the immediate area of project activities. In addition, the heavy equipment and construction activities may result in the introduction of petroleum products, heavy metals, or other contaminants to nearshore waters. Construction-related impacts would be temporary and are not anticipated to significantly impact water quality. NASA would ensure that appropriate BMPs are used and that project activities comply with the CWA and Virginia water quality standards. It is anticipated that Alternative 1 Option 5 would have no adverse impacts on surface waters when mitigation measures such as BMPs are implemented.

Option 6 - Sand Dunes with Various Cores

Construction activities associated with the creation of vegetated sand dunes with stabilizing cores would occur in close proximity to surface waters and would likely result in turbidity and suspended solids concentrations that are elevated over normal background levels in the surf zone in the immediate area of project activities. In addition, the heavy equipment and construction activities may result in the introduction of petroleum products, heavy metals, or other contaminants to nearshore waters. Construction-related impacts would be temporary and are not anticipated to significantly impact water quality. NASA would ensure that appropriate BMPs are used and that project activities comply with the CWA and Virginia water quality standards. It is anticipated that Alternative 1 Option 6 would have no adverse impacts on surface waters when mitigation measures such as BMPs are implemented.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees

Construction activities associated with the construction of critical structure levees could occur in close proximity to surface waters and would likely result in turbidity and suspended solids concentrations that are elevated over normal background levels in the immediate area of project activities. In addition, the heavy equipment and construction activities may result in the introduction of petroleum products, heavy metals, or other contaminants to nearshore waters. Construction-related impacts would be temporary. The nature and extent of water quality impacts cannot be defined until NASA develops a final plan for implementing this option. An SEA would be prepared to document specific project activities, potential impacts to surface waters, and proposed mitigation measures should this option be chosen. NASA would ensure that project activities comply with the CWA and Virginia water quality standards, and that appropriate BMPs are utilized during implementation of project activities. It is anticipated that Alternative 2 Option 1 would have no adverse impacts on surface waters when mitigation measures such as BMPs are implemented.

Option 2 - Elevation of Critical Structures and Roadways

Construction activities under Alternative 2 Option 2 would be similar to construction activities under Alternative 2 Option 1; therefore, Alternative 2 Option 2 would have the same temporary impacts to surface water resources and the same mitigating BMPs.

Option 3 - Elevate the Island and Structures by Pumping Sand

Project activities under Alternative 2 Option 3 would be similar to dredging activities under Alternative 1 Option 1; therefore, Alternative 2 Option 3 would have the same temporary impacts to surface water resources and the same mitigating BMPs.

Option 4 - Build a Levee around the Entire Island

Construction activities under Alternative 2 Option 4 would be similar to construction activities under Alternative 2 Option 1; therefore, Alternative 2 Option 4 would have the same temporary impacts to surface water resources and the same mitigating BMPs.

4.2.2.2 Stormwater

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. It is anticipated that the No Action Alternative would have no impact on stormwater patterns because BMPs would be implemented as needed when maintenance or emergency repair activities are conducted.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under each option within Alternative 1, project activities are not expected to increase the amount of stormwater or to change stormwater flow patterns on Wallops Island. Fine-grained sediments deposited on the shoreline during project activities may be transported to local waters due to stormwater flows, temporarily increasing turbidity and suspended solids concentrations during and after storm events. BMPs would be implemented during construction activities to ensure that erosion to nearby surface waters is minimized during the duration of construction activities. It is anticipated that none of the options under Alternative 1 would impact stormwater quality and stormwater patterns would not change.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees

The levees constructed under Alternative 2 Option 1 would collect rainwater and would require pumping to extract stormwater from the system. It is unknown at this time what would be done with the water after it has been pumped out. Should this option be chosen, an SEA would be completed to describe project activities, evaluate potential environmental impacts, and recommend mitigation measures. It is anticipated that Alternative 2 Option 1 would not have an

impact on stormwater quality when mitigation measures such as BMPs are implemented although stormwater patterns may change.

Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Project activities under Alternative 2 Options 2, 3, and 4 would be similar to activities under Alternative 1; therefore, Alternative 2 Options 2, 3, and 4 would not impact stormwater quality and stormwater patterns would not change.

4.2.2.3 Marine Waters

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. Maintenance to the existing seawall may require permits from USCAE or VMRC. It is anticipated that the No Action Alternative would have no impact on marine waters because BMPs would be implemented as necessary when maintenance and emergency repair activities are conducted.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Temporary impacts to marine waters could occur during the disposal of dredged material on Wallops Island and the construction of sand-retention structures. It is expected that placement of dredged material and the construction of sand-retention structures will result in turbidity and suspended solids concentrations that are elevated over normal background levels in the surf zone in the immediate area of disposal operation. Appropriate BMPs would be implemented to reduce the impacts to marine waters during construction activities.

The proposed dredged material placement plan will be evaluated with regard to the requirements of Section 404(b)(1) of the Clean Water Act. In addition to the required Department of the Army permit and Virginia Marine Resources Commission permit, the applicant will obtain a Virginia Water Protection Permit/401 certification from the Virginia Department of Environmental Quality to ensure compliance with applicable laws and regulations pertaining to water quality.

Temporary impacts to marine waters may also occur at the borrow site. However, the quantity of water removed from the Atlantic Ocean would be insufficient to cause adverse impacts to the ecosystem. Dredging at the borrow site may increase turbidity and suspended sediment concentrations during and for a period after dredging operations. Appropriate BMPs would be implemented to reduce the impacts to water quality during construction activities. It is anticipated that Alternative 1 Option 1 would have minor and temporary impacts on marine waters.

Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under Options 2, 3, 4, 5, and 6, dredging operations, in-water construction, and construction in the nearshore environment are similar to Alternative 1 Option 1; therefore, impacts to marine

waters and potential permits would be similar. It is anticipated that Alternative 1 Options 2, 3, 4, 5, and 6 would have a minor temporary impact on marine waters.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways

Under Alternative 2 Option 1 and 2, construction activities would occur inland. Construction-related impacts would be temporary. NASA would ensure that project activities comply with the CWA and Virginia water quality standards, and that appropriate BMPs are utilized during implementation of project activities. BMPs would reduce sediment or pollutants from reaching the marine environment. It is anticipated that Alternative 2 Option 1 and 2 would have no or very minor impacts on marine waters when mitigation measures such as BMPs are implemented.

Option 3 - Elevate the Island and Structures by Pumping Sand

Under Alternative 2 Option 3, project operations are similar to Alternative 1 Option 1; therefore, impacts to marine waters and potential permits would be similar. It is anticipated that Alternative 2 Options 3 would have a minor temporary impacts on marine waters.

Option 4 - Build a Levee around the Entire Island

The construction of a levee around Wallops Island would be a major construction activity that would have short-term impacts to marine waters surrounding Wallops Island during the period of construction, and long-term impacts to marine waters associated with maintenance of the structure. Likely impacts associated with this option include; increased turbidity or suspended solids concentrations and the introduction of petroleum products, heavy metals, or other contaminants associated with heavy machinery and construction and maintenance activities. NASA would ensure that appropriate BMPs be used and that project activities comply with the CWA and Virginia water quality standards. Long-term impacts may include alteration and disruption of the shoreline sediment transport cycle. An SEA would be prepared to document specific project activities, potential impacts to marine waters, and proposed mitigation measures. CWA Section 404 and River and Harbors Act Section 10 permits would be required from the USACE, as well as CWA Section 401 water quality certification from the Commonwealth of Virginia prior to project implementation. It is anticipated that Alternative 2 Option 4 would have short-term impacts on the marine waters that are not expected to be significant.

4.2.2.4 Groundwater

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. It is anticipated that the No Action Alternative would have no impact on groundwater because none of the project activities are near groundwater wells or recharge zones.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

None of the options under Alternative 1 would have an impact on Wallops Island's groundwater because no work would be conducted near groundwater wells or recharge zones.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

None of the options under Alternative 2 would have an impact on Wallops Island's groundwater because no work would be conducted near groundwater wells or recharge zones.

4.2.2.5 Wetlands

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. Maintenance to the existing seawall may require permits from USACE or VMRC. It is anticipated that the No Action Alternative would have no adverse impact on wetlands when proper BMPs are used during maintenance or emergency repair activities occurring near wetlands.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only

Under Alternative 1 Options 1, 2, and 3, no impacts to vegetated wetlands would occur because no wetlands are located within the project area. Potential permits for work within Waters of the U.S. are discussed in Section 4.2.2.3.

Option 4 - Emergency Actions

Under Alternative 1 Option 4, impacts to wetlands may occur depending on the location and scope of the emergency action. If work is done within a wetland, a Section 404 permit would be required. Any necessary permits would be obtained prior to construction and BMPs would be implemented. This issue would be further addressed in a follow-up SEA, if required.

Option 5 - Installation of Geotextile Tubes

Under Alternative 1 Option 5, no impacts to wetlands would occur because no wetlands are located within the area where geotubes would be placed. Geotubes would also be placed above the mean high water mark so no permits under the CWA would be required.

Option 6 - Sand Dunes with Various Cores

Under Alternative 1 Option 6, no impacts to wetlands would occur because no wetlands are located within the area where the cores would be placed. Potential permits for work within Waters of the U.S. are discussed in Section 4.2.2.3.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under all options under Alternative 2, temporary impacts to wetlands may occur depending on the location and scope of project activities. If work within or near wetlands cannot be avoided a Section 404 permit would be required. Any necessary permits would be obtained prior to construction and BMPs would be implemented. This issue would be further addressed in a SEA, if required.

4.2.2.6 Floodplains

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. Because the entire island is within the 100-year floodplain, there are few practicable alternatives to conducting project activities within the floodplain. NASA would ensure that maintenance activities comply with EO 11988 (Floodplain Management) and 14 CFR 1216.2 by minimizing floodplain impacts and protecting and restoring the natural and beneficial functions of floodplains wherever possible. It is anticipated that the No Action Alternative would have no impact on floodplains.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under all options within Alternative 1, project activities would occur within the regulated 100-year floodplain. Because Wallops Island is located entirely within the 100-year floodplain and due to the nature of coastal stabilization projects (i.e., they occur along the land-sea interface), there are few practicable alternatives to conducting project activities within the floodplain. Nourishing the beach and reducing wave action on the shoreline through the construction of offshore breakwaters would help to restore the natural and beneficial functions of the floodplain and protect critical infrastructure and facilities from future storm and flood damage. NASA would ensure that project activities comply with EO 11988 (Floodplain Management) and 14 CFR 1216.2 by minimizing floodplain impacts and protecting and restoring the natural and beneficial functions of floodplains wherever possible. It is anticipated that the options within Alternative 1 would have no impacts to the floodplain.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under all options within Alternative 2, project activities would occur within the regulated 100-year floodplain. Because Wallops Island is located entirely within the 100-year floodplain and due to the nature of coastal stabilization projects (i.e., they occur along the land-sea interface), there are few practicable alternatives to conducting project activities within the floodplain. Nourishing the beach and reducing wave action on the shoreline through the construction of offshore breakwaters would help to restore the natural and beneficial functions of the floodplain and protect critical infrastructure and facilities from future storm and flood damage. NASA would ensure that project activities comply with EO 11988 (Floodplain Management) and 14 CFR 1216.2 by minimizing floodplain impacts and protecting and restoring the natural and beneficial functions of floodplains wherever possible. It is anticipated that the options within Alternative 2 would have no impacts to the floodplain.

4.2.2.7 Coastal Zone Management

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. Maintenance activities may require a permit from VMRC for work within the Virginia Coastal Zone; Wallops Island is exempt from CBRA. It is anticipated that the No Action Alternative would have no impact on the coastal zone because NASA would ensure that project activities comply with the enforceable policies of the Virginia's Coastal Resources Management Program.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under all options within Alternative 1, project activities would occur within the coastal zone and could have reasonably foreseeable coastal effects. NASA would ensure that project activities comply with the enforceable policies of Virginia's Coastal Resources Management Program. Under the provisions of CZMA, NASA would file a consistency determination with the Virginia DEQ prior to project implementation and would utilize BMPs. Beneficial impacts include re-establishment and protection of beach and dune habitat. It is anticipated that all options within Alternative 1 would have temporary, minor impacts on coastal resources.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under all options within Alternative 2, project activities would occur within the coastal zone and could have reasonably foreseeable coastal effects. NASA would ensure that project activities comply with the enforceable policies of Virginia's Coastal Resources Management Program. Under the provisions of CZMA, NASA would file a consistency determination with the Virginia DEQ prior to project implementation and would implement BMPs. It is anticipated that all options within Alternative 2 would have temporary, minor impacts on coastal resources.

4.2.3 Air Quality

No Action Alternative

Under the No Action Alternative, project-specific maintenance and emergency repair activities could generate temporary, localized, short-term impacts to air quality during the operation of heavy equipment. Construction equipment and vehicles could temporarily increase levels of CO, NO_2, O_3, PM_{10} and VOCs. Impacts to air quality would be dependent on the type and length of the repair/maintenance project. However, it is anticipated that the No Action Alternative would have no significant impacts to air quality.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under all options within Alternative 1, short-term impacts to air quality would occur during the construction period. Impacts to air quality would be dependent on the length and frequency of the project, but no significant increases in criteria pollutants are anticipated. Construction equipment and vehicles could temporarily increase levels of CO, NO_2, O_3, PM_{10} and VOCs. To mitigate these temporary increases in criteria pollutants, construction equipment and vehicles would be maintained in good working order and run times would be kept to a minimum. When supplemental shoreline restoration measures are needed, WFF environmental staff would check the current EPA attainment data for WFF's attainment status. All current and future work would comply with federal and state air quality regulations. Therefore, it is anticipated that options under Alternative 1 would have short-term, minor impacts to air quality.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island;

Under all options within Alternative 2, short-term impacts to air quality would occur during the construction period. Impacts to air quality would be dependent on the length and frequency of the project, but no significant increases in criteria pollutants are anticipated. Construction equipment and vehicles could temporarily increase levels of CO, NO_2, O_3, PM_{10} and VOCs. To mitigate these temporary increases in criteria pollutants, construction equipment and vehicles would be maintained in good working order and run times would be kept to a minimum. When supplemental shoreline restoration measures needed, WFF environmental staff would check the current EPA attainment data for WFF's attainment status. All current and future work would comply with federal and state air quality regulations. Therefore, it is anticipated that options under Alternative 2 would have short-term, minor impacts to air quality.

4.2.4 Noise

No Action Alternative

Under the No Action Alternative, project-specific short-term impacts to noise would occur during maintenance and emergency repair activities. Impacts to noise would be dependent on the type, length, and frequency of the project, but are not anticipated to be significant.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under all options within Alternative 1, short-term, temporary to noise levels on WFF would occur during construction activities. Impacts to noise would be dependent on the type, length, and frequency of the activity, but are not anticipated to be significant. In accordance with OSHA safety standards, machine operators may be required to wear hearing protection. There are no adjacent communities or sensitive noise receptors near the island, so none of the options under Alternative 1 would impact those resources.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under all options within Alternative 2, short-term, temporary to noise levels on WFF would occur during construction activities. Impacts to noise would be dependent on the type, length, and frequency of the activity, but are not anticipated to be significant. In accordance with OSHA

safety standards, machine operators may be required to wear hearing protection. There are no adjacent communities or sensitive noise receptors near the island, so none of the options under Alternative 2 would impact those resources.

4.2.5 Hazardous Materials and Hazardous Waste

No Action Alternative

Under the No Action Alternative, impacts to hazardous materials and hazardous waste are possible as existing infrastructure containing storage areas or accumulation points would continually be at risk from wave overtopping and flooding (especially during severe storm events), as well as continued shoreline retreat. NASA would likely remove hazardous materials and hazardous wastes from Wallops Island more frequently and prior to threatening weather to lessen potential impacts to hazardous materials and hazardous waste. It is anticipated that the No Action Alternative would not have a significant impact on the current hazardous materials and hazardous waste procedures although potential for a negative impact exists as stated above.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under all options within Alternative 1, no impacts on hazardous materials and hazardous waste would occur from construction activities. Any hazardous materials used or waste generated during construction would be disposed of in accordance with NASA procedures and state laws.

Options 1 and 2 would have a beneficial impact by restoring the shoreline and increasing the distance between the wave breaking area and critical storage areas and accumulation points. Options 3, 4, 5, and 6 would have less of a beneficial impact because the zone of wave break would not be moved further away from accumulation points or storage facilities. NASA would likely remove hazardous materials and hazardous wastes from Wallops Island more frequently and prior to threatening weather to lessen impacts to hazardous materials and hazardous waste.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under all options within Alternative 2, no impacts on hazardous materials and hazardous waste would occur from construction activities. Any hazardous materials used or waste generated during construction would be disposed of in accordance with NASA procedures and state laws.

Option 3 would have a beneficial impact by restoring the shoreline and increasing the distance between the wave breaking area and critical storage areas and accumulation points. Options 1, 2, and 4 would have less of a beneficial impact because the zone of wave break would not be moved further away from accumulation points or storage facilities. NASA would likely remove

hazardous materials and hazardous wastes from Wallops Island more frequently and prior to threatening weather to lessen impacts to hazardous materials and hazardous waste.

4.2.6 Unexploded Ordnance

No Action Alternative

Under the No Action Alternative, no UXOs are anticipated to be located on the island or within areas near the shoreline where maintenance or emergency repair activities would occur. Also, no UXOs are anticipated to be encountered because no ocean dredging or new offshore construction would occur. Therefore, no impacts on safety from UXOs are anticipated under the No Action Alternative.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Under Alternative 1 Option 1, no UXOs are anticipated to be encountered provided that dredging for the beach fill would only occur in Sector South 1. If UXOs are accidentally dredged up and later observed on the restored shoreline, NASA personnel would need to flag the UXOs, restrict access, notify the WFF Security Office, who would arrange to have it properly removed. In addition, sand retention structures would have to be constructed close to the shoreline to avoid disturbing offshore locations where UXOs could potentially be located in Sectors 2 and 3. It is anticipated that Alternative 1 Option 1 would not have an impact on safety from UXOs because measures would be taken to avoid potential locations of UXOs; in addition, the Wallops Island shoreline is closed to the public.

Option 2 - Shore Protection: Beach Fill Only

Project activities under Alternative 1 Option 2 would be similar to project activities under Alternative 1 Option 1; therefore, Alternative 1 Option 2 would likely have no impact on safety from UXOs because measures would be taken to avoid potential locations of UXOs.

Option 3 - Breakwater Construction Only

Under Alternative 1 Option 3, no UXOs are anticipated to be encountered provided that sand retention structures are constructed close to the shoreline to avoid disturbing offshore locations where UXOs could potentially be located. It is anticipated that Alternative 1 Option 3 would not have an impact on safety from UXOs because measures would be taken to avoid potential locations of UXOs.

Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under Alternative 1 Options 4, 5, and 6 no UXOs are anticipated to be encountered provided that sand only be taken from Sector 1 or from inland borrow pits. If UXOs are accidentally dredged up and later observed on the restored shoreline, NASA personnel would need to flag the UXOs, notify the WFF . It is anticipated that Alternative 1 Options 4, 5, and 6 would not have an impact on safety from UXOs because measures would be taken to avoid potential locations of UXOs.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways

Under Alternative 2 Options 1 and 2, no UXOs are anticipated to be located on the island or within areas near the shoreline. It is anticipated that no impacts on safety from UXOs are anticipated because no ocean dredging or new offshore construction would occur.

Option 3 - Elevate the Island and Structures by Pumping Sand

Project activities under Alternative 2 Option 3 would be similar to project activities under Alternative 1 Option 1; therefore, Alternative 2 Option 3 would have no impact on safety from UXOs because measures would be taken to avoid potential locations of UXOs.

Option 4 - Build a Levee around the Entire Island

Under Alternative 2 Option 4, no impacts on UXOs are anticipated provided that the levee is built on the shoreline to avoid disturbing offshore locations where UXOs could potentially be located in Sectors 2 and 3.

4.3 BIOLOGICAL ENVIRONMENT

4.3.1 Vegetation

No Action Alternative

Under the No Action Alternative, vegetation associated with the dune and swale zones would continue to be depleted as the shoreline continues to retreat. Repairs and maintenance of the existing structures are likely to decrease the rate of erosion over the central part of the island that is currently protected by the seawall.

The shrub, thicket, and maritime forest areas of the island located at the northern and southern ends of the island would be at continued risk. Future shoreline retreat and increased exposure to higher salinities would affect these areas more immediately and to a greater extent than Wallops Island's protected central section. It is anticipated that the No Action Alternative would cause temporary impacts to vegetation, because areas that are disturbed during maintenance activities would be revegetated. Over time, because this alternative would not prevent shoreline retreat, vegetation on the northern and southern portions of the island may be negatively affected.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Under Alternative 1 Option 1, dredged beach fill would restore the shoreline and slow shoreline retreat, thereby protecting facilities on the island by moving the zone of wave breaking well away from vulnerable infrastructure. Beach fill would reduce inundation from storms, dissipate wave energy, help prevent overtopping of the seawall and inland flooding, and would prevent further loss of sand from the backside of the seawall. It would also restore the beach, allowing grasses to repopulate the upper dune areas.

Placement of sand retention structures would further reduce the amount of wave energy reaching the protected area and slow sand migration to the south. This would result in significant shoreline sediment deposition behind the breakwaters.

Vegetative species associated with dune and swale systems would benefit from the expanded beach habitat projected under Alternative 1 Option 1. Additionally, shrub, thicket, and marine forest systems on the island would have additional protection from erosion and wave action. It is anticipated that Alternative 1 Option 1 would result in beneficial impacts to Wallops Island vegetation.

Option 2 - Shore Protection: Beach Fill Only

Project activities under Alternative 1 Option 2 would be similar to construction activities under Alternative 1 Option 1; therefore, Alternative 1 Option 2 would result in beneficial impacts to Wallops Island vegetation.

Option 3 - Breakwater Construction Only

Placement of sand retention structures or nearshore breakwaters would reduce the amount of wave energy reaching protected areas and slow sand migration. This results in increased shoreline sediment deposition behind the breakwaters. However, without an additional sediment source such as beach fill, shoreline retreat is likely to continue, although at a slower rate. Therefore, sand may have to be trucked in and dumped over the existing seawall to introduce sand into the system.

It is anticipated that Alternative 1 Option 3 would have temporary impacts on vegetation because movement of dump trucks is likely to trample some vegetation.

Option 4 - Emergency Actions

Under Alternative 1 Option 4, NASA would continue emergency actions to prevent infrastructure from being damaged during storms. This may include hauling in additional rock to add to the existing seawall, hauling and placing sand on the beach or behind existing shoreline protection, or installing sheet piling in or near the high tide mark.

Under this scenario, NASA would likely focus on protecting the central portion of the island which contains the launch facilities and runway. As such, the northern and southern ends of the islands would continue to be subjected to erosion pressures.

It is anticipated that Alternative 1 Option 4 would have a minor, temporary impact on vegetation. Areas that are disturbed during emergency actions would be revegetated. Over time, because this alternative would not prevent shoreline retreat, vegetation on the northern and southern portions of the island may be affected.

Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under Alternative 1 Options 5 and 6, NASA would place geotubes or sand dunes on shore to slow down the transportation of sand off the beach and help protect onshore assets from wave action. It is anticipated that Alternative 1 Options 5 and 6 would have no impact on vegetation. Over time, because these options would not prevent shoreline retreat, vegetation on the northern and southern portions of the island may be negatively affected.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways

Under Alternative 2 Option 1 and 2, temporary, minor impacts to vegetation may occur during construction activities. Areas that are disturbed during construction activities would be revegetated. Over time, because these options would not prevent shoreline retreat, vegetation on the northern and southern portions of the island may be negatively affected.

Option 3 - Elevate the Island and Structures by Pumping Sand

Project activities under Alternative 2 Option 3 would be similar to construction activities under Alternative 1 Option 1; therefore, Alternative 2 Option 3 would result in net beneficial impacts to Wallops Island vegetation. However, short-term negative impacts could be expected as vegetation is buried. Areas that are impacted would be revegetated.

Option 4 - Build a Levee around the Entire Island

Construction activities under Alternative 2 Option 4 would be similar to construction activities under Alternative 2 Option 1; therefore, temporary, minor impacts to vegetation may occur during construction activities. Areas that are disturbed during construction activities would be revegetated. Depending on levee location and maintenance practices, the vegetative makeup of the community may shift to a more shrub and thicket-oriented composition. Over time, because this option would not prevent shoreline retreat, vegetation on the northern and southern portions of the island and vegetation outside the levee may be negatively affected.

4.3.2 Terrestrial Wildlife and Migratory Birds

No Action Alternative

Under the No Action Alternative, beach habitat is likely to continue to be depleted as shoreline retreat continues. Repairs and maintenance of the existing structures are likely to slow the rate of erosion over the central part of the island that is currently protected by the seawall. However, erosion behind the seawall will continue. The dune and swale, shrub, thicket and maritime forest areas of the island located at the northern and southern ends of the island will be at continued risk.

It is anticipated that the No Action Alternative would not have a direct impact on terrestrial wildlife or migratory birds. Over time, because this alternative would not prevent shoreline retreat, terrestrial wildlife and migratory bird habitat on the northern and southern portions of the island may be negatively affected.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Under Alternative 1 Option 1, dredged beach fill would restore the shoreline and slow shoreline retreat, thereby protecting facilities on the island by moving the zone of wave breaking well away from vulnerable infrastructure. Beach fill would reduce inundation from storms and dissipate wave energy. It would help prevent overtopping of the seawall and inland flooding and

would prevent further loss of sand from the backside of the seawall. It would also restore the beach, providing habitat for terrestrial wildlife and migratory birds.

An increase in the intertidal and upper beach habitat would benefit the 15 species of shorebirds that are known to forage in these areas. Additionally, coastal invertebrates and mammals known to rely on these habitats for shelter and foraging would benefit. Raptor species that prey on shorebirds and small prey species are also likely to benefit from an increase in prey items. Species of birds, mammals, reptiles and amphibians species occupying shrub and thicket habitats would benefit from decreased shoreline retreat and associated habitat loss pressures.

It is anticipated that Alternative 1 Option 1 would result in beneficial impacts to terrestrial wildlife and migratory birds by expanding habitat on Wallops Island.

Option 2 - Shore Protection: Beach Fill Only

Project activities under Alternative 1 Option 2 would be similar to construction activities under Alternative 1 Option 1; therefore, Alternative 1 Option 2 would result in beneficial impacts to terrestrial wildlife and migratory birds by expanding habitat on Wallops Island.

Option 3 - Breakwater Construction Only

It is anticipated that Alternative 1 Option 3 would not have a direct impact on terrestrial wildlife or migratory birds because the project would occur offshore. Over time, because this option would not prevent shoreline retreat, terrestrial wildlife and migratory bird habitat on the northern and southern portions of the island may be negatively affected.

Option 4 - Emergency Actions; Option 5 – Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under Alternative 1 Options 4, 5, and 6, project activities would occur on shore to slow down the transportation of sand off the beach and help protect onshore assets from wave action. It is anticipated that Alternative 1 Options 4, 5, and 6 would not have a direct impact on terrestrial wildlife or migratory birds. Over time, because these options would not prevent shoreline retreat, terrestrial wildlife and migratory bird habitat on the northern and southern portions of the island may be negatively affected.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under all options within Alternative 2, temporary impacts to terrestrial wildlife or migratory birds may occur during construction activities. Areas that are disturbed during construction activities would be revegetated. Only Alternative 2 Option 3 would prevent shoreline retreat and therefore benefit terrestrial wildlife and migratory birds by expanding habitat on Wallops Island. Over time, because Options 1, 2, and 4 would not prevent shoreline retreat, terrestrial wildlife and migratory bird habitat on the northern and southern portions of the island may be negatively affected.

4.3.3 Threatened and Endangered Species

No Action Alternative

Under the No Action Alternative, beach habitat is likely to continue to be depleted as shoreline retreat continues. Repairs and maintenance of the existing structures are likely to slow the rate of erosion over the central part of the island that is currently protected by the seawall. However, erosion behind the seawall will continue. The dune and swale, shrub, thicket and maritime forest areas of the island located at the northern and southern ends of the island will be at continued risk.

Because no project activities would occur in open water, no impacts to protected whales or sea turtles are anticipated.

It is anticipated that the No Action Alternative would not have a direct impact on any threatened or endangered species.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

In a letter to NMFS dated May 4, 2007, NASA transmitted a draft Biological Assessment (BA) describing potential impacts on protected whales and sea turtles from the Shoreline Restoration Program (Appendix B). Section 7(c) of the Endangered Species Act (ESA) amended November 10, 1978, requires that a BA be prepared on all major Federal actions involving construction when federally listed or proposed endangered or threatened species may be affected. The primary concern is whether impacts associated with the proposed action will "jeopardize" the continued existence of sea turtles and whales. Federal regulation defines "jeopardize" as "engaging in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (ESA, 1973).

The purpose of the BA is to examine the potential impacts associated with a dredging operation in one or more borrow areas. Five listed sea turtle species (loggerhead, leatherback, Kemp's ridley, green, and hawksbill) were assessed as part of the BA. Entrainment in hopper dragheads during dredging operations in the borrow areas is the primary risk regarding any incidental take of sea turtles, although for the larger leatherback species this is not a concern. Although the mechanism is not 100 percent effective, turtle deflectors have been very successfully utilized on dragheads to keep sea turtles from being captured and killed. Vessel collisions have been reported, especially incidents involving the leatherbacks due to size and behavior patterns. Employing slower dredge vessel speeds should reduce the risk of collision. Given the information in the BA, NASA concludes that Alternative 1 Option 1 "may affect, likely to adversely affect" the loggerhead and Kemp's ridley sea turtle species. However, Alternative 1 Option 1 would not jeopardize the future existence of the species. NMFS is required to respond with a Biological Opinion of NASA's findings within 120 days of receipt of the Biological Assessment. To date no response has been received.

The three listed whale species assessed as part of the BA (i.e., humpback, fin and right whale) may traverse near or through the dredging area during migration although they tend to prefer deeper habitats than those of the project area. As such, there exists a small potential for

incidental take should a collision with a dredge occur. However, dredge speeds are relatively low (approximately 8 knots). This should enable the operators to avoid whales by maneuvering to avoid a whale strike. Therefore, NASA concludes that the Alternative 1 Option 1 "may affect, not likely to adversely affect" any of the three listed whale species. NMFS is required to respond with a Biological Opinion of NASA's findings within 120 days of receipt of the Biological Assessment. To date no response has been received. NASA would address NMFS comments in a SEA.

In a letter to USFWS dated March 1, 2007, NASA transmitted a BA addressing potential impacts to the piping plover (Appendix A). It was determined that an increase in the intertidal and upper beach habitat is likely to benefit piping plover. Therefore, NASA concluded that Alternative 1 Option 1 is "not likely to adversely affect" the piping plover. In a letter dated April 24, 2007, USFWS stated that the Proposed Project would not adversely affect threatened or endangered species (Appendix A).

In summary, it is anticipated that Alternative 1 Option 1 may adversely impact sea turtles, is not likely to adversely impact whales, and would beneficially impact the piping plover.

Option 2 - Shore Protection: Beach Fill Only

Dredging and fill placement activities under Alternative 1 Option 2 would be similar to construction activities under Alternative 1 Option 1; therefore, it is anticipated that Alternative 1 Option 2 may adversely impact sea turtles, is not likely to adversely impact whales, and would beneficially impact the piping plover.

Option 3 - Breakwater Construction Only

Under Alternative 1 Option 3, in water work may occur and has the potential to impact sea turtles and whale species; however the close proximity to the shoreline would reduce the potential for a barge striking either species. It is anticipated that Alternative 1 Option 3 would not have a direct negative impact on any threatened or endangered species. Over time, because this alternative would not prevent natural shoreline retreat, piping plover habitat on the northern and southern portions of the island may be negatively affected.

Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under Alternative 1 Options 4, 5, and 6 construction activities would take place on land and would not affect any sea turtle or whale species. In addition these options would not occur close enough to piping plover habitat to cause an impact. Therefore, it is anticipated that Alternative 1 Options 4, 5, and 6 would have no direct impact on threatened and endangered species occurring in the project area. Over time, because this alternative would not prevent natural shoreline retreat, piping plover habitat on the northern and southern portions of the island may be negatively affected.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways

Under Alternative 2 Options 1 and 2, construction activities would take place on land and would not affect any sea turtle or whale species. In addition, these options would not occur close

enough to piping plover habitat to cause an impact. Therefore, it is anticipated that Alternative 2 Options 1 and 2 would have no impact on threatened and endangered species occurring in the project area. Over time, because this alternative would not prevent natural shoreline retreat, piping plover habitat on the northern and southern portions of the island may be negatively affected.

Option 3 - Elevate the Island and Structures by Pumping Sand

Dredging and fill placement activities under Alternative 2 Option 3 would be similar to construction activities under Alternative 1 Option 1; therefore, it is anticipated that Alternative 2 Option 3 may adversely impact sea turtles, is not likely to adversely impact whales, and would beneficially impact the piping plover.

Option 4 - Build a Levee around the Entire Island

Under Alternative 2 Options 4 construction activities would take place on land and would not affect any sea turtle or whale species. In addition this Option would not occur close enough to piping plover habitat to impact them. Therefore, it is anticipated that Alternative 2 Option 4 would have no impact on threatened and endangered species occurring in the project area. Over time, because this alternative would not prevent natural shoreline retreat, piping plover habitat on the northern and southern portions of the island may be affected.

4.3.4 Marine Mammals and Essential Fish Habitat

No Action Alternative

The maintenance and emergency repairs conducted under the No Action Alternative are not anticipated to affect habitat types or prey species favored by marine mammals or EFH, because no work in offshore waters would occur. Therefore, no impacts to marine mammals or EFH are anticipated under the No Action Alternative.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Impacts to whales that are protected under the ESA are discussed under Section 4.3.3, Alternative 1 Option 1; this section describes impacts to other marine mammals and EFH.

Under Alternative 1 Option 1, the potential exists for marine mammals to be struck by the dredge or barge placing the sand-retention structures; however, this is a remote possibility considering how slow the dredge and barge would be moving. Therefore, no impacts to marine mammals are anticipated.

In a letter dated April 23, 2007, NASA transmitted an EFH assessment to NMFS (Appendix A). Alternative 1 Option 1 would result in some unavoidable temporary, minor impacts to habitats designated as EFH for several federally managed species. This includes temporary disturbance to a small area of non-vegetated bottom and temporary degradation of the marine water column due to an increase in suspended sediment concentrations. No significant long-term EFH impacts are anticipated. Based on current project information, NASA has concluded that periodic temporary impacts will not have a substantial, adverse impact on EFH and that no additional mitigation is necessary. Accordingly, NASA has concluded that there will be “no effect on EFH.” In a memorandum dated May 14, 2007, NMFS Habitat Conservation Division stated that

more project specific information is needed to come to a conclusion on impacts (Appendix A). NASA will focus on potential EFH impacts in the SEAs for both the off-shore borrow site and for the installation of the off-shore breakwaters. These SEAs will be submitted to NMFS for review and comment.

Option 2 - Shore Protection: Beach Fill Only

Under Alternative 1 Option 2, project operations are similar to Alternative 1 Option 1; therefore, no impacts to marine mammals and temporary, minor impacts to EFH are anticipated. In a memorandum dated May 14, 2007, NMFS Habitat Conservation Division stated that more project specific information is needed to come to a conclusion on impacts (Appendix A). NASA will focus on potential EFH impacts in the SEAs for both the off-shore borrow site and for the installation of the off-shore breakwaters. These SEAs will be submitted to NMFS for review and comment.

Option 3 - Breakwater Construction Only

Under Alternative 1 Option 3, project operations are similar to Alternative 1 Option 1; therefore, no impacts to marine mammals and temporary, minor impacts to EFH are anticipated.

Option 4 – Emergency Actions; Option 5 – Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under Alternative 1 Options 4, 5, and 6, there are no habitat types or prey species favored by marine mammals within the project area, nor is the work within EFH. Therefore, it is anticipated that these options would not impact marine mammals or EFH.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways

Under Alternative 2 Options 1 and 2, there are no habitat types or prey species favored by marine mammals within the project area, nor is the work within EFH. Therefore, it is anticipated that these options would not impact marine mammals or EFH.

Option 3 - Elevate the Island and Structures by Pumping Sand

Under Alternative 2 Option 3, project operations are similar to Alternative 1 Option 1; therefore, no impacts to marine mammals and short-term impacts to EFH are anticipated.

Option 4 - Build a Levee around the Entire Island

Under Alternative 2 Option 4, there are no habitat types or prey species favored by marine mammals within the project area, nor is the work within EFH. Therefore, it is anticipated that this option would not impact marine mammals or EFH.

4.4 SOCIAL AND ECONOMIC ENVIRONMENT

4.4.1 Population

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. No impacts to population numbers are anticipated because the work would not influence population trends.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under each option within Alternative 1, project activities are not expected to impact population numbers in the county or state.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under each option within Alternative 2, project activities are not expected to impact population numbers in the county or state.

4.4.2 Recreation

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. It is anticipated that the No Action Alternative would not impact recreation because the project area is closed to recreational activities.

Alternative 1: Shoreline Restoration Measures

Options 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under each Option within Alternative 1, project activities are not expected to impact recreational activities because the land portions of the project area are closed to recreational activities. Marine advisories may be posted for Options 1 and 2, to alert boaters to dredging activities.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under each Option within Alternative 2, project activities are not expected to impact recreational activities because the land portions of the project area are closed to recreation. Marine advisories may be posted for Option 3, to alert boaters to dredging activities.

4.4.3 Employment and Income

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. Under this alternative, damage and/or loss of WFF assets could occur; these losses would delay Wallops Island mission assignments and could eliminate technological capabilities as well as employment opportunities. It is anticipated that impacts would occur to employment and income if operations on Wallops Island are halted; however, these impacts would not be significant because WFF comprises only 5 percent of the labor force in Accomack County.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under each option within Alternative 1, project activities are not expected to impact employment or income. Local contractors may be hired to perform some of the labor associated with these options, but this would not be a significant increase in employment when compared to available and more labor-intensive jobs in Accomack County.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under each option within Alternative 2, project activities are not expected to impact employment or income. Local contractors may be hired to perform some of the labor associated with these options, but this would not be a significant increase in employment when compared to available and more labor-intensive jobs in Accomack County.

4.4.4 Health and Safety

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would

occur. Construction contractors would perform all work in accordance with Occupational Safety and Health Administration (OSHA) standards. It is anticipated that the No Action Alternative would not impact health and safety.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under each option within Alternative 1, project activities would occur well away from WFF employees and local citizens. Construction contractors would perform all work in accordance with OSHA standards. Therefore, it is anticipated that the options within Alternative 1 would not impact the health and safety of WFF employees, local citizens, or contractors.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under each option within Alternative 2, project activities would occur well away from employees and local citizens. Construction contractors would perform all work in accordance with OSHA standards. Therefore, it is anticipated that the options within Alternative 2 would not impact the health and safety of WFF employees, local citizens, or contractors.

4.4.5 Cultural Resources

The *Historic Resources Survey and Eligibility Report for Wallops Flight Facility* (URS/EG&G 2004) serves as the baseline for understanding the aboveground cultural resources at WFF and for determining the potential effects of any undertakings on those historic properties. The archaeological sensitivity model proposed in the *Cultural Resources Assessment, NASA Wallops Flight Facility* (URS/EG&G 2003) serves as the baseline for understanding archaeological resources on the island. NASA would take into consideration, however, that additional cultural resources on Wallops Island may meet the 50-year threshold for consideration of National Register-eligibility after the PEA is completed. Resources that meet the 50-year threshold after completion of the PEA and that fall within an identified APE for each option would need to be evaluated for their National Register eligibility under separate Section 106 consultation.

For any identified cultural resources that may be affected by NASA activities under this PEA, NASA would be responsible for complying with Section 106 and Section 110 of the NHPA. NASA would consult with the VDHR and any other interested parties for actions that would potentially impact NRHP-listed or eligible resources to identify the area of potential effects, the effects the action would have on cultural resources, and the appropriate measures to avoid or mitigate impacts to cultural resources.

No Action Alternative

Under the No Action Alternative, shoreline retreat would continue. Maintenance and emergency repairs to existing structures would likely be necessary as a result of future, substantial storm events. As needed, maintenance and emergency repairs to damaged structures would need to be completed in accordance with Section 106 and Section 110 of the NHPA. This would include the review of any newer buildings or structures that have reached the NHPA 50-year threshold for their National Register eligibility after the *Historic Resources Survey and Eligibility Report for Wallops Flight Facility* was approved by VDHR. Therefore, it is anticipated that the No Action Alternative would have an adverse effects.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill

Under Alternative 1 Option 1, dredged beach fill would serve to retard shoreline retreat and protect facilities on the island by moving the zone of wave breaking well away from vulnerable infrastructure. This option could affect potential underwater archaeological resources at offshore dredging sites and at the locations of constructed offshore sand retention structures. A remote sensing Phase I survey would be completed to address potential underwater archaeological sites once ground disturbance locations are identified. The results of this survey would be shared with the VDHR and NASA would evaluate the potential for impacting underwater archaeological resources through additional consultation with VDHR. Terrestrial archaeology would likely not be affected by this option as there would be no ground disturbing activities on the beachfront; in addition, no archaeological material or features were found during the Phase I Archaeological Survey conducted in September 2006. Results of the survey were transmitted in a letter to VDHR on February 28, 2007. To date no response has been received.

The construction of the sand-retention structures would not alter the viewshed from identified historic properties. An APE, taking into consideration any visual impact of the planned breakwaters, would be developed and structures within it evaluated, if necessary, in consultation with VDHR before construction began. Once details are finalized, the impact to historic resources would be revisited in an SEA. The long-term beneficial impacts associated with this option, however, would include the safeguarding of historic resources on the island from the current rate of shoreline retreat.

It is anticipated that, through consultation with the VDHR and implementation of any mitigation measures, Alternative 1 Option 1 would have no adverse effect.

Option 2 - Shore Protection, Beach Fill Only

Under Alternative 1 Option 2, project operations are similar to Alternative 1 Option 1; therefore, this option would have a short-term beneficial impact of safeguarding historic resources on the island from the current rate of shoreline restoration and no impacts to cultural resources are anticipated.

Option 3 - Breakwater Construction Only

Under this option, NASA would construct sand retention structures (detached offshore breakwaters, T-head groins, or a combination of the two) along a portion of Wallops Island. The size, composition, spacing, and offshore siting of these structures is yet to be determined and

would be discussed more specifically in a SEA, though the offshore siting locations would be within 100 feet of the current beachfront. Due to the erosion of the beachfront over the last 50 years, these offshore siting locations would likely not impact known archaeological resources. The construction of the sand-retention structures would have the potential to alter the viewsheds from historic properties near the shoreline depending on the height, size, and location of the retention structures. An APE, taking into consideration views of the newly constructed structures, would be developed and structures within it evaluated, if necessary, in consultation with VDHR before construction began. Once details are finalized, the impact on cultural resources would be revisited in an SEA. The short-term beneficial impacts associated with this option, however, would include the safeguarding of cultural resources on the island from the current rate of shoreline retreat.

It is anticipated that, through consultation with the VDHR and implementation of any mitigation measures, Alternative 1 Option 3 would have no adverse effect.

Option 4 - Emergency Actions

Under this option, NASA would continue implementing emergency actions to prevent the current infrastructure from being damaged during storms. Repairs to the existing infrastructure would largely be in-kind, including the replacement of rock on the existing seawall and sand on the beaches. The only potential impacts to cultural resources would be the use of heavy equipment disturbing unknown archaeological sites along the beach. However, based on the Reconnaissance Level Archaeological Survey conducted in September 2006, however, there is little potential for archaeological sites to occur along the beachfront.

It is anticipated that Alternative 1 Option 4 would have no adverse effect.

Option 5 - Installation of Geotextile Tubes

Under this option, NASA would place geotubes on shore to slow down the transportation of sand off the beach and help protect onshore assets from wave action. The placement of the geotubes would have the potential to alter the viewsheds from identified historic properties near the shoreline. On January 24, 2007, NASA began consultation with VDHR regarding the installation of geotubes along the beach as an emergency measure. An APE, taking into consideration views of the geotubes and the moderate historic archaeological sensitivity zone in which the project activities would occur, was developed and evaluated. NASA found that there would be no adverse effect from the installation of geotubes along the beach. Results of the survey were transmitted in a letter to VDHR on January 24, 2007. On January 25, 2007, VDHR concurred that geotubes would not affect historic properties (Appendix D).

The short-term beneficial impacts associated with this option are temporarily safeguarding cultural resources on the island. Alternative 1 Option 5 would have no adverse effect.

Option 6 - Sand Dunes with Various Cores

Under this option, NASA would create vegetated sand dunes with one of the following cores: rock core, semi-rigid containers filled with rock or sand, geotextile tubes filled with sand or grout, or a clay core. At this time it is unknown where these sand dunes would be located. As a result, the potential impacts to historic resources are largely unknown at this time and would be revisited through additional consultation with VDHR. The short-term beneficial impacts associated with this option are temporarily safeguarding historical resources on the island.

It is anticipated that through consultation with the VDHR and implementation of any mitigation measures, Alternative 1 Option 6 would have no adverse effect.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees

Under Alternative 2 Option 1, NASA would construct dikes or levees around critical facilities on the island, prioritizing construction at the more vulnerable areas. The plans associated with this alternative, however, are unknown including the height of dikes or levees and where pumps would be installed to pump out rain water from the system. This alternative would have the potential to affect historic resources on the island as a result of necessary ground disturbance. An APE, taking into consideration both viewsheds and the level of ground disturbance, would be developed and historic resources within it evaluated, if necessary, in consultation with VDHR before levees were constructed. The positive impacts associated with this option are safeguarding historical resources on the island while the levees or dikes are operational.

Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand

Under Alternative 2 Options 2 and 3, NASA would raise the elevation of new structures built on the island by filling the foundation or the island itself to an elevation able to sustain the anticipated rise in sea level as a result of future storms. New construction such as this has the potential to affect historic resources throughout the island. An APE, taking into consideration both viewsheds and the level of ground disturbance, would be developed and historic resources within it evaluated, if necessary, in consultation with VDHR before new construction began. However, this option addresses only the safeguarding of future, anticipated construction, however. Cultural resources would continue to be at risk for damage inflicted by storm events. As a result, the long-term effects of this alternative to cultural resources are potentially negative.

Option 4 - Build a Levee around the Entire Island

Under Alternative 2 Option 4, project operations are similar to Alternative 2 Option 1; therefore, a short-term beneficial impact to cultural resources would occur through the safeguarding of cultural resources on the island while the levee is operational and no adverse effects are anticipated.

4.4.6 Environmental Justice

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. It is anticipated that the No Action Alternative would not impact low income or minority populations because there are none located near the project area.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under each option within Alternative 1, project activities would occur well away from low-income or minority populations. Therefore, it is anticipated that the options within Alternative 1 comply with environmental justice policy and would not impact any low-income or minority populations in Accomack County.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under each option within Alternative 2, project activities would occur well away from low-income or minority populations. Therefore, it is anticipated that the options within Alternative 2 comply with environmental justice policy and would not impact any low-income or minority populations in Accomack County.

4.4.7 Transportation

No Action Alternative

Under the No Action Alternative, a Shoreline Restoration and Infrastructure Protection Program would not be implemented; however, minor maintenance and emergency repair activities would occur. It is anticipated that the No Action Alternative would not impact transportation on the facility or in the region because there are no major thoroughfares in the project area.

Alternative 1: Shoreline Restoration Measures

Option 1 - Optimum Shore Protection Plan: Sand-Retention Structures and Beach Fill; Option 2 - Shore Protection: Beach Fill Only; Option 3 - Breakwater Construction Only; Option 4 - Emergency Actions; Option 5 - Installation of Geotextile Tubes; Option 6 - Sand Dunes with Various Cores

Under each option within Alternative 1, project activities would occur outside of major transportation thoroughfares. Appropriate signage would be placed in the vicinity of the project area to identify alternate routes and detours. Therefore, it is anticipated that the options within Alternative 1 would not impact any transportation resources.

Alternative 2: Flood Protection Measures

Option 1 - Critical Structure Ring Levees; Option 2 - Elevation of Critical Structures and Roadways; Option 3 - Elevate the Island and Structures by Pumping Sand; Option 4 - Build a Levee around the Entire Island

Under each Option within Alternative 2, project activities would occur outside of major transportation thoroughfares. Appropriate signage would be placed in the vicinity of the project

area to identify alternate routes and detours. Therefore, it is anticipated that the options within Alternative 2 would not impact any transportation resources.

4.5 CUMULATIVE EFFECTS

The Council on Environmental Quality (CEQ) defines cumulative effects as the "impact on the environment which results from the incremental impact of the action(s) when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1500). NASA has determined that cumulative impacts on some resources could occur when the impacts of NASA's Proposed Action (the WFF Shoreline Restoration and Infrastructure Protection Program) are considered along with the impacts of other shoreline projects and commercial fishing operations. Cumulative impacts are anticipated to land resources, water resources, terrestrial wildlife and migratory birds, threatened and endangered, and marine mammals and sea turtles.

A study conducted by the Maryland Department of Natural Resources found that approximately 16.5 percent of Maryland Coastal Bays contain beach armoring. The coastal bays included in this study were Assawoman Bay, Isle of Wight Bay, St Martin River, Sinepuxant Bay, Newport Bay, and Chincoteague Bay (MDNR, 2006). Ocean City, Maryland, located approximately 80 kilometers (50 miles) north of WFF, has a seawall protecting the city's boardwalk. In the 1930s, the U.S. Army Corps of Engineers built two jetties to stabilize the Ocean City Inlet. These jetties have exacerbated the down-drift erosion of Assateague Island, located directly south and adjacent to Ocean City.

In New Jersey, to help protect coastal infrastructure, hundreds of feet of geotubes have been installed at Sea Isle City, located approximately 201 kilometers (125 miles) north of WFF. Ocean City also recently installed approximately 457 meters (1,500 feet) of geotubes along the city's Morningside Beach. Because of the apparent success of this installation, Ocean City is considering adding additional geotubes to other beaches (Surfrider, 2006).

Beginning in 2003, the National Park Service undertook a beach restoration effort at Assateague Island to mitigate the effects of the Ocean City Inlet jetty system built in the 1930s. The jetties have prevented the natural movement of sand along the shore from north to south, resulting in unnatural erosion and accelerated shoreline migration. Since the 1930s, portions of northern Assateague have shifted westward more than 325 yards. The objective of the NPS project is not traditional beach nourishment to protect the shoreline from storm damage or to halt erosion, but rather it is to restore Assateague Island's sand budget and ensure that natural coastal processes continue to dictate the evolution of the island (NPS, 2003).

Many communities and facilities along the eastern shore have begun to realize the negative effects of beach armoring and jetty systems, and have turned to more natural approaches to shoreline stabilization.

Land Resources

The combined effects of NASA's Proposed Action and other shoreline stabilization projects will result in more natural topography because many of the beaches are being restored to a natural state. NASA's Proposed Action would slow sediment transport south, and barrier islands south of Wallops Island would benefit from the reintroduction of sand into the natural system through the placement of beach fill. Over time the placement of beach fill may help to replenish

shorelines south of Wallops Island. Communities along the Eastern Shore are working independently and collectively to reduce erosion and shoreline retreat. The effects of these projects, when evaluated collectively with NASA's Proposed Action, would have a positive cumulative impact by contributing to restored beach habitats along the Eastern Shore.

Water Resources

While nearly all of the impacts to water resources associated with shoreline stabilization projects are temporary impacts, these impacts can result in high turbidity and increased concentrations of suspended solids overall. These impacts are significantly limited, both spatially and temporally, to the immediate project. The resulting cumulative impact to water resources as a result of regional development, beach alteration projects involving dredging and geotubes, and NASA's Proposed Action, would be minimal.

Terrestrial Wildlife and Migratory Birds

The Proposed Action, combined with other shoreline stabilization projects in the region, would result in beneficial cumulative impacts to terrestrial wildlife and migratory birds by increasing the amount of suitable beach habitat in the area.

Threatened and Endangered Species and Marine Mammals

The Proposed Action, combined with other off-shore dredging operations associated with shoreline restoration projects and ongoing commercial fishing along the east coast, could increase the chance for a negative impact on marine mammals or protected sea turtles from incidental take resulting from dredging or fishing operations.

List of URS and EG&G Preparers:

Shari Silbert, Wallops Environmental Office, EG&G Project Manager

Ryan Thompson, Project Environmental Planner, URS Project Manager

Angela Chaisson, Senior Practice Leader for NEPA/Natural Resources, URS Independent Technical Reviewer

Fred Holycross, URS Principal Historian, URS Independent Technical Reviewer

Chris Polglase, URS Principal Archaeologist, URS Independent Technical Reviewer

Kristin Leahy, URS Senior Historian

Kristine Sinkez, URS Environmental Scientist

Kim Collini, URS Senior Environmental Scientist

Suzie Loadholt, URS Senior Environmental Scientist

Robert Pauline, URS Principal Biologist

Molly Notestine, URS Senior Ecologist

Lynne McMullen, URS Senior Environmental Scientist

Anthony Randolph, URS Principal Archaeologist

Initial coordination letters were sent to the following agencies:

Federal Agencies:

Mr. Roger Amato
Acting Chief, Alternative Energy and Marine Mineral Branch
Minerals Management Service Branch Chief
Offshore Mineral Management
381 Elden Street MS 4010
Herndon, VA 20170

U.S. Fish and Wildlife Service
Attn: Mr. Eric Davis
6669 Short Lane
Gloucester, VA 23061
(804) 693-6694

National Marine Fisheries Service
Attn: Mr. Peter D. Colosi,
One Blackburn Drive
Gloucester, MA 01930-2298

National Marine Fisheries Service
Attn: Ms. Patricia Kurkul
Regional Administrator
Northeast Regional Office
Office of Protected Resource
One Blackburn Drive
Gloucester, MA 01930

State Agencies:

Office of Environmental Impact Review
Attn: Ms. Ellie Irons
Virginia Department of Environmental Quality
629 East Main Street, Room 631
Richmond, VA 23219

Virginia Department of Historic Resources
Attn: Ms. Kathleen Kilpatrick
Federal Review and Compliance Coordinator
2801 Kensington Avenue
Richmond, VA 23221

NASA is the lead Federal agency for conducting the NEPA compliance process for this Programmatic EA at Wallops Flight Facility. The lead agency's goal is to expedite the preparation and review of NEPA documents while meeting the intent of NEPA and complying with all NEPA provisions including NHPA, EO 12114, EO 11988, EO 11990, Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act.

The Programmatic EA has been made available for public review between May 23, 2007 and June 22, 2007, at the following locations:

NASA WFF Technical Library
Building E-105
Wallops Island, Virginia 23337
(757) 824-1065
Hours: Mon – Fri: 8 a.m. - 4:30 p.m.

Island Library
4077 Main Street
Chincoteague, Virginia 23336
(757) 336-3460
Hours: Mon: 10 a.m. - 2 p.m.
Tues: 10 a.m. - 5 p.m.
Wed, Fri, Sat: 1 p.m. - 5 p.m.

NASA solicited public and agency review and comment on the environmental impacts of the proposed action through:

1. A notice of availability of the draft Programmatic EA published in the Eastern Shore News and the Chincoteague Beacon on May 23, 2007;
2. Publication of the draft PEA on the WFF Environmental Office website;
3. Consultations with local, state, and federal agencies; and
5. Direct mailing of the draft PEA to interested parties.

The draft PEA can be viewed on the WFF Environmental Office website:
http://sites.wff.nasa.gov/code250/Documents/documents.htm

A limited number of copies of the draft PEA are available by contacting:

Joshua A. Bundick
Wallops Flight Facility, Code 250.W
Wallops Island, VA 23337
Phone: (757) 824-2319
FAX: (757)824-1819

The following Public Notice advertising the availability of the Programmatic EA was placed in the Eastern Shore News and the Chincoteague Beacon on May 23, 2007.

PUBLIC NOTICE
THE NASA GODDARD SPACE FLIGHT CENTER'S
WALLOPS FLIGHT FACILITY WALLOPS ISLAND, VIRGINIA
INVITES
PUBLIC COMMENTS ON THE
ENVIRONMENTAL ASSESSMENT
DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT
WALLOPS ISLAND SHORELINE RESTORATION AND
INFRASTRUCTURE PROTECTION PROGRAM
WALLOPS FLIGHT FACILITY

In accordance with the requirements of the National Environmental Policy Act (NEPA), NASA Goddard Space Flight Center's (GSFC) Wallops Flight Facility (WFF) invites public comment on the Draft Programmatic Environmental Assessment (PEA) for the Shoreline Restoration and Infrastructure Protection Program on WFF, Wallops Island, Virginia. NASA has analyzed and addressed the potential impacts of anticipated shoreline restoration and infrastructure protection activities on Wallops Island in one NEPA document in an effort to create a more integrated review and analysis. This document will facilitate NASA's compliance with NEPA by providing a framework within which to address the environmental impacts of future shoreline restoration and infrastructure protection actions on Wallops Island.

The PEA is available for review between May 23, 2007 and June 22, 2007,

Comments must be submitted by 5:00 PM on June 22, 2007.

Comments should be submitted to:

Joshua A. Bundick
NEPA Program Manager
Code 250.W
Goddard Space Flight Center's Wallops Flight Facility
National Aeronautics and Space Administration
Wallops Island, VA 23337
(757) 824-2319

Comments may be sent electronically to Joshua.A.Bundick@nasa.gov
Subject: PEA
The public is encouraged to review all materials associated with the Environmental Assessment at the following places.
The PEA may be viewed on-line at http://sites.wff.nasa.gov/code250/Documents/documents.htm

Administrative Record File:
Technical Library
Building E-105
NASA Wallops Flight Facility
Wallops Island, Virginia 23337
(757) 824-1065
Hours: Monday - Friday, 8 a.m. - 4:30 p.m.

Eastern Shore Public Library
23610 Front Street
Accomac, Virginia 23301
(757) 787-3400
Hours: Monday, Tuesday, Wednesday, Friday: 9 a.m. - 6 p.m.
Thursday: 9 a.m. - 9 p.m.
Saturday: 9 a.m. - 1 p.m.

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Appendix A

Agency Coordination

Appendix B
National Marine Fisheries Service
Biological Assessment

Appendix C

National Marine Fisheries Service Biological Opinion

The NMFS BO has not been received to date.

Appendix D

Cultural Resources Correspondence