



U.S. Fish & Wildlife Service

# Chincoteague and Wallops Island National Wildlife Refuges

*Final Comprehensive Conservation Plan  
and Environmental Impact Statement*

*August 2015*

*Volume 2 - Appendix A through O*



*Front cover:*

*Sunrise at Chincoteague National Wildlife Refuge*

Steve Hillebrand/USFWS



*This blue goose, designed by  
J.N. "Ding" Darling, has become  
the symbol of the National Wildlife  
Refuge System.*

The U.S. Fish and Wildlife Service (Service) is the principal Federal agency responsible for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The Service manages the National Wildlife Refuge System comprised of over 150 million acres including over 555 national wildlife refuges and thousands of waterfowl production areas. The Service also operates 70 national fish hatcheries and 81 ecological services field stations. The agency enforces Federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Wildlife and Sportfish Restoration Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

Comprehensive Conservation Plans (CCPs) provide long-term guidance for management decisions on a refuge and set forth goals, objectives, and strategies needed to accomplish refuge purposes. CCPs also identify the Service's best estimate of future needs. These plans detail program levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. CCPs do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

# Chincoteague and Wallops Island National Wildlife Refuges

## *Final Comprehensive Conservation Plan and Environmental Impact Statement*

*August 2015*

### **Refuge Vision Statement**

Our vision statement for the refuges is a synthesis of the refuges' purposes, the National Wildlife Refuge System mission and goals, and other biological, legal, and social concerns in which the refuge has a role. It is intended to be an expression of what the refuge will be like in the future in terms of natural resources and visitor experience. Our vision for the refuge, developed to help provide the core component of management strategies hereafter, is as follows:

*Chincoteague and Wallops Island National Wildlife Refuges encompass extraordinary and ever-changing lands at the edge of the sea, a place where unique habitats and wildlife flourish. In partnership with others, the refuges are a vital part of a larger system of protected lands and waters on the Delmarva Peninsula critical to migratory birds. People from around the world can visit the refuges to learn, recreate, refresh themselves, be inspired by wildlife and wild lands, and renew their connection with nature.*

## Table of Contents

|                                                                                                                                                                                                                               |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| *Appendix A: The Proposed Assateague Wilderness .....                                                                                                                                                                         | A-1        |
| *Appendix B: Other Federal Mandates and Relevant Plans and Initiatives.....                                                                                                                                                   | B-1        |
| *Appendix C: Laws and Executive Orders Applicable to Chincoteague and Wallops Island NWR CCP .....                                                                                                                            | C-1        |
| *Appendix D: Interim Chincoteague Pony Management.....                                                                                                                                                                        | D-1        |
| *Appendix E: Memorandum of Agreement: Interagency Cooperate at Assateague Island National Seashore<br>and Chincoteague National Wildlife Refuge .....                                                                         | E-1        |
| *Appendix F: Biological Opinion on Monitoring and Management Practices for Piping Plovers, Loggerhead<br>Sea Turtle, Green Sea Turtle, Leatherback Sea Turtle, and Seabeach Amaranth.....                                     | F-1        |
| *Appendix G: Notes on Sea Level Rise and Projected Impacts on Chincoteague NWR.....                                                                                                                                           | G-1        |
| *Appendix H: Adapting Now to a Changing Climate: Wallops Flight Facility and the Eastern Shore .....                                                                                                                          | H-1        |
| *Appendix I: Summary Costs of Draft Alternatives and Comparison of Beach Access Costs .....                                                                                                                                   | I-1        |
| *Appendix J: Chincoteague National Wildlife Refuge Beachfill. Abbreviated Analysis and Cost Opinion for<br>Maintaining the Existing Parking Areas and Recreational Beach .....                                                | J-1        |
| *Appendix K: Staffing Charts for All Alternatives .....                                                                                                                                                                       | K-1        |
| *Appendix L: Species Lists for Chincoteague and Wallops Island NWRs .....                                                                                                                                                     | L-1        |
| *Appendix M: Chincoteague NWR Economic Analysis in Support of CCP .....                                                                                                                                                       | M-1        |
| *Appendix N: Chincoteague NWR: Recreational Beach Structured Decision-Making Process, Locating the<br>Best Site for a Recreational Beach and Parking Lot .....                                                                | N-1        |
| *Appendix O: Section 7 Biological Opinion for Alternative B .....                                                                                                                                                             | O-1        |
| <b>Appendix P: Compatibility Determinations .....</b>                                                                                                                                                                         | <b>P-1</b> |
| Wildlife Observation, Wildlife Photography, and Interpretation .....                                                                                                                                                          | P-3        |
| Environmental Education.....                                                                                                                                                                                                  | P-21       |
| Fishing (Recreational).....                                                                                                                                                                                                   | P-31       |
| Migratory Game Bird Hunting.....                                                                                                                                                                                              | P-47       |
| Big Game Hunting .....                                                                                                                                                                                                        | P-69       |
| Commercial Filming, Still Photography, and Photography Workshops.....                                                                                                                                                         | P-91       |
| Grazing of Chincoteague Ponies.....                                                                                                                                                                                           | P-99       |
| Horseback Riding .....                                                                                                                                                                                                        | P-111      |
| Research and Studies Conducted by non-USFWS Staff.....                                                                                                                                                                        | P-121      |
| Shell Collection.....                                                                                                                                                                                                         | P-141      |
| Big Game Hunting (Wallops Island NWR).....                                                                                                                                                                                    | P-147      |
| Research and Studies Conducted by non-USFWS Staff (Wallops Island).....                                                                                                                                                       | P-157      |
| <b>Appendix Q: Findings of Appropriateness .....</b>                                                                                                                                                                          | <b>Q-1</b> |
| <b>Appendix R: Summary of Public Comments and USFWS Responses on the Draft Comprehensive Conservation<br/>Plan and Environmental Impact Statement for Chincoteague and Wallops Island National<br/>Wildlife Refuges .....</b> | <b>R-1</b> |
| <b>Appendix S: Federal Consistency Determination.....</b>                                                                                                                                                                     | <b>S-1</b> |

*\*Appendices A through O are not included in print copy. Available online or on CD-ROM.*

**Appendix A**

Bill Thompson/USFWS



*American Black Duck*

# **The Proposed Assateague Wilderness: Building Blocks for the Wilderness Character Monitoring Report**



**2012**

U.S. Fish & Wildlife  
Service  
U.S. National Park  
Service

Taryn Sudol  
Wilderness Fellow



# **[THE PROPOSED ASSATEAGUE ISLAND WILDERNESS]**

Building Blocks for the Wilderness Character Monitoring Report

## Executive Summary

The Assateague barrier island off the Maryland and Virginia mainland is managed, in part, by the U.S. Fish and Wildlife Service as the Chincoteague National Wildlife Refuge (CNWR), the U.S. National Park Service as the Assateague Island National Seashore (ASIS), and the Maryland Department of Natural Resources as Assateague State Park. Federal and state protection of this island provides a wildlife sanctuary, especially for shorebirds and migratory birds, and recreational opportunities for a high number of visitors.

In response to the Wilderness Act, 1964, the entire island was reviewed to see which areas still possessed primeval characteristics. As a result, the central 6,500 acres of Assateague Island was proposed as wilderness in 1974, but has yet to receive designation. Until such a Congressional decision is made, ASIS and CNWR manage the area to preserve its wilderness character. An evaluation of the current land status will set a 2012 baseline for wilderness character and support a plan for monitoring long-term trends.

An interagency team, representing the U.S. Fish & Wildlife Service (USFWS), National Park Service (NPS), U.S. Forest Service (USFS), and Bureau of Land Management (BLM), developed a guide for wilderness character monitoring. This national strategy is described in the 2008 “Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character across the national Wilderness Preservation System” publication, and will be followed herein.

The purpose of this document is to describe a wilderness character monitoring program for the proposed Assateague Island wilderness. The designed 33 measures are largely consistent for both ASIS and CNWR. They were developed with ASIS and CNWR staff as well as outside USFWS and NPS guidance. They are composed of readily available data such as field surveys, management policies, documented uses, and professional judgment.

First, the setting of the proposed wilderness is described, including current boundary descriptions, the island’s ecology, a legislative history and refuge and park purposes. Second, a wilderness narrative expresses what makes the proposed Island Wilderness special. Third, the process for developing these measures is explained. Fourth, the wilderness character hierarchy is expanded upon to provide context for the fifth section, the Measures. This section describes the suite of proposed measures, such as their relevance to wilderness character, how the data is collected, and 2012 data. This section also includes measures under development and those measures considered but ultimately dismissed as not functional. Lastly, concluding thoughts are given on the proposed monitoring program and continuing issues.

In effect, this document provides a 2012 baseline assessment and describes the wilderness character monitoring program for the proposed Assateague Island wilderness.

## Contents

|                                                                                |    |
|--------------------------------------------------------------------------------|----|
| Executive Summary.....                                                         | 2  |
| Section 1. Setting of the Assateague Island Wilderness .....                   | 5  |
| 1.1 Geographic setting: Current Land Status, Boundary Description and Map..... | 5  |
| 1.2 Ecological setting .....                                                   | 8  |
| 1.3 History of land status, legislation, and establishing the wilderness ..... | 9  |
| 1.4 Refuge and Park purposes .....                                             | 9  |
| 1.5 Significant resources and values.....                                      | 10 |
| Section 2. Wilderness Character Narrative .....                                | 11 |
| <i>UNTRAMMELED</i> .....                                                       | 11 |
| <i>NATURAL</i> .....                                                           | 13 |
| <i>UNDEVELOPED</i> .....                                                       | 14 |
| <i>SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION</i> .....                   | 15 |
| <i>OTHER FEATURES OF THE WILDERNESS</i> .....                                  | 16 |
| Section 3. Resources and Process .....                                         | 17 |
| 3.1 Documents Consulted.....                                                   | 17 |
| 3.2 Assateague NS and Chincoteague NWR Staff Consulted.....                    | 17 |
| 3.3 Process Used For Identifying Measures.....                                 | 18 |
| Section 4. Framework For Wilderness Character Monitoring .....                 | 19 |
| Section 5. Measurements .....                                                  | 21 |
| 5.1 Natural .....                                                              | 21 |
| 5.2 Untrammeled.....                                                           | 28 |
| 5.3 Undeveloped.....                                                           | 31 |
| 5.4 Solitude or Primitive and Unconfined Recreation .....                      | 40 |
| 5.5 Other Features .....                                                       | 46 |
| 5.6 Measures under Development .....                                           | 47 |
| 5.7 Measures Not Used.....                                                     | 49 |
| Section 6. Issues and Conclusion .....                                         | 50 |
| Appendix A. Wilderness Act.....                                                | 51 |
| Appendix B. Worksheet to Prioritize Measures.....                              | 55 |
| Appendix C. Summary of Measures.....                                           | 69 |
| Appendix D. Effort.....                                                        | 75 |
| Appendix E. Actions –Detailed .....                                            | 81 |
| Appendix F. List of Authorized Developments.....                               | 82 |

Appendix G. Authorized motorized vehicles, mechanical transport and motorized equipment –Detailed ..... 84

## Section 1. Setting of the Assateague Island Wilderness

### *1.1 Geographic setting: Current Land Status, Boundary Description and Map*

The proposed Assateague Island Wilderness is located on the central portion of Assateague Island. This island resides to the east of the Delmarva Peninsula, situated between the Sinepuxent and Chincoteague Bays and Atlantic Ocean. Stretching longer than 37 miles, it crosses through Accomack County, Virginia and Worcester County, Maryland. While the island's shape is in a constant flux, it is approximately 15,616 land acres, and varies between 1.25 and 3 miles wide. The wilderness portion of the barrier island spans the state line. In Maryland it begins south of Fox Hills, stretches through Virginia and ends around the Old Fields Impoundment. The wilderness area is about 5,700 acres or 37% of the island.

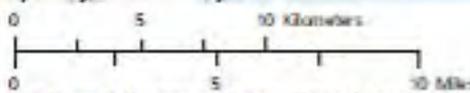
The length of the island is divided by three managing agencies. The Maryland Department of Natural Resources owns the Assateague State Park, 688 acres, in the northern part of the island across from the Sinepuxent Bay. The National Park Service (NPS) manages the northern tip of the barrier island, skips over the state park then reaches down to the Virginia state line as the Assateague Island National Seashore (ASIS). The NPS also owns a few small islands bayside of the state line and manages one mile of Tom's Cove Recreational Beach on the Fish and Wildlife Service (FWS) portion of the island through an interagency agreement with the Chincoteague National Wildlife Refuge (CNWR). The FWS manage 9,021 acres on the southern end of the barrier island in Virginia (17 miles) as well as a few islands in southern Maryland as the CNWR

At the time of the wilderness proposal, the FWS was to manage 1,300 acres (882 in Virginia and 418 in Maryland) of recommended wilderness. The NPS was to manage 440 acres of recommended wilderness as well as 4,760 proposed additional wilderness or 5,200 acres total. A recent NPS analysis using 2008 aerial photography and GIS has determined that the NPS wilderness area is actually 4,034 acres rather than 5,200 acres. The most recent GIS maps show that FWS manages 1,721 acres in Virginia. This difference in acreage between 1974 and 2011 is attributed to Assateague Island's changing shape and inaccuracies in the original land estimations.

Beach recreation and wildlife viewing make the Park and Refuge attractive destinations for the nearby urban and suburban residents. The island is within moderate driving distance of several major urban centers. Norfolk, VA is about two and half hours away (85 air miles), Washington D.C. is three and half hours away (110 air miles), and Philadelphia is less than four hours away (105 air miles). As such, CNWR is regularly one of the top six visited National Wildlife Refuges. In the 2011 fiscal year, it received 1,353,354 visitors. The Assateague Island National Seashore received 301,007 visitors (ASIS is ranked 36<sup>th</sup> in NPS recreation visits). A limited number of these total visitors (about 1% in CNWR and less than 10% in ASIS), however, enter into the Island Wilderness.

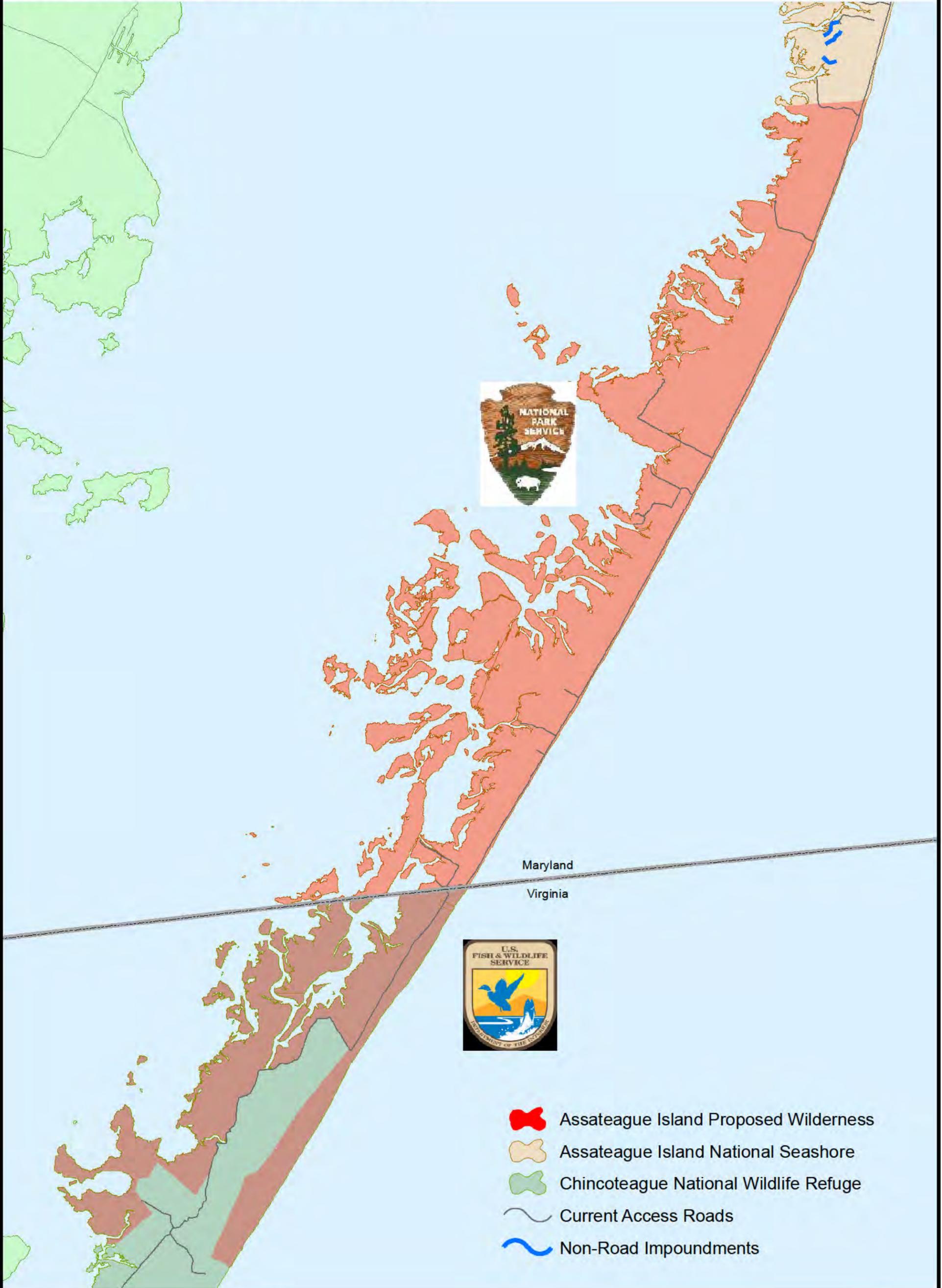


|  |                                               |  |                         |
|--|-----------------------------------------------|--|-------------------------|
|  | National Park Service Lands                   |  | NPS Boundary            |
|  | National Wildlife Refuge Lands                |  | Proposed Wilderness     |
|  | Refuge public closure<br>March 15 - August 31 |  | Backcountry Campsites   |
|  | Maryland State Lands                          |  | Structures              |
|  | NASA Lands<br>(restricted access)             |  | Road park roads         |
|  | Municipalities                                |  | Over-land vehicle route |





# ASIS Wilderness Character Map



0 3 Kilometers  
0 2 Miles

Produced by Assateague Island National Seashore, Resource Management, GIS



August 2012

## 1.2 Ecological setting

As a barrier island, Assateague Island is constantly responding to wind, waves, and storm surges. Strong waves and storm surges can erode the sand on the beach away from the dune line and back into the ocean or they can push the sand past the dunes and overwhelm the interior and western portions of the island with sand. Natural sand dunes form based off the frequency and extent of storms and prevailing winds as well as the growth of stabilizing vegetation. Historically the island had low dunes and was frequently overwhelmed. The coastal edge progressively moves to the west due to erosion and overwhelm. When the sand is spread across the dunes and marshes, and deposited into the bays on the island's backside, the process is sometimes described as "barrier island rollover" or "island migration."

During the 1950s and early 1960s, tall artificial dunes were built along the Maryland and Virginia portions of the Assateague coast to protect features on the island's interior such as impoundments (moist soil management units for migratory birds) and public use facilities. These tall dunes are vulnerable to strong storms that may blow out or wash the dunes away. Global climate change may bring greater storm events and higher sea levels which will accelerate erosion and overwhelm. Up until the 1990s, many of these artificial dunes were maintained. The 1993 Master Plan for CNWR deemphasized dune maintenance in Virginia. Strong coastal storm events in Maryland during the 1990s eliminated the majority of these relict artificial dune lines resulting in wide expansive ocean beaches. Allowing for natural barrier island migration is now the favored management practice, as opposed to dune maintenance, on ASIS and the CNWR.

The climate for Assateague Island is primarily influenced by the Atlantic Ocean. The barrier island acts as a buffer for the mainland against hurricanes or tropical storms that travel through the Atlantic. Summer days are usually hot and humid while autumn days are cool and clear. Autumn and winter, however, are Nor'easter season. Nor'easters are low pressure storms with heavy rains, very strong northeast winds, high tides and rough seas. Nor'easters can exert great force on the island. Winter temperatures average at 49 degrees Fahrenheit. Snowfall is uncommon, and rarely accumulates. Rainfall has a uniform distribution throughout the year with an average of 3.5 inches per month or 42 inches a year.

Multiple habitats occur on the barrier island and within the wilderness. These habitats transition from ocean to bayside:

The beach habitat hosts pioneer species such as American sea rocket and sea lavender that can tolerate shifting sands, overwhelm, limited fresh water, salt water sprays, and extreme winds and temperatures. The beach grass community establishes itself on the stabilized dunes beyond the high tide line. Sea beach Amaranth, a federally threatened plant, is present in low numbers across the island, including the wilderness area. Nesting birds such as the Piping Plover, American Oystercatcher, Least Tern and Black Skimmer will utilize the beach for nesting habitat. Loggerhead sea turtles will also opportunistically nest predominantly within CNWR.

Beyond the dunes are pockets of shrub/early successional habitat. This is composed of shrubs, small trees, and vines, such as wax myrtle, northern bayberry and false Mayberry. Land birds such as the Yellow Warblers, Pine Warblers and Brown Thrashers may be present. Monarch butterflies, tree swallows and Peregrine falcons all migrate through Assateague Island each Fall.

Ancient, stable dunes and stable sand ridges support the forested uplands. The soil is sandy and suited for loblolly pine, the dominant species, and dogwood, high-bush blueberry, greenbrier and fox grape in the understory. Rare or uncommon plants such as the Indian pipe, crested yellow orchid, and pink lady slipper can also be found in the Virginia uplands. The Delmarva Fox Squirrel is present in woodlands in the southern portion of CNWR and may have extended into the wilderness. The uplands may transition to shrub lands again before shifting into the salt marsh habitat.

Salt marshes are rich and productive ecosystems. The vegetation is influenced by tidal flooding and the silty loam soil. Salt marsh cordgrass dominates the low marsh (the zone between low and high tide). Northern sea lavender

and marsh elder grow along the marsh/upland edge. The Clapper Rail and Salt Marsh Sparrow are species of interest in the salt marsh. The Diamondback terrapin also inhabits the salt marsh islands.

### *1.3 History of land status, legislation, and establishing the wilderness*

While no direct evidence has yet been found, it is likely that Assateague Island was used by Native Americans for thousands of years as a place for seasonal plant gathering, hunting and fishing. Giovanni da Verrazano first explored the island in 1524 while sailing for the King of France. For the next one hundred years explorers investigated the island, but colonists preferred the better soils and protected environment offered on the mainland. During the late-1600s, livestock grazed on the island as a way to avoid fencing ordinances on the mainland. The first Assateague Lighthouse was constructed in 1833 and later two life-saving stations, one near Green Run Inlet, MD, were occupied to respond to shipwrecks. Over time livestock herding, hunting, salt extraction and shell fishing brought more inhabitants to the island and established a small village.

In the 1930s and 1940s numerous, large ditches were dug in the salt marshes within Maryland as an effort to control the mosquito population. This failed to limit the mosquitoes and instead disrupted the salt marsh hydrology. In 1943 the Virginia portion of the island became the Chincoteague National Wildlife Refuge to provide a sanctuary for migratory birds, particularly the snow goose. On the Maryland portion, during the 1950s and 1960s intensive development was planned. Ultimately few houses were built but associated infrastructure such as forest clearing, roads and artificial dune construction was underway. In 1962 the Ash Wednesday Nor'easter struck, destroying much of the developments so that only about 30 structures remained in Maryland. When the national seashore was designated in 1965, these structures were moved or destroyed in place. Eleven property owners retained their rights within the seashore, occupying their properties which included roads, docks, and duck blinds over the next 25 years.



Photo: Chincoteague National Wildlife Refuge

The passing of the Wilderness Act of 1964 required that the Secretary of the Interior review every roadless area of 5,000 contiguous acres or more in the units of the NPS as well as any roadless area regardless of size within the NWR, for the suitability of wilderness designation. The results of this review would lead to a wilderness study for potential areas. Based off the wilderness studies, the Secretary of the Interior would make his recommendation to the President of the United States. From there the President would pass his recommendation to Congress, which would formally sign the bill for designated wilderness.

The Chincoteague National Wildlife Refuge was studied jointly with the Assateague Island National Seashore for the inclusion of land in the National Wilderness Preservation System in 1973. The entire island was considered at the time. Due to the heavy recreational uses at the islands poles, lands which still represented primeval character were reduced to the central portion of the island. In 1973, this estimated acreage was 6,500 acres, with 1,740 acres being recommended wilderness and 4,760 acres as additional wilderness. These 4,760 acres would be eligible as wilderness when nonconforming uses, such as multiple retained rights hunting camps were removed or terminated. The public had some concerns with regard to the prohibition of motorized vehicles, but were largely in favor of the wilderness proposal.

United States President, Gerald Ford, recommended this Assateague area as wilderness and Congress drew up the bill in 1974, but has not signed it since. Even though Assateague's lands have not been formally designated as Federal wilderness, the recommended and potential wilderness lands are meant to be managed to preserve the wilderness character. The NPS and FWS manage the land in a way that is generally consistent with the Wilderness Act.

### *1.4 Refuge and Park purposes*

The Chincoteague NWR was established on May 13, 1943 under the authority of the Migratory Bird Conservation Act. This FWS ownership of the land was necessary for the protection of migratory birds, such as the snow goose. The purposes of the refuge are:

“...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” (Migratory Bird Conservation Act)

“... suitable for – (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species...” (Refuge Recreation Act)

“... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligation contained in various migratory bird treaties and conventions...” (Emergency Wetlands Resources Act of 1986)

The Assateague Island NS was established on September 21, 1965 by President Lyndon B. Johnson. The purposes of the seashore are to:

“Preserve the outstanding Mid-Atlantic coastal resources of Assateague Island and its adjacent waters and the natural processes upon which they depend;

“Provide high quality resource-compatible recreational opportunities.”

According to the General Management Plan Wilderness Update, the primary goals in managing the Assateague Island Wilderness are to:

“Protect, restore, and preserve the area’s natural resources and values, and the integrity of its wilderness character for present and future generations;

“Provide for freedom of public use and enjoyment of the wilderness area in a manner that is consistent with the Wilderness Act, NPS management policies, park purposes, and the protection of resources and values; and

“Provide for public understanding and support of wilderness resources and values”

### 1.5 Significant resources and values

*Natural* –As described in section 1.2, the proposed Island wilderness supports a continuum of habitats that include beach, dunes, shrub lands, maritime forest, and salt marsh. Specialized species have adapted to these habitats year round and this is an important stopover site for migratory birds. Aquatic habitats in the form of sea grasses, salt marshes, sand shallows and mudflats additionally support a high diversity of life. Additionally, the wilderness is intended to have high water quality. The island’s hydrology includes the ocean, estuary, groundwater, and standing surface water. The wilderness is also an area to observe natural coastal processes such as dune formation and migration.

*Visitor Experiences* –The proposed wilderness can provide visitors with panoramic views, natural sounds, inviting waters, and dark night skies. The diversity of ecosystem types in an accessible landscape is attractive to many locals in the surrounding area as well as long distance visitors. The refuge and seashore value recreation opportunities that include hunting, fishing, birding, hiking and swimming.



Photo: Taryn Sudol

*Cultural* –Given the history of the island, certain sites have heritage value. The Green Run Hunting Lodge qualifies for the national register. There is a small cemetery in the northern portion of the wilderness as well. Old shipwrecks are still buried beneath the island’s sands and should they emerge, they will be preserved on site or removed to protect their value.

## Section 2. Wilderness Character Narrative

*A wilderness character narrative is a positive and affirming description of what is unique and special about a given wilderness. The narrative describes the five tangible and measurable qualities of wilderness character. This is a description of values, issues, and threats for the subject wilderness; it is not a critique on the state of wilderness or recommendation for management.*

In the beloved children's book, *Misty of Chincoteague*, Marguerite Henry describes the legendary arrival of the island's famous wild horses: "Then they rolled in the wiry grass, letting out great whinnies of happiness. They seemed unable to believe that the island was all their own. Not a human being anywhere. Only grass. And sea. And sky and the wind."

Assateague Island, the Virginia portion of which contains the Chincoteague National Wildlife Refuge, is a barrier island which has been set aside as a wild place of nature. An ocean breeze will push the sand up the beach, roll it over the dunes, rustle the leaves on the wax myrtle shrub and whistle through the tall loblolly pines in the upland forest, until it passes across the salt marshes to the Chincoteague Bay. There are no buildings for the breeze to collide against, no mail boxes to nudge it, and no drive-overs for it to whiz beneath. Although the entire island is preserved as a national park or wildlife refuge, the central 5,700 acres across the Maryland-Virginia state line, is a federally proposed wilderness, where the markings of man are minor and natural forces prevail.

Barrier islands are in constant flux, in response to climatologic impacts. Historically, man has applied his hand to these lands, but their dynamism, over time, erases the human imprint ---Mother Nature clears the scars. The island has existed for thousands of years but has only survived by constantly changing form. Therefore, when visitors stand atop an ancient dune on Assateague, a dune that is perhaps one hundred years old, they see a snapshot in time; they see how nature has meant a barrier island to evolve. The new shape of Assateague may be different, but it is still the barrier island that Giovanni da Verrazzano explored over four hundred years ago.

When the Island Wilderness was proposed in 1974, it was the only undeveloped barrier island between Massachusetts and North Carolina. It is a rarity, and yet within a moderate drive for millions of people from the Norfolk, Washington, DC, Baltimore and Philadelphia metropolises. President Johnson's philosophy was that the Assateague Wilderness would protect one of the few natural shorelines still left, and provide the greatest good for the greatest number of the public.

As of 2012, the United States Congress has yet to sign to bill for Island Wilderness designation but the Assateague Island National Seashore (ASIS) and the Chincoteague National Wildlife Refuge (CNWR) have managed to preserve the wilderness character of the proposed wilderness.

### **UNTRAMMELED**

*Wilderness is essentially unhindered and free from modern human actions that control or manipulate the community of life.*



At the time of the wilderness recommendation, the Director of the CNWR and the Deputy Director of the ASIS decided that, “The really significant aspect of the proposal is to allow the natural processes of the barrier island to flourish.”

A barrier island, without man’s rigid grip, fluctuates, bends, and rolls over itself on a faster timescale than many other geological processes. The migration of the land has a natural push west to the mainland and to the south because of the tides and littoral drift. The sun, moon, and the Earth all exert their forces to shape this coastal sliver of sand. Storm events and sea level rise further mold the island: pulling sand away, pushing it into new dunes or creating entirely new inlets. These forces act on the island regardless of the presence of man.

One purpose of the proposed wilderness is to provide a natural laboratory, where geologists may observe and study how an island responds to the flow of wind and waves.

If current trends continue and future predications are actualized, it is likely that the island will subside, sea level will rise, and significant storm events will increase. The island, along with the rest of the region, is subsiding due to unknown reasons but scientists speculate the effects of deep aquifer removal. This subsidence adds to local trends in sea level rise. A rise in sea level may reduce the island’s size, erode the sand, alter the habitat composition, and hasten the western and southern migration.

Major storm events reshape island morphology by causing breaks in the dune systems or creating new inlets between the Atlantic Ocean and Chincoteague Bay. With increasing sea level, there is an increased probability of these changes. Yet, much uncertainty remains about the pace of sea level rise and the consequences of global climate change.

An untrammled wilderness, such as Assateague, allows for substantial alteration due to natural forces. But, the effect of potential landscape alterations may contest with what the public feels is appropriate. In such an instance, the ASIS and CNWR managers are obligated to meet the objectives of the federal Wilderness designation, as well as their specific mandates for the protection of resources. Any engineering, such as dune maintenance or shoreline stabilization, would interfere with the true, natural processes of the barrier island and be considered incompatible with the wilderness designation.

Day-to-day activities of the agencies managing the island’s Wilderness is mostly passive: monitoring species of concern as well as implementation of necessary precautions for the successful proliferation of these species, such as predator exclosures; herbicide applications are made to invasive plants; and steps are taken for the management of the rare fire event. Mitigation efforts, such as removal of abandoned structures and salt marsh restoration activities are currently conducted to improve wilderness character. While these activities may temporarily trammel the environment, they are necessary to restore and enhance the untrammled qualities of the barrier island.

It is evident that, given free reign, nature is a dynamic, changing force on the Island Wilderness.

## **NATURAL**

*Wilderness maintains ecological systems that are substantially free from the effects of modern civilization*



Assateague Island, in the ASIS Administrative History, was described as, “A barren place, swept by wind and sun, its solitude broken only by the shrill cry of wheeling gulls and the metronome boom of the surf.”

In the glare of the bright white sand, pioneer species, such as the American sea rocket and the sea lavender, grasp for a foothold in constantly shifting sands and sprays of salt water. It is a harsh environment where the indigenous species have victoriously adapted.

The sea rocket, for example, has a long taproot to anchor it in the sand and thick, fleshy leaves to retain moisture. The speckled shorebird eggs mimic the seashells which dapple the sand. The dune grass community has established a foothold beyond the high tide line; these flora include American beach grass, sea-oats, seaside goldenrod and sea beach amaranth (a federally threatened plant).

On the other hand, Phragmites and Asiatic sand sedge are invasive non-native plants that have rapidly begun to dominate parts of the wilderness. These two species, left unchecked, will likely spread their monotypic stands, out-competing the native plants which provide better habitat for the wildlife.

The habitat types range from shrubs on the wind-rippled dunes to needle-carpeted upland forests. In these forests, loblolly pines have taken root on only the most stable interior dunes and sand ridges. Years ago these dunes formed as the island rolled over on itself. The continuum of habitats may shift from the sweet pungency of pine woods back to the shrubs, and then to the sharp, tangy salt marsh.

The sun is strong and the wind is often forceful, yet wildlife found here and have nestled closely with available flora. The wild horses and Sika deer, both introduced animal species, have adapted to this harsh, salty scrub by feeding on salt grasses and other plant life. Although the wild horses have become a cultural attraction, and the Sika deer have supplemented the hunter’s catch, their grazing pressures and trampling effects have added strain to the fragile and challenged vegetation system.

In addition, climate change will expose vulnerabilities in current vegetation composition and wildlife populations. As mentioned above, the wilderness will likely face more frequent disturbances in the form of sea level rise as well as increased storms and droughts. The varieties of habitat may shift as the beach expands or contracts. Beach

nesting shorebirds and other wildlife can be significantly impacted from a single storm event. The amount and quality of forage, as well as freshwater may become further limited during droughts.

As the natural features change on the island, the new characteristics will not be any less natural, but they may cause a greater change in a shorter time period than would be expected without a change in climate.

## **UNDEVELOPED**

*Wilderness retains its primeval character and influence, and is essentially without permanent improvements or modern human occupation.*



An outstanding feature at the time of the wilderness recommendation was Assateague's undeveloped quality. This barren island, with its shrill gulls, was an "onlyness" which had to be protected.

Just as the wire cages protect the federally threatened Piping Plover nests from the common predators, the ASIS and CNWR policies have generally protected this natural landform from the human encroachment.

Assateague Island is relatively flat and one's sight extends far out to distant horizons. On the bay side, the skyline is pine trees; the view is a scattered jigsaw of salt marshes. On the Atlantic side, the blue of the ocean meets the blue of the sky. Within the wilderness, cottontail rabbits cut one off instead of cars; gulls, terns, warblers, and sparrows produce a more complex and pleasing cacophony than the sound of lawnmowers, motor vehicles, and sirens. The corner of one's eye will barely glimpse a deer before it soundlessly disappears into the shrub. What is the wilderness for, if not Beauty?

Luckily, the harsh, infertile qualities of the land have kept Assateague from ever being much developed. The hunting clubs and the fishing camps that did develop have been limited and could be removed. Private property rights from inholdings of 1964 have since been transferred to the National Park Service. Infrastructure associated with intended development such as roads, berms, artificial dunes, and mosquito ditches have been abandoned and eventually will be reset by nature or restored through management. The remaining weatherworn and warped old homes stand in stark contrast to the wind-swept grass and are a reminder of how transient humankind is.

There are still some persistent structures throughout the proposed wilderness. There are unpaved roads for administrative uses, research, and limited recreation. Three back country campsites in ASIS have minimal features such as picnic tables, toilets, or fire rings. Fencing along the state line between Maryland and Virginia is necessary to separate the Assateague and Chincoteague wild horse herds, creates barriers and closures throughout multiple parts of the wilderness. Research structures, signing, and the weather stations also punctuate an otherwise undeveloped landscape.

To sustain resource and visitor protection, staff for research/wildlife monitoring, and law enforcement patrols access the wilderness with motor vehicles. Additionally, recreationists with an Over Sand Vehicle (OSV) permit on the ASIS in Maryland are allowed to drive their vehicle along the beach. This combination of vehicular presence currently impacts the island's wilderness character.

### ***SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION***

*Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.*



Photo: Taryn Sudol

The proposed Island Wilderness offers a vivid contrast to the recreational beaches of either of its sides. To the north or south, visitors can spy birds from the comfort of their own air-conditioned "SUV" seats or tote their cooler and beach blanket only a few yards between the parking lot and the beach.

But, to reach the wilderness on foot a seven mile hike from the Chincoteague side as well as a several mile hike from the Assateague side. It would seem that only the most intrepid would trek to the wilderness, having to brave the summer heat and the thick mosquitoes.

While the CNWR and ASIS are both highly visited, a small proportion of these visitors (approximately 1% on CNWR and less than 10% on ASIS) actually enter the wilderness.

In the wilderness, however, visitors will have escaped a thicket of beach umbrellas and reclining chairs. Here, they can find hoof prints of the wild horses instead of the footprints of flip-flops. When, a visitor reaches the wilderness, the only footprints he or she will see will be their own.

Hiking to the state line in the Island Wilderness makes the word "shipwrecked" feels much more real. It may generate a mixture of accomplishment and humbleness: an oneness with nature. A visitor may contemplate the steady roll of the waves or sympathize with the American sea rocket that has found a way to grow in the hot sun, sand, and salt. There is the chance to see more secretive wildlife that avoid the more populous areas in the park and refuge: a river otter may play on the banks of the Old Fields impoundment; a hunting eagle may soar overhead; a mare may even be giving birth to her colt.

In this scenario, it is easy to feel at peace with nature, but there are distractions which may intrude on any self-induced shipwreck: the persistent or abandoned structures may be more startling in this otherwise undeveloped environment; litter, from far away, may have drifted upon the shore; tire tracks from the last monitoring patrol may mar

the sand; an OSV permit owner may even drive up within a few minutes next to the exhausted hiker. The gas-powered OSV vehicle user, however, will not have the same experience as a human-powered encounter with nature.

This primitive, unconfined recreation on Assateague Island is the intention for its proposed wilderness designation.

### ***OTHER FEATURES OF THE WILDERNESS***

*A wilderness' future existence and significance evolves with the current flow of natural forces.*

The limited human development and the dynamic evolution of Assateague's landscape have left few cultural or archeological features on the island.

Nonetheless, Green Run, a former hunting lodge, has cultural significance and will be preserved. The small cemetery on site will also be protected. Also, an artifact of significance may arise at any time, such as after a major storm. For instance, beneath the feet of a wilderness visitor may await, ready to emerge at a given natural event, the ribs of a washed-up ship; under the drifting sand may be hundreds of ancient maritime relics or other archeological treasures --- for now, unknown and undiscovered.

In conclusion, Assateague Island is a living patch of land moving inexorably over the past and reacting only to the present.

## Section 3. Resources and Process

### 3.1 Documents Consulted

The following is a list of documents consulted to inform the wilderness character monitoring report.

Assateague Island National Seashore. 2012. General Update-Wilderness.

Bureau of Land Management. Measuring Attributes of Wilderness Character: BLM Implementation Guide Version 1.4.

Chincoteague National Wildlife Refuge. 2011. Habitat Management Plan for Chincoteague & Wallops Island National Wildlife Refuges.

Landres, P., et al. 2008. Keeping It Wild: An Interagency Strategy to Monitor Trend in Wilderness Character across the National Wilderness Preservation System. Gen. Tech. Rep. RMRS-GTR-212. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Mackintosh, Barry. 1982. Assateague Island national Seashore: An Administrative History. History Division National Park Service, Department of the Interior, Washington D.C.

U.S. Bureau of Sport Fisheries and Wildlife and National Park Service. 1974. Assateague Island Wilderness Study Summary.

U.S. Bureau of Sport Fisheries and Wildlife and National Park Service. 1973. A Preliminary Feasibility Study of Wilderness Potential on Assateague Island.

U.S. Bureau of Sport Fisheries and Wildlife and National Park Service. 1973. Joint Wilderness Study Draft Assateague Island (VA/MD).

U.S. Bureau of Sport Fisheries and Wildlife and National Park Service. 1974. Draft Environmental Statement: Proposed Assateague Island Wilderness Area Maryland-Virginia.

U.S. Fish and Wildlife Service, Northeast Region Five. 1993. Master Plan Chincoteague National Wildlife Refuge Virginia and Maryland.

### 3.2 Assateague NS and Chincoteague NWR Staff Consulted

The following is a list of staff that was consulted in the process of identifying measures and researching Assateague Island's wilderness properties. Their time and effort is greatly appreciated.

#### Assateague NS

Trish Kicklighter, Superintendent  
 Bill Hulslander, Chief, Resource Management  
 Jack Kumer, Natural Resource Specialist  
 Brian Sturgis, Aquatic Ecologist  
 Neil Winn, GIS Specialist  
 Walt West, Law Enforcement  
 Ish Ennis, Chief of Maintenance

#### Chincoteague NWR

Lou Hinds, Refuge Manager  
 Kim Halpin, Deputy Refuge Manager  
 Kevin Holcomb, Supervisory Wildlife Biologist  
 Emarie Ayala, Wildlife Biologist  
 Eva Savage, Biological Technician  
 Janelle Walters, Biological Technician  
 Charlene Swartz, Maintenance Worker  
 Grover "Drizz" Wilgus Jr., Engineering Equip. Operator  
 Jenny Owen, Park Ranger  
 Jim Fair, Law Enforcement Officer  
 Lee Woltman, Refuge Volunteer

### *3.3 Process Used For Identifying Measures*

This section describes the process used to identify the measures for the Assateague Island wilderness character baseline assessment. From the beginning, measures were designed to fit within the “Keeping It Wild” Monitoring Framework.

Research for potential measures first began with an overview of internal Chincoteague NWR documents. The legislative history for the proposed wilderness, including the environmental impact statement and wilderness study, were reviewed to gain insight into valuable features of the lands or development present at the time of designation. Planning documents, such as the Chincoteague NWR Master Plan and Habitat Management Plan were read to learn about activities throughout the Refuge or specifically the proposed wilderness. A tour of the wilderness displayed the ecological systems on site as well as any human impacts within or adjacent to the wilderness. Short interviews with the biological staff further informed the types of activities that take place and led to other literature sources. A search through the CNWR Public drive also attempted to identify wilderness features. This initial overview was used to produce a general inventory of wilderness features and activities in order to determine which measures would be relevant to the assessment.

Reference material through the four land management agencies (BLM, FS, FWS, and NPS) largely informed the compilation of draft measures. Potential measures provided through the Ft. Collins Wilderness Fellows training suggested broad enough measures to be applicable to many refuges. The BLM technical manual was influential in setting measure protocols. Details, such as activity indexes, were completely specific to the proposed Island Wilderness. These were created based off literature and interviews and were further revised in the review process.

The wilderness fellow, Taryn Sudol, reviewed the draft measures with CNWR Supervisory Biologist, Kevin Holcomb, during multiple meetings. These draft measures were then presented to ASIS staff which included Bill Hulslander, Neil Winn, Jack Kumer, and Brian Sturgis. This thorough discussion revised the draft measures so that some measures were added while a few were dismissed. Primary concerns at the meeting included defining what best represented the Natural quality for wilderness character and whether the wilderness character monitoring would require too much time, effort, or resources for the staff to implement. When these measures were decided upon, the wilderness fellow completed her interpretation of the priority score worksheet. This draft was circulated and edits incorporated.

Data collection for the finalized measures occurred over the next several weeks. This included interviews with biological, maintenance and law enforcement staff for knowledge of actions and developments. Data were also collected through external research for regional data, internal data on number of hunters and harvest, and calculations with GIS. As data were collected, measures would be updated to better fit what was available. During this time the wilderness fellow also composed the other parts of the report. When data collection was near completion, Taryn Sudol, Kevin Holcomb, and Bill Hulslander convened to discuss what qualified as a significant change in data. What qualified as a significant change was measure-dependent, but tended to be based on the frequency and variability of when the measurable events occurred. The final time period was spent filling in any gaps in the data and refining the report.

## Section 4. Framework For Wilderness Character Monitoring

The Wilderness Act mandates the “preservation of wilderness character.” Based off the legal description of the wilderness definition, the “Keeping It Wild” publication derived five specific qualities to support wilderness character: Untrammeled, Natural, Undeveloped, Opportunities for Solitude or Primitive and Unconfined Recreation and Other Features. This monitoring framework further divides the five qualities of wilderness character into successively finer elements. This hierarchy, from the top down, is composed of qualities, monitoring questions, indicators, and measurements.



**Qualities** are the primary elements of the wilderness character that are directly related to the statutory language of the Wilderness Act.

**Untrammeled** –The Wilderness Act states that wilderness is “an area where the earth and its community of life are untrammeled by man,” and “generally appears to have been affected primarily by the forces of nature.” This quality is degraded by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness. Any modern human action, authorized or unauthorized, that alters the wilderness is considered trammeling, meaning that restraint is a necessary tool in wilderness stewardship. An *action* for this monitoring report is an act or series of acts that purposefully manipulate the biophysical environment. Actions may degrade the untrammeled quality but have a desired impact on another quality.

**Natural** - The Wilderness Act states that wilderness should be free from the *effects* of “an increasing population, accompanied by expanding settlement and growing mechanization” and that the “earth and its community of life...is protected and managed so as to preserve its natural conditions.” This quality is degraded by intended or unintended effects of modern people on the ecological systems inside the wilderness since the area was designated.

**Native species’ communities and the structure and function of ecological systems within wilderness are meant to be protected. All ecological systems change over time and vary from one place to another. This monitoring is not intended to maintain static or unchanging natural conditions in the wilderness nor is one habitat composition more natural than another (if natural forces shaped them). Trends in the indicators may suggest the need for research or more intensive monitoring to verify the change and understand its cause.**

**Undeveloped** –The Wilderness Act states that wilderness is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation,” “where man himself is a visitor who does not remain,” and “with the imprint of man’s work substantially unnoticeable.” This quality is degraded by the presence of structures, installations, habitations, and by the use of motor vehicles, motorized equipment, or mechanical transport because these increase people’s ability to occupy or modify the environment.

Only non-recreational developments are measured under this quality, while recreational structures are measured under a different quality (to avoid double-counting). Some cultural developments may be an important part of wilderness character. These features are allowed to persist in the wilderness.

Solitude or Primitive and Unconfined Recreation –The Wilderness Act states that wilderness has “outstanding opportunities for solitude or primitive and unconfined type of recreation.” This quality is degraded by settings that reduce those opportunities, such as visitor encounters, signs of modern civilization, recreation facilities and management restrictions on visitor behavior. Solitude is meant to separate people from civilization. Primitive recreation relies on personal skills. Unconfined recreation is freedom from societal or managerial controls. Monitoring this quality assessment how the opportunity for people to experience is changing, not on how visitor experiences are changing.

Other Features – The Wilderness Act states that a wilderness “may also contain ecological, geological, or other features of scientific, education, scenic, or historical value.” This quality is degraded by the deterioration or loss of cultural resources integral to the wilderness character. Cultural resources may be damaged by natural disasters or humans.

**Monitoring questions** are major elements under each quality that are significantly different from one another, which are meant to frame particular management questions.

**Indicators** are distinct and important elements within each monitoring question. Each monitoring question typically has more than one indicator. There are a total of thirteen indicators. Every indicator must have a measure.

**Measures** are specific aspects of wilderness on which data are collected to assess the trend of an indicator. More than one measure can describe an indicator therefore providing management with a range of options to assess indicator trends. All measures for the proposed Island Wilderness will be summarized and described in detail in section five.

This hierarchy allows for national assessments of trends while still allowing flexibility for individual agencies and wildernesses to monitoring the specific elements of wilderness character most meaningful to them. The Wilderness Act (P.L. 88-577, Section 7) requires the Secretaries of Agriculture and Interior to jointly report on the status of the National Wilderness Preservation System including descriptions of the areas, regulations in effect, and other pertinent information, together with any recommendations. This mandate necessitates individual wildernesses to monitor and assess wilderness character and report to the national level.

Baseline conditions must be set as a reference point against which change over time is measured and evaluated. Ideally, all baseline data would have been collected at the time of designation. Since few existing wilderness actually have the data that extends back to designation for the measurements created at the time of the monitoring report, the initial condition assessment will be the substitute. For the proposed Island Wilderness, the baseline assessment year is 2012.

With the baseline in place, change can be monitored over time. The trend (improving, degrading, or stable) will be assessed based on what is determined as a significant change. If a significant change has occurred since the last monitoring point, a  $\uparrow$  is assigned for an increase, a  $\downarrow$  is assigned for a decrease and a  $\leftrightarrow$  for stable. These arrows translate into a numerical score: +1 for  $\uparrow$ , a -1 for  $\downarrow$  and a 0 for  $\leftrightarrow$ . These scores are summed together for the number of measures in each indicator to produce the trend for the indicator; the indicators' trends are summed for the monitoring question trend, the monitoring trends summed for the qualities' trend, and finally the qualities' trends summed for the overall wilderness character trend. If a +1 is added to a -1 this is an “offsetting stable”. This process to compute the trend is automatically done in the wilderness character database when the measurement data is added at each monitoring period.

## Section 5. Measurements

This section provides the suite of measures selected to actively monitor wilderness character in 2012 for the proposed Assateague Island Wilderness. Each of the five qualities and their associated measurements has a sub-section. Each sub-section has a table which summarizes the monitoring questions, indicators, measures, and frequency of reporting for each quality. Secondly, each quality will have the detailed attributes for each of its measurements. The following outlines the general format and definitions of the attributes that will discuss each measure.

| Definitions of Attributes of Measures |                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Measure</b>                        | A <i>measure</i> is a specific aspect of wilderness on which data are collected to assess the trend of an indicator. The measure being discussed is listed in this section                                                                                                                                                                               |
| <b>Indicator</b>                      | An <i>indicator</i> is defined as a distinct and important element within each monitoring question. The indicator corresponding with each measure is specified in this section to provide context.                                                                                                                                                       |
| <b>Context</b>                        | The <i>context</i> describes why the measure is appropriate for the site and any background for understanding or interpreting trend in the measure.                                                                                                                                                                                                      |
| <b>Data Source(s)</b>                 | The <i>data source(s)</i> provides information on where or with whom the data is located for reference. If the data source changes over time, this field should be updated with appropriate information                                                                                                                                                  |
| <b>Data Collection Process</b>        | The <i>data collection process</i> is the process used to compile or gather the data with as much detail as possible.                                                                                                                                                                                                                                    |
| <b>Significant change</b>             | A <i>significant change</i> provides information on what degree of change signifies a change in trend. This section also describes how a change in data would improve or degrade the quality or under what ranges the measurement is considered stable. A significant change can be defined as any change, a percent change, or other appropriate units. |
| <b>Data adequacy (H/M/L)</b>          | The <i>data adequacy</i> discusses the degree of confidence in the quality of the data. Data adequacy is ranked high, medium, or low.                                                                                                                                                                                                                    |
| <b>Confidence</b>                     | The <i>confidence</i> describes how the staff feel toward the accuracy or comprehensiveness of the data provided. It is ranked high, medium, or low.                                                                                                                                                                                                     |
| <b>2012 Data</b>                      | The <i>2012 data</i> refers to the data being reported for the baseline year. This row will provided the data for the subsequent monitoring years as well.                                                                                                                                                                                               |
| <b>Condition</b>                      | The <i>condition</i> comments on the staff's general impression of the state of the wilderness with regard to the particular measurement. It is ranked as good, caution, poor, or unknown.                                                                                                                                                               |

### 5.1 Natural

| Monitoring Question                                                                                          | Indicator                                | Measurement                                              | Freq. of Reporting |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------|--------------------|
| <b>What are the trends in terrestrial, aquatic, and atmospheric natural resources inside the wilderness?</b> | Plant and animal species and communities | Population dynamics of selected non-native plant species | Every five years   |
|                                                                                                              |                                          | Population dynamics of non-native wild horses            | Every five years   |
|                                                                                                              |                                          | Population dynamics of non-native Sika deer              | Every five years   |
|                                                                                                              |                                          | Number of extirpated indigenous species                  | Every five years   |
|                                                                                                              | Physical                                 | Visibility                                               | Every five years   |

|  |                       |                                            |                        |
|--|-----------------------|--------------------------------------------|------------------------|
|  | Resources             | Ozone air                                  | Every five years       |
|  |                       | Total Nitrogen and total Sulfur deposition | Every five years       |
|  | Biophysical Processes | Mean Sea Level Rise                        | Every five years       |
|  |                       | Significance of storm events               | Sum of past five years |

**Measure 1.1 Population dynamics of selected non-native plant species**

| <b>Indicator</b>               | Plant and animal species and communities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------------------------------------------------|-------|--|--------------------------|---|--|------------|---|--|------------------|---|--|---------------|---|--|--------------------|---|--|----------------|---|
| <b>Context</b>                 | <p>A wilderness area can provide protection for sensitive, native plant species. The presence of non-native plant species can shift the flora composition to a historically unnatural state. The proliferation of certain non-native plant species can outcompete native species, resulting in a loss of diversity that once made Assateague Island a distinct natural location.</p> <p>At the time of this baseline assessment, two non-native plants species are considered a threat, Phragmites and Asiatic Sand Sedge (CAKO). Phragmites is a large perennial grass that is capable of forming monotypic stands that out-competes native wetland vegetation and provide poorer habitat for the wetland fauna. Phragmites is able to proliferate in freshwater ponds and on the fringes of salt marshes, supposing the salinity is low enough. While Phragmites may provide cover and shoreline stabilization, the native plant composition would be preferable to supply stabilization, food (seed source), and cover. Asiatic sand sedge colonizes beach habitats and can out-compete American beach grass. Asiatic sand sedge is more vulnerable to wind blow outs or storm erosion. When it forms thick mats in the sand, it becomes poor Piping Plover habitat. While Asiatic sand sedge is a threat as of 2012, there is no known occupied acreage of it in the wilderness at this time.</p> |         |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
| <b>Data source</b>             | Internal survey documents and professional judgment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |         |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
| <b>Data collection process</b> | <p>A list is compiled for selected non-native plant species. Scouting and vegetative surveys provide the acreage occupied for the selected non-native plants. This is limited to monotypic stands rather than interspersed species. The total measure will be the sum of each specie’s “Percent of acreage occupied” score.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="background-color: #e0e0e0;">Species</th> <th style="background-color: #e0e0e0;">estimated percent of the wilderness on which it is found</th> <th style="background-color: #e0e0e0;">Score</th> </tr> </thead> <tbody> <tr> <td></td> <td>Very Low (or Spot) = &lt;1%</td> <td>1</td> </tr> <tr> <td></td> <td>Low = 1-5%</td> <td>2</td> </tr> <tr> <td></td> <td>Moderate = 5-20%</td> <td>3</td> </tr> <tr> <td></td> <td>High = 20-35%</td> <td>4</td> </tr> <tr> <td></td> <td>Very High = 35-65%</td> <td>5</td> </tr> <tr> <td></td> <td>Extreme = &gt;65%</td> <td>6</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                   | Species | estimated percent of the wilderness on which it is found | Score |  | Very Low (or Spot) = <1% | 1 |  | Low = 1-5% | 2 |  | Moderate = 5-20% | 3 |  | High = 20-35% | 4 |  | Very High = 35-65% | 5 |  | Extreme = >65% | 6 |
| Species                        | estimated percent of the wilderness on which it is found                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Score   |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
|                                | Very Low (or Spot) = <1%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1       |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
|                                | Low = 1-5%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2       |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
|                                | Moderate = 5-20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3       |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
|                                | High = 20-35%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4       |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
|                                | Very High = 35-65%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5       |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
|                                | Extreme = >65%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6       |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
| <b>Data Entry</b>              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
| <b>Significant Change</b>      | ANY change in the acreage occupied score is significant. If the acreage occupied score increases since the last data monitoring point, then it degrades the measurement. If the acreage occupied score decreases, then it improves the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |         |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |
| <b>Data Adequacy</b>           | Medium-This is limited to monotypic stands. The baseline data is not 2012 but still considered representative of the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                          |       |  |                          |   |  |            |   |  |                  |   |  |               |   |  |                    |   |  |                |   |

|            |                                                                                                                 |                        |      |
|------------|-----------------------------------------------------------------------------------------------------------------|------------------------|------|
| Confidence | Low –Given the age of the data set (1993/1995), staff does not feel it represents the invasive coverage of 2012 |                        |      |
| 2012 Data  | Species                                                                                                         | Percent Occupied Score |      |
|            |                                                                                                                 | ASIS                   | CNWR |
|            | Phragmites                                                                                                      | 1                      | 0    |
|            | Asiatic Sand Sedge                                                                                              | 0                      | 0    |
|            | Total                                                                                                           | 1                      | 0    |
| Condition  | Good                                                                                                            |                        |      |

**Measure 1.2 Population dynamics of non-native wild horses**

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Indicator               | Plant and animal species and communities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |
| Context                 | While the wild horses on Assateague Island have become a cultural resource, the natural ecosystems on the island become stressed by grazing pressure and trampling effects when horse herds become too large. ASIS and CNWR both have management strategies to maintain a target wild horse population. The horses' island presence is an important feature to many visitors and the public, which requires careful management of the wild horse population.                                                                                                                                                                                                                                                                                                                                                     |            |
| Data source             | Internal records –Bill Hulslander, Kim Halpin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |
| Data collection process | The adult horse population (including foals bought back during the Chincoteague Volunteer Fire Company (CVFC auction) for the entire island (herds in both Assateague NS and Chincoteague NWR except the CNWR southern herd which does not have wilderness access) will serve as a surrogate measure for the horses' wilderness presence. These horses have access to large parts of the island including the wilderness area. ASIS monitors their horse population through routine surveys and manages their population through a fertility control program, while the CVFC keeps a number of the CNWR herds. Of the total horse population in CNWR, about two-thirds reside in the North herd which has access to the wilderness. This number may change as horses are transferred from one herd to the other. |            |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
| Significant Change      | If the horse population increases by 50 since the last data monitoring point, then this degrades the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |
| Data Adequacy           | Medium-Wild Horse populations are monitored by ASIS staff and the CVFC. This does not directly comment on the amount of impact horses have in the wilderness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |
| Confidence              | High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |
| 2012 Data               | Wild Horse herds                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Population |
|                         | Chincoteague NWR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 83         |
|                         | Assateague ISLAND NS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 113        |
|                         | Total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 196        |
|                         | Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Good       |



**Measure 1.3 Population dynamics of non-native Sika deer**

| Indicator               | Plant and animal species and communities                                                                                                                                                                                                                                                                                                                                                                            |              |            |               |                         |  |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|---------------|-------------------------|--|
| Context                 | The Sika deer were introduced in the early 1920s and have since grown into considerable population. While the island’s carrying capacity for Sika deer is unknown, large populations impact the natural quality by overgrazing, competing white-tailed deer, and becoming a source for ticks. A hunting program, in place since the 1960s, have allowed for the harvest of Sika deer.                               |              |            |               |                         |  |
| Data source             | Distance sampling data, Mark Sturm, professional judgment, Jack Kumer                                                                                                                                                                                                                                                                                                                                               |              |            |               |                         |  |
| Data collection process | ASIS has four years of distance sampling data that is able to provide an estimated range for the Sika population as part of a study on ungulate grazing effects on vegetation by Mark Sturm. In the future, ASIS hopes to have new technology or population density methods so that the distance sampling technique does not have to be repeated but the new technique will provide comparable statistical results. |              |            |               |                         |  |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                    |              |            |               |                         |  |
| Significant Change      | If the Sika deer harvest increases by 25%, then this degrades the measurement. If the population decreases by 25%, then it improves the measurement.                                                                                                                                                                                                                                                                |              |            |               |                         |  |
| Data Adequacy           | Medium -This data reflects the island as a whole and is not confined to the wilderness.                                                                                                                                                                                                                                                                                                                             |              |            |               |                         |  |
| Confidence              | Medium –This is a best estimate from a recent but not current study.                                                                                                                                                                                                                                                                                                                                                |              |            |               |                         |  |
| 2012 Data               | <table border="1"> <tr> <th>Sika Harvest</th> <th>Population</th> </tr> <tr> <td>Assateague NS</td> <td>24 sika per square mile</td> </tr> </table>                                                                                                                                                                                                                                                                 | Sika Harvest | Population | Assateague NS | 24 sika per square mile |  |
| Sika Harvest            | Population                                                                                                                                                                                                                                                                                                                                                                                                          |              |            |               |                         |  |
| Assateague NS           | 24 sika per square mile                                                                                                                                                                                                                                                                                                                                                                                             |              |            |               |                         |  |
| Condition               | Unknown –Do not yet know what the island’s carrying capacity is for Sika.                                                                                                                                                                                                                                                                                                                                           |              |            |               |                         |  |

**Measure 1.4 Number of extirpated indigenous species**

|                         |                                                                                                                                                                                                                                                                   |  |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Indicator               | Plant and animal species and communities                                                                                                                                                                                                                          |  |
| Context                 | The loss of indigenous species on the island reduces biodiversity. This affects the public understanding and experience on the island. Potentially the loss of a certain species can have cascading effects through the ecosystem and reduce ecological services. |  |
| Data source             | Internal survey documents and professional judgment, Kevin Holcomb, Jack Kumer                                                                                                                                                                                    |  |
| Data collection process | Based off an inventory of flora and fauna and professional judgment, a count is maintained of any indigenous species no longer believed to be present on the island within the past five years.                                                                   |  |
| Data Entry              | Every five years –any known extirpations since the last monitoring report                                                                                                                                                                                         |  |
| Significant             | ANY change in the number of extirpated indigenous species is significant. The more                                                                                                                                                                                |  |

|                          |                                                                                                                                                                                                                                                                               |                               |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Change                   | species extirpated the more the measurement is degraded, unless it is believed that extirpation occurred through natural processes such as shifting habitats. If an extirpated species is recovered or reintroduced in the wilderness, then it would improve the measurement. |                               |
| Data Adequacy Confidence | Medium- It is difficult to monitor every specie on the island and know whether is has been completely extirpated or still have a viable population.                                                                                                                           |                               |
| 2012 Data                | Medium                                                                                                                                                                                                                                                                        |                               |
| Condition                | Extirpated Species                                                                                                                                                                                                                                                            | Estimated Date of Extirpation |
|                          | Total                                                                                                                                                                                                                                                                         | 0 for ASIS/CNWR               |
| Condition                | Good                                                                                                                                                                                                                                                                          |                               |

Measure 1.5 Visibility

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator                | Physical Resources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Context                  | Deciview is a cumulative index to express light extinction. In other words, deciview indicates the amount of visibility in the landscape. Ideally, a wilderness area will have skies clear of anthropogenic pollutants. Deciview measures the fine nitrates and sulfates in the air, the accumulation of which reduces visibility. Deciview is not measured on site for the Assateague island, so the nearest Deciview reading location will be used.                                                                                                                                                                                             |
| Data source              | USFWS National Air Quality Office                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Data collection process  | To evaluate the condition of each indicator we used all available monitoring data (from NPS, EPA, FS, FWS, state, tribal, and local monitors) to generate interpolations, averaged over five years, to derive estimates of air quality at NPS and FWS units located within the continental United States. Estimates for NPS areas are available at <a href="http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm">http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm</a> . Estimates for FWS areas are available from the NPS Air Resources Division (contact <a href="mailto:ellen_porter@nps.gov">ellen_porter@nps.gov</a> ). |
| Data Entry               | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Significant Change       | For examining temporal changes, we cannot perform a rigorous statistical trend analysis on interpolated data (and for only 2 data points). Instead, we are simply assessing whether the estimated value is increasing or decreasing.<br>Visibility (deciviews – dv):<br>< 2 dv - Good<br>2-8 dv - Moderate<br>> 8 dv - Significant Concern                                                                                                                                                                                                                                                                                                        |
| Data Adequacy Confidence | Medium --data for this measure came from a location farther than 100 km.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 2012 Data                | Group 50 Visibility minus natural conditions= 11.7 for 2005-2009                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Condition                | Significant Concern                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

Measure 1.6 Ozone air pollution

|                 |                                                                                                                                                                           |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator       | Physical Resources                                                                                                                                                        |
| Context         | Ozone can be a man-made air pollutant. It is capable of traveling long distances and so may be an unnatural presence in the Island wilderness.                            |
| Data source     | USFWS National Air Quality Office                                                                                                                                         |
| Data collection | To evaluate the condition of each indicator we used all available monitoring data (from NPS, EPA, FS, FWS, state, tribal, and local monitors) to generate interpolations, |

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| process             | averaged over five years, to derive estimates of air quality at NPS and FWS units located within the continental United States. Estimates for NPS areas are available at <a href="http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm">http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm</a> . Estimates for FWS areas are available from the NPS Air Resources Division (contact <a href="mailto:ellen_porter@nps.gov">ellen_porter@nps.gov</a> ). |
| Data Entry          | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Significant Change  | For examining temporal changes, we cannot perform a rigorous statistical trend analysis on interpolated data (and for only 2 data points). Instead, we are simply assessing whether the estimated value is increasing or decreasing.<br>Ozone (parts per billion – ppb):<br>< 60 ppb - Good<br>61-75 - Moderate<br>> 76 - Significant Concern                                                                                                                           |
| Data Adequacy       | Medium – data for this measure came from a location farther than 16 km.                                                                                                                                                                                                                                                                                                                                                                                                 |
| Confidence          | Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2012 Data Condition | Ozone 4 <sup>th</sup> highest 8 hr= 79.1 ppb for 2005-2009<br>Significant Concern                                                                                                                                                                                                                                                                                                                                                                                       |

#### Measure 1.7 Total Nitrogen and Total Sulfur deposition

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator               | Physical Resources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Context                 | Acid deposition is the concentration of sulfur and nitrogen in the rain or snow. High concentrations can be detrimental for algae, aquatic invertebrates, amphibians, fish, soil microorganisms, plants and trees.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Data source             | USFWS National Air Quality Office                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Data collection process | To evaluate the condition of each indicator we used all available monitoring data (from NPS, EPA, FS, FWS, state, tribal, and local monitors) to generate interpolations, averaged over five years, to derive estimates of air quality at NPS and FWS units located within the continental United States. Estimates for NPS areas are available at <a href="http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm">http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm</a> . Estimates for FWS areas are available from the NPS Air Resources Division (contact <a href="mailto:ellen_porter@nps.gov">ellen_porter@nps.gov</a> ). |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Significant Change      | For examining temporal changes, we cannot perform a rigorous statistical trend analysis on interpolated data (and for only 2 data points). Instead, we are simply assessing whether the estimated value is increasing or decreasing.<br>Total-N and S (based on wet deposition in kilograms per hectare per year – kg/ha/yr):<br><1 - Good<br>1-3 - Moderate<br>> 3 - Significant Concern                                                                                                                                                                                                                                                         |
| Data Adequacy           | High – data for this measure came from a location within 16 km.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Confidence              | High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2012 Data Condition     | Total N= 3.9, Total S= 5.0 for 2005-2009<br>Significant Concern                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

#### Measure 1.8 Mean Sea Level Rise

|           |                                                                                       |
|-----------|---------------------------------------------------------------------------------------|
| Indicator | Biophysical Processes                                                                 |
| Context   | Sea level rise exerts a major impact on barrier island dynamics. Assateague Island is |

subsiding and may continue to subside in the future. The island’s subsidence also contributes to a relative rise in sea level. An increase in sea level causes increases in erosion and quickens the island’s westward and southern migration. Sea level rise can disrupt and alter salt marshes. Also, sea level rise is connected to salt water intrusion and storm surge impacts. Should the sea level rise in the future, it may be responsible for changes in wilderness acreage and habitat composition. The altered landscape will not be considered more unnatural than the original. The change in sea level will be monitored, however, to potentially provide an explanation to ecological changes.

Data source

NOAA Mean Sea Level Trend, Ocean City Inlet, MD  
[http://tidesandcurrents.noaa.gov/sltrends/sltrends\\_station.shtml?stnid=8570283](http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8570283)

Data collection process

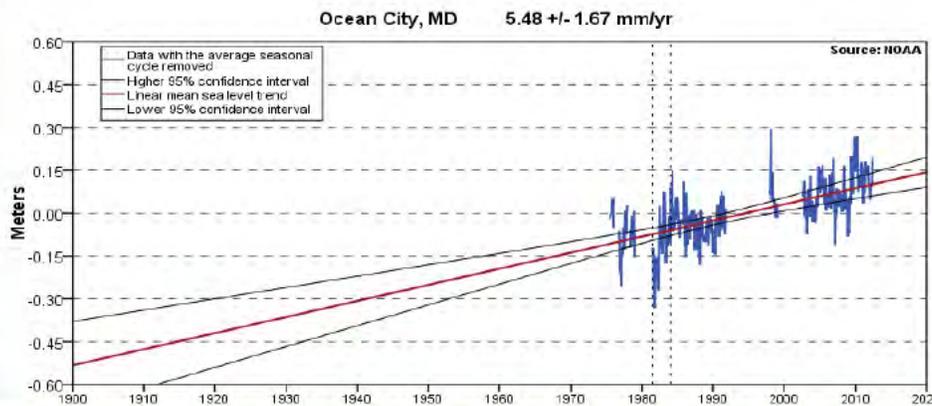
The mean sea level trend and a plot (from 1900 to 2010) shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. This data is taken from NOAA Tides and Currents at the Ocean City Inlet, MD, which is the nearest station to Assateague Island.

Data Entry Significant Change

Every five years  
 At this time, the Refuge and NPS has not determined a sea level rise which is unnatural. The trend will remain stable unless staff’s discretion agrees that the current sea level rise is degrading or improving the natural quality for the wilderness.

Data Adequacy Confidence 2012 Data

High- The data was collected with a high degree of confidence from the Ocean City station that is monitored by NOAA  
 High



As of July, 25 2012 the mean sea level trend shows a 5.48 mm/yr rise in sea level with a 95% confidence level of +/- 1.67 mm/yr based on monthly mean sea level data from 1975 to 2006. This is equal to 1.8 feet of sea level rise in 100 years.

Condition

Unknown –While the trend shows a rise in sea level it is difficult to directly comment on how the natural quality is being affected.

Measure 1.9 Frequency of Storm Events

Indicator

Biophysical process

Context

Storm events can influence the barrier island’s shape in terms of shore line and dune formation. Strong wind and waves can cause blow outs or overwash as well as erosion. Some meteorological models suggest an increase in storm events due to climate change, thereby exposing the island possibly to more storm events. The resulting landscape from the storm events will not be considered unnatural, but the effects of these storm events may prompt other management actions or developments.

Data source

Hurricanes/Tropical Storms/Tropical Depressions are logged at NOAA Historical

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data collection process            | Hurricane Tracks <a href="http://csc.noaa.gov/hurricanes/index.html">http://csc.noaa.gov/hurricanes/index.html</a> and Nor'easters are logged at National Weather Service Forecast Office: Wakefield VA <a href="http://www.erh.noaa.gov/er/akq/EREVIEW.php">http://www.erh.noaa.gov/er/akq/EREVIEW.php</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Data Entry Significant Change      | Hurricane/Tropical Storms/Tropical Depressions are recorded at NOAA's website above. Locations, Chincoteague and ASIS, are entered in and the storm events are recorded for the five year monitoring period or annually. To learn about Nor'easters go to the National Weather Service Forecast Office for Wakefield VA and see if any Historical Winter Storm Graphics/Events are labeled as Nor'easters in the drop down menu. If so, check the Nor'easter data to make sure it affected the ASIS/CNWR wilderness. As monitoring continues, other weather events that appear to have significantly affected the landscape can be included in this measure so long as it is confirmed and titled consistently with NOAA or the Wakefield Forecast Office.<br>Sum of storms for the past five years<br>Storm events are variable from year to year but a trend may be visible over time that shows an increase in storms or a decrease in storms. At this time there is no determination of how many storms would be considered unnatural. Depending on the trend over time, future staff may decide whether the number of storms has improved or degraded the natural quality. |
| Data Adequacy Confidence 2012 Data | High –NOAA's tracking is reliable and CNWR/ASIS staff can determine if the reported storm occurred on the island.<br>High<br>Number of significant storms in the past five years: 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Condition                          | Unknown –Are three storms in five years normal?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

5.2 Untrammelled

| Monitoring Question                                                                                                           | Indicator                                                                                   | Measurement                                                                                                  | Freq. of Reporting |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------|
| <b>What are the trends in actions that control or manipulate the "earth and its community of life" inside the wilderness?</b> | Actions authorized by the Federal land manager that manipulates biophysical the environment | Number of actions to manage plants, animals, pathogens, soil, water, or fire                                 | Annually           |
|                                                                                                                               |                                                                                             | Number of actions to manipulate fire                                                                         | Annually           |
|                                                                                                                               |                                                                                             | Number of actions for dune maintenance                                                                       | Annually           |
|                                                                                                                               | Actions not authorized by the Federal land manager that manipulate                          | Number of unauthorized actions to manipulate plant, wildlife, insects, fish, pathogens, soil, water, or fire | Annually           |

|  |                             |  |  |
|--|-----------------------------|--|--|
|  | the biophysical environment |  |  |
|--|-----------------------------|--|--|

**Measure 2.1** Number of actions to manage plants, animals, pathogens, soil, water or fire

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        |           |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------|
| <b>Indicator</b>                     | Actions authorized by the Federal land manager that manipulates biophysical environment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                        |           |
| <b>Context</b>                       | An action is the implementation of an intentional decision to manipulate the biophysical environment. Large or significant actions taken within the proposed wilderness are trammeling the biophysical environment. Some actions in the wilderness are accounted for in the management plan. Unforeseen, intentional actions will be added to the record as they occur. The authorized actions by the ASIS and CNWR Federal land managers are recorded below. Actions that apply to fire or dune maintenance are not recorded here but in their own separate measures. The tools, equipment, structures or transportation used in association with these actions will be included under the Undeveloped measurements. |                        |           |
| <b>Data source</b>                   | Internal staff inventory of actions: Charlene Swartz/Drizz Wilgus, Eva Savage, Jim Fair and Ish Ennis, Jack Kumer, Walt West                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |           |
| <b>Data collection process</b>       | Actions are counted annually and entered into the database each year. The time spent on each activity (recorded as number of days that staff entered the wilderness and worked some period of time on the activity) is listed. It is assumed that the more time spent conducting the action, the more trammeling has occurred (this is not always the case but given the breath of activities, the generalization applies). This table is condensed, but a detailed list of specific activities for monitoring, maintenance, etc is located in Appendix D.                                                                                                                                                            |                        |           |
| <b>Data Entry Significant Change</b> | Annually<br>+/- 25%. An increase of 25% in time spent on actions in the wilderness since the last monitoring point degrades the measurement; A decrease of 25% in time spent in the wilderness improves the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |           |
| <b>Data Adequacy</b>                 | High- These are authorized activities which staff can reliably record. This first year may not be as accurate as future years because it was a recall of the past year, not day to day tracking.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |           |
| <b>Confidence 2012 Data</b>          | Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |           |
|                                      | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Time Spent on Activity |           |
|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ASIS                   | CNWR      |
|                                      | Set up for monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 103                    | 13        |
|                                      | Installing informational signs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 38                     | 1         |
|                                      | Maintaining existing structures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 24                     | 5         |
|                                      | Mowing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 14                     | 8         |
|                                      | Horse Management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 25                     | 4         |
|                                      | Treating Phragmites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 60                     |           |
|                                      | Marsh Restoration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100                    |           |
|                                      | Survey Benchmark installation and maintenance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 15                     |           |
|                                      | Trapping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        | 60        |
|                                      | <b>TOTAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>379</b>             | <b>91</b> |
| <b>Condition</b>                     | Caution –There is a considerable amount of activities in the wilderness even though they all serve a purpose.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |           |

Measure 2.2 Number of actions to manage fire

| Indicator               | Actions authorized by the Federal land manager that manipulates biophysical environment                                                                                                                                                                                                                                                                                            |          |                        |   |  |                                                                                                                                               |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------|---|--|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Context                 | Fire has not been a historical disturbance on the island. Wildfires, however, may occur through natural or human ignitions. Any actions associated with fire will be listed here. If a fire is allowed to burn without intervention then it will not be recorded. Wildfires may be suppressed or contained. This distinction between these actions will be made in the data table. |          |                        |   |  |                                                                                                                                               |
| Data source             | Internal staff inventory of actions as well as outside fire crews                                                                                                                                                                                                                                                                                                                  |          |                        |   |  |                                                                                                                                               |
| Data collection process | Actions are counted annually and entered into the database each year. Refer to measure 2.1. For this measurement, two types of activities are expected: fire suppression or fire containment, in which fire is allowed within a designated area but prevented from spreading to undesirable areas. Fire suppression should be weighted more heavily than fire containment.         |          |                        |   |  |                                                                                                                                               |
| Data Entry              | Annually                                                                                                                                                                                                                                                                                                                                                                           |          |                        |   |  |                                                                                                                                               |
| Significant Change      | ANY action to manage fire is significant. A greater amount of actions in the wilderness degrades the measurement; fewer actions improve the measurement.                                                                                                                                                                                                                           |          |                        |   |  |                                                                                                                                               |
| Data Adequacy           | High-While it is possible for small fires to go undetected, on the whole fire events and associated actions are noticeable and well recorded.                                                                                                                                                                                                                                      |          |                        |   |  |                                                                                                                                               |
| Confidence              | High                                                                                                                                                                                                                                                                                                                                                                               |          |                        |   |  |                                                                                                                                               |
| 2012 Data               | <table border="1"> <thead> <tr> <th>Activity</th> <th>Time Spent on Activity</th> </tr> </thead> <tbody> <tr> <td>0</td> <td></td> </tr> </tbody> </table>                                                                                                                                                                                                                         | Activity | Time Spent on Activity | 0 |  | While one call came to ASIS about a fire in the wilderness, no fire was found. No fire events have occurred in ASIS or CNWR in the past year. |
| Activity                | Time Spent on Activity                                                                                                                                                                                                                                                                                                                                                             |          |                        |   |  |                                                                                                                                               |
| 0                       |                                                                                                                                                                                                                                                                                                                                                                                    |          |                        |   |  |                                                                                                                                               |
| Condition               | Good                                                                                                                                                                                                                                                                                                                                                                               |          |                        |   |  |                                                                                                                                               |

Measure 2.3 Number of actions for dune maintenance

| Indicator               | Actions authorized by the Federal land manager that manipulates biophysical environment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |                        |  |  |  |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------|--|--|--|
| Context                 | Dunes form, accumulate, or erode naturally, however, man can and has manipulated dunes to serve his purposes on Assateague Island. Artificial dunes in the past have been built as storm breaks to protect the interior lands. These artificial dunes may blow out or wash out during storms. Sometimes these dunes will then be repaired, however, they are costly to maintain and impede the natural migration of the islands, sand transport, and overwash habitat creation. Both ASIS and CWNR have planned to allow natural processes to dominate where possible. Any actions in dune maintenance will highlight a departure from the planning process. |          |                        |  |  |  |
| Data source             | Internal staff inventory of actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |                        |  |  |  |
| Data collection process | Actions are counted annually and entered into the database each year. Refer to measure 2.1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |                        |  |  |  |
| Data Entry              | Annual average of past five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |          |                        |  |  |  |
| Significant Change      | ANY change in dune maintenance is significant. A greater amount of actions in the wilderness degrades the measurement; fewer actions improve the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |                        |  |  |  |
| Data Adequacy           | High- Alteration to dunes requires a deliberate management decision. Any alterations will be well recorded.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |                        |  |  |  |
| Confidence              | High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |          |                        |  |  |  |
| 2012 Data               | <table border="1"> <thead> <tr> <th>Activity</th> <th>Time Spent on Activity</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Activity | Time Spent on Activity |  |  |  |
| Activity                | Time Spent on Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |                        |  |  |  |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |          |                        |  |  |  |

|           |                                                         |   |
|-----------|---------------------------------------------------------|---|
|           | 0                                                       | 0 |
| Condition | No dune maintenance occurred in ASIS or CNWR this year. |   |
|           | Good                                                    |   |

**Measure 2.4** Number of unauthorized actions to manipulate plant, wildlife, insects, fish, pathogens, soil, water, or fire

| Indicator                     | Actions not authorized by the Federal land manager that manipulate the biophysical environment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                 |  |                  |                                 |                                 |           |        |           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--|------------------|---------------------------------|---------------------------------|-----------|--------|-----------|
| Context                       | Actions may be taken on the island without the authorization of the federal land managers. An unauthorized action is any action undertaken by any individual, group, or agency without specific approval by the authorized officer. The individuals, citizen groups, or agencies may take actions which are not necessarily violations but still trammel the environment. At this time, staff at ASIS and CNWR is not aware of any regular, unauthorized actions or the frequency of possible unauthorized actions. This data is limited, therefore, to only specific actions that are known to have occurred rather than any estimation on what the staff suspects may be occurring. |                                 |  |                  |                                 |                                 |           |        |           |
| Data source                   | Internal staff observations and personal judgment of different actions and occurrences: Jim Fair, Walt West                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                 |  |                  |                                 |                                 |           |        |           |
| Data collection process       | Actions are counted annually and entered into the database each year. Actions are organized by type of activity and number of times this activity was reported or estimated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                 |  |                  |                                 |                                 |           |        |           |
| Data Entry Significant Change | Annual average of past five years<br>+/- 15 cases. Fifteen more unauthorized actions since the last monitoring point in the wilderness degrades the measurement; fifteen fewer actions improve the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                 |  |                  |                                 |                                 |           |        |           |
| Data Adequacy Confidence      | Medium- Many potential unauthorized activities are difficult to catch in the act, so a precise count is likely impossible.<br>Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                 |  |                  |                                 |                                 |           |        |           |
| 2012 Data                     | <table border="1"> <thead> <tr> <th>Type of Activity</th> <th>Agency/Group/Person responsible</th> <th>No. of times reported/estimated</th> </tr> </thead> <tbody> <tr> <td>Littering</td> <td>Public</td> <td>14 (CNWR)</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                 |  | Type of Activity | Agency/Group/Person responsible | No. of times reported/estimated | Littering | Public | 14 (CNWR) |
| Type of Activity              | Agency/Group/Person responsible                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | No. of times reported/estimated |  |                  |                                 |                                 |           |        |           |
| Littering                     | Public                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 14 (CNWR)                       |  |                  |                                 |                                 |           |        |           |
| Condition                     | It is also possible that pets are within the proposed wilderness, but it is difficult to know for sure and no reports have been made within the last year.<br>Good                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                 |  |                  |                                 |                                 |           |        |           |

*5.3 Undeveloped*

| Monitoring Question                                                               | Indicator                                                    | Measurement                                                               | Freq. of Reporting |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------|--------------------|
| <b>What are the trends in non-recreational development inside the wilderness?</b> | Non-recreational structures, installations, and developments | Index of authorized physical structures, installations, or developments   | Annually           |
|                                                                                   |                                                              | Length of active roads and fence                                          | Every five years   |
|                                                                                   |                                                              | Index of unauthorized physical structures, installations, or developments | Every five years   |
|                                                                                   |                                                              | Index of abandoned structures                                             | Every five years   |
|                                                                                   |                                                              | Length of abandoned roads and fence                                       | Every five years   |
|                                                                                   | Inholdings                                                   | Index of inholdings with wilderness                                       | Every five years   |

|                                                             |                                                                                                                                |                                                                                                       |          |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------|
| What are the trends in mechanization inside the wilderness? | Use of motor vehicles, motorized equipment, and mechanical transport                                                           | Type and amount of administrative use of motor vehicles, motorized equipment, or mechanical transport | Annually |
|                                                             |                                                                                                                                | Authorized Recreational Motor Vehicle Use                                                             | Annually |
|                                                             | Type and amount of motor vehicles, motorized equipment, or mechanical transport use not authorized by the Federal land manager | Annually                                                                                              |          |

Measure 3.1 Index of authorized physical structures, installations, or developments

| Indicator                               | Non-recreational structures, installations, and developments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |        |       |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|-------|------|-----------------------------------------|-----------------------------------------------|--|--------|-------|--|------|------|------|------|---------|---|--|---|---|--|-------|---|---|---|----|----|-----------------|---|---|---|---|---|-------|--|----|---|--|----|----------------|--|---|---|--|----|-----------------------|----------------------------------------|-----------|---|-------|---|
| Context                                 | The wilderness area is meant to be free of man’s imprint on the landscape. Any man-made features therefore detract from the undeveloped quality. The Island Wilderness was designated with some man-made features already present; other features, such as research equipment have been added over time. This measure includes all active, authorized physical structures, installations and developments that are currently within the wilderness such as those present prior to designation and temporary structures. This measure does not include unauthorized structures, recreational structures, or abandoned structures. These developments are included in subsequent measures.                                                                                                                                                                                                                                      |           |        |       |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Data source                             | Internal documentation/GIS/knowledge of structures: Eva Savage, Jack Kumer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |        |       |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Data collection process                 | A list of structures, installations, and developments will be created based off of inventories already present in GIS as well as any unmapped features known to be on the ground. The list of structures, installations, and developments are multiplied by the weight defined in an index. This weight includes the magnitude of the structure and how long the structure was in place. The sum of the product of structure, installations, and developments and weight will be the measure for the five year monitoring period. A detailed list of known structures is in Appendix G, which is intended to help track added structures.                                                                                                                                                                                                                                                                                     |           |        |       |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Data Entry                              | Annually                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |        |       |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Significant Change                      | More than 25% of new developments in the wilderness since the last monitoring period degrade the measure; 10% fewer developments since the last monitoring period improve the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |        |       |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Data Adequacy Confidence                | Medium-Some structures are mapped, but the temporary or minor structures such as posts and flags are best estimates.<br>Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |        |       |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| 2012 Data                               | <table border="1"> <thead> <tr> <th rowspan="2">Structure, Installation, or Development</th> <th colspan="2">Number present x fraction of the year present</th> <th rowspan="2">Weight</th> <th colspan="2">Total</th> </tr> <tr> <th>ASIS</th> <th>CNWR</th> <th>ASIS</th> <th>CNWR</th> </tr> </thead> <tbody> <tr> <td>Bridges</td> <td>1</td> <td></td> <td>5</td> <td>5</td> <td></td> </tr> <tr> <td>Gates</td> <td>6</td> <td>5</td> <td>3</td> <td>18</td> <td>15</td> </tr> <tr> <td>Weather Station</td> <td>1</td> <td>1</td> <td>3</td> <td>3</td> <td>3</td> </tr> <tr> <td>Traps</td> <td></td> <td>50</td> <td>1</td> <td></td> <td>50</td> </tr> <tr> <td>Squirrel boxes</td> <td></td> <td>5</td> <td>2</td> <td></td> <td>10</td> </tr> <tr> <td>Biological exclosures</td> <td>Am: (120 x .33) + PP: (6 x .19) =40.74</td> <td>(4 x .25)</td> <td>2</td> <td>81.48</td> <td>2</td> </tr> </tbody> </table> |           |        |       |      | Structure, Installation, or Development | Number present x fraction of the year present |  | Weight | Total |  | ASIS | CNWR | ASIS | CNWR | Bridges | 1 |  | 5 | 5 |  | Gates | 6 | 5 | 3 | 18 | 15 | Weather Station | 1 | 1 | 3 | 3 | 3 | Traps |  | 50 | 1 |  | 50 | Squirrel boxes |  | 5 | 2 |  | 10 | Biological exclosures | Am: (120 x .33) + PP: (6 x .19) =40.74 | (4 x .25) | 2 | 81.48 | 2 |
| Structure, Installation, or Development | Number present x fraction of the year present                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           | Weight | Total |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
|                                         | ASIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | CNWR      |        | ASIS  | CNWR |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Bridges                                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           | 5      | 5     |      |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Gates                                   | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5         | 3      | 18    | 15   |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Weather Station                         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1         | 3      | 3     | 3    |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Traps                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 50        | 1      |       | 50   |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Squirrel boxes                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5         | 2      |       | 10   |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |
| Biological exclosures                   | Am: (120 x .33) + PP: (6 x .19) =40.74                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | (4 x .25) | 2      | 81.48 | 2    |                                         |                                               |  |        |       |  |      |      |      |      |         |   |  |   |   |  |       |   |   |   |    |    |                 |   |   |   |   |   |       |  |    |   |  |    |                |  |   |   |  |    |                       |                                        |           |   |       |   |

|                            |                                                         |            |   |          |     |
|----------------------------|---------------------------------------------------------|------------|---|----------|-----|
| Biological signs           | PP: (100 x .19) + BE (25 X .33) + BB (140 X .49) =95.85 | (22 x .46) | 2 | 191.7    | 20  |
| Cultural sites             | 2 (Green Run, Graveyard)                                |            | 5 | 10       |     |
| Fence lines                | PP: (30 posts + rope x .19) =5.7                        |            | 2 | 11.4     |     |
| Deer cameras               | (12 x .16) =1.92                                        |            | 2 | 3.84     |     |
| Fox cameras                | (90 x .33)=29.6                                         |            | 2 | 59.2     |     |
| PVC Pipe                   | 124                                                     |            | 2 | 248      |     |
| Wells                      | 8                                                       |            | 2 | 16       |     |
| Flags                      | 100                                                     |            | 1 | 100      |     |
| Posts for pond marsh       | 10                                                      |            | 2 | 20       |     |
| Survey benchmark           | 3                                                       | 2          | 1 | 3        | 2   |
| No Hunting signs           | 150                                                     |            | 2 | 300      |     |
| Pond hydrology instruments | 6                                                       |            | 2 | 12       |     |
| OSV boundary posts         | 160                                                     |            | 2 | 320      |     |
| SETs                       | 3                                                       |            | 1 | 3        |     |
| Deer/Horse grazing posts   | 336                                                     |            | 2 | 672      |     |
| TOTAL                      |                                                         |            |   | 2,077.62 | 100 |

Condition

Caution –Increases in structures will reduce the undeveloped quality

Measure 3.2 Length of authorized physical structures, installations, or developments

|                         |                                                                                                                                                                                                                                                                                                          |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator               | Non-recreational structures, installations, and developments                                                                                                                                                                                                                                             |
| Context                 | This measure lists any authorized, active, physical structures, installations, or developments that are measured by length –primarily roads and fences. Refer to measure 3.1.                                                                                                                            |
| Data source             | Internal documentation/GIS/knowledge of structures: Jack Kumer                                                                                                                                                                                                                                           |
| Data collection process | Features that are measured by length, primarily roads and fences, are listed below. The sum of roads and fences will be compared every five years. Roads and fences are not weighted because while the roads may have a greater footprint, they are unpaved and access routes and fences cause barriers. |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                         |
| Significant Change      | +/- 1000 m. More than 1000 m of road or fence in the wilderness degrade the measure; a reduction of 1000 m of road or fence improves the measurement.                                                                                                                                                    |
| Data Adequacy           | High –All known road and fence accounted for                                                                                                                                                                                                                                                             |

|                         |                                               |                                             |        |
|-------------------------|-----------------------------------------------|---------------------------------------------|--------|
| Confidence<br>2012 Data | High                                          |                                             |        |
|                         | Structure,<br>Installation, or<br>Development | Length                                      |        |
|                         |                                               | ASIS                                        | CNWR   |
|                         | Roads                                         | 20380 m                                     | 8351 m |
|                         | Pony Fence                                    |                                             | 6437 m |
|                         | State line<br>Fence                           | 1145 m                                      |        |
|                         | Post and cable<br>fence along<br>roadways     | FX: 989 +<br>BL: 1943 +<br>CB: 443<br>=3375 |        |
|                         | Horse fence                                   | 1200 m                                      |        |
|                         | Deer fence                                    | 240 m                                       |        |
|                         | Deer/horse<br>grazing fence                   | 1600 m                                      |        |
| Total                   | 27940 m                                       | 14788 m                                     |        |
| Condition               | Good –But could be improved                   |                                             |        |



Photo: Taryn Sudol

**Measure 3.3 Index of unauthorized physical structures, installations, or developments**

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator          | Non-recreational structures, installations, and developments                                                                                                                                                                                                                                                                                                                                                                                               |
| Context            | Unauthorized physical structures, installations, or developments still show man’s impact or present on the natural landscape. Any features erected by individuals, citizen groups or Federal or state agencies that have not been authorized will be included in this measurement. Any unauthorized recreational structures will not be included here but in a subsequent measure under a Solitude or Primitive and Unconfined Recreation Quality measure. |
| Data source        | Internal documentation/knowledge of structures, etc.                                                                                                                                                                                                                                                                                                                                                                                                       |
| Data collection    | A list of unauthorized features will be developed based off any maps and on the ground observations. The sum of these developments will be compared every five years.                                                                                                                                                                                                                                                                                      |
| Data Entry         | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Significant Change | ANY change in the number of unauthorized developments is significant. More developments in the wilderness degrade the measurement; fewer developments                                                                                                                                                                                                                                                                                                      |

|                      |                                                                                                                                                                                                            |                |        |        |       |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|--------|-------|
| Data Adequacy        | improve the measurement.                                                                                                                                                                                   |                |        |        |       |
|                      | Medium-These are on the ground chance observations. While there is fairly high confidence in these judgments, no survey was conducted and it is possible that that unauthorized structures went unnoticed. |                |        |        |       |
| Confidence 2012 Data | Medium                                                                                                                                                                                                     |                |        |        |       |
|                      | Structure, Installation, or Development                                                                                                                                                                    | Number present | Length | Weight | Total |
|                      | 0                                                                                                                                                                                                          |                |        |        |       |
| Condition            | There are no known unauthorized structures in the proposed wilderness at this time.<br>Good                                                                                                                |                |        |        |       |

Measure 3.4 Index of abandoned structures

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |      |        |       |      |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------|--------|-------|------|
| Indicator Context       | Non-recreational structures, installations, and developments<br>Some structures, installations or developments are no longer active in the wilderness. They remain present, but are not being used. Over time the features may be removed or naturally decompose and be absorbed in the landscape. We will determine when these structures have decomposed enough or been absorbed back into the landscape. A significant number of features have been abandoned on Assateague and have therefore been separated as a single measure. In a sense, abandoned structures are “on their way out” and may be viewed differently from active, maintained structures. |                    |      |        |       |      |
| Data source             | Internal documentation/GIS/knowledge of structures, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |      |        |       |      |
| Data collection process | This list will be created based off maps and on the ground observations. The list of structures, installations, and developments is multiplied by the weight defined in an index. This list will be limited to abandoned structures that may be both authorized and unauthorized. Recreational structures that are now abandoned are also included in this measure because they no longer serve a recreational function. The sum of the product of structure, installations, and developments and weight will be the measure for the five year monitoring period.                                                                                               |                    |      |        |       |      |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |      |        |       |      |
| Significant Change      | An increase of 25% of abandoned developments in the wilderness degrade the measurement; Any reduction in the abandoned developments improve the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |      |        |       |      |
| Data Adequacy           | High-Staff is confident in their knowledge of abandoned structures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |      |        |       |      |
| Confidence 2012 Data    | High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    |      |        |       |      |
|                         | Structure, Installation, or Development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Number present     |      | Weight | Total |      |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ASIS               | CNWR |        | ASIS  | CNWR |
|                         | Retention Structures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7                  |      | 5      | 35    |      |
|                         | Mosquito ditches                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 812 affected acres |      | 2      | 1624  |      |
|                         | Blinds                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0                  |      | 3      |       |      |
|                         | TOTAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |      |        | 1659  |      |
| Condition               | While there are known berms and dikes on ASIS at this time, they are not mapped and estimation on their footprint cannot be made. When berms/dikes are quantified they will be weighted a 3.<br>Good                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    |      |        |       |      |



Photo: Taryn Sudol

**Measure 3.5 Length of abandoned physical structures, installations, and developments**

| Indicator                               | Non-recreational structures, installations, and developments                                                                                                                                                                                                                                                                                                       |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------------------|--------|--|------|------|-------|---------|--|--------|---|--|-------|---------|--|
| Context                                 | Refer to measure 3.4                                                                                                                                                                                                                                                                                                                                               |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Data source                             | Internal documentation/GIS/knowledge of structures, etc.                                                                                                                                                                                                                                                                                                           |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Data collection process                 | Refer to measure 3.3. The same protocol is followed except that applicable structures are measured by length in meters.                                                                                                                                                                                                                                            |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Data Entry                              | Every five years                                                                                                                                                                                                                                                                                                                                                   |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Significant Change                      | An increase of 25% in abandoned developments in the wilderness degrade the measurement; any fewer abandoned developments improve the measurement.                                                                                                                                                                                                                  |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Data Adequacy                           | High-Staff is confident in their knowledge of abandoned structures                                                                                                                                                                                                                                                                                                 |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Confidence                              | High                                                                                                                                                                                                                                                                                                                                                               |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| 2012 Data                               | <table border="1"> <thead> <tr> <th rowspan="2">Structure, Installation, or Development</th> <th colspan="2">Length</th> </tr> <tr> <th>ASIS</th> <th>CNWR</th> </tr> </thead> <tbody> <tr> <td>Roads</td> <td>14293 m</td> <td></td> </tr> <tr> <td>Fences</td> <td>0</td> <td></td> </tr> <tr> <td>TOTAL</td> <td>14293 m</td> <td></td> </tr> </tbody> </table> |      | Structure, Installation, or Development | Length |  | ASIS | CNWR | Roads | 14293 m |  | Fences | 0 |  | TOTAL | 14293 m |  |
| Structure, Installation, or Development | Length                                                                                                                                                                                                                                                                                                                                                             |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
|                                         | ASIS                                                                                                                                                                                                                                                                                                                                                               | CNWR |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Roads                                   | 14293 m                                                                                                                                                                                                                                                                                                                                                            |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Fences                                  | 0                                                                                                                                                                                                                                                                                                                                                                  |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| TOTAL                                   | 14293 m                                                                                                                                                                                                                                                                                                                                                            |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |
| Condition                               | Good                                                                                                                                                                                                                                                                                                                                                               |      |                                         |        |  |      |      |       |         |  |        |   |  |       |         |  |

**Measure 3.6 Inholdings**

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator | Inholdings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Context   | An inholding is any non-federal land within the wilderness boundary. It does not include cherry-stemmed parcels or external edge-holdings that may be acquired in the future. While inholdings existed at the time of the wilderness proposal, those rights have since expired and been transferred to NPS. Some of those old inholdings may still be on site but they are now included in the abandoned structure measure. At the time of this baseline assessment, there are no inholdings on site nor is there any foreseeable properties that may become inholdings. |

| Data source             | Internal inventory                                                                                                                                                                                                                                                                                                                                              |           |         |   |   |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|---|---|
| Data collection process | A count of each inholding and its acreage                                                                                                                                                                                                                                                                                                                       |           |         |   |   |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                |           |         |   |   |
| Significant Change      | ANY change in the number of inholdings is significant. More inholdings degrade the measurement while fewer inholdings improve the measurement.                                                                                                                                                                                                                  |           |         |   |   |
| Data Adequacy           | High –There is an accurate count of the number of inholdings.                                                                                                                                                                                                                                                                                                   |           |         |   |   |
| Confidence              | High                                                                                                                                                                                                                                                                                                                                                            |           |         |   |   |
| 2012 Data               | <p>Number of Inholdings and Their Acreage in the Proposed Island Wilderness</p> <table border="1"> <thead> <tr> <th>Inholding</th> <th>Acreage</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> </tr> </tbody> </table> <p>There are no inholdings for ASIS or CNWR in 2012. Any old inholdings are now included in the abandoned structures measure.</p> | Inholding | Acreage | 0 | 0 |
| Inholding               | Acreage                                                                                                                                                                                                                                                                                                                                                         |           |         |   |   |
| 0                       | 0                                                                                                                                                                                                                                                                                                                                                               |           |         |   |   |
| Condition               | Good                                                                                                                                                                                                                                                                                                                                                            |           |         |   |   |

Measure 3.7 Type and amount of administrative use of motor vehicles, motorized equipment, or mechanical transport

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator               | Use of motor vehicles, motorized equipment, and mechanical transport                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Context                 | <p>“Motor vehicles” are any machines used to transport people or material across or over land, water, or air, and which are powered by the use of a motor, engine, or other nonliving power source. This includes, but is not limited to, ATVS, motor boats, trucks and aircraft that either land or drop off or pick up people or material (i.e., not aircraft that merely fly over the wilderness).</p> <p>“Motorized equipment” are any machines that are not used for transportation by are powered by a motor, engine, or other nonliving source. This includes, but is not limited to, machines such as chainsaws and generators. It does not include small hand-carried devices such as shavers, wristwatches, flashlights, cameras, etc.</p> <p>“Mechanical transport” refers to any contrivance for moving people or material in or over land, water, or air, having moving parts, that provides a mechanical advantage to the user, and that is powered by a living or non-motorized power source. This includes, but is not limited to, sailboats, bicycles, game carriers, carts, and wagons. It does not include wheelchairs when used as necessary medical appliances. It also does not include rafts, canoes, or similar primitive devices without moving parts.</p> <p>This measure applies to all sectors of the NPS and FWS staff or other authorized bodies. This includes law enforcement patrols or those agencies that respond to emergencies. Since emergencies are rare events, they are included in this measure instead of being a separate measure.</p> <p>At the time of this baseline assessment, recreational OSVs are permitted in the NPS portion of the Island Wilderness. At most, 145 OSVs are allowed per day in the wilderness zone during certain portions of the year.</p> |
| Data source             | Internal staff reporting of activities and associated transport/equipment. CNWR: Charlene Swartz and Drizz Wilgus, Eva Savage and Jim Fair. ASIS: Ish Ennis, Jack Kumer, and Walt West.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Data collection process | Use of motorized vehicles and equipment and mechanical transport is recorded based on activity, the number of times it was used (a “time” means it entered and exited the wilderness. A time does not exceed one whole day in length, but otherwise this does not indicate the length the vehicle or equipment was in use). Transportation and equipment used is assumed based on the activity done. Refer to Appendix G for a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                          |                                                                                                                                                                                                                                                                                                                                         |                                      |      |                                        |      |                                       |      |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------|----------------------------------------|------|---------------------------------------|------|
| Significant Change       | detailed list of activities.<br>+/- 10%. An increase of 10% of motorized vehicles, motorized equipment, and mechanical transport in the wilderness degrades the measurement while 10% less motorized vehicles, motorized equipment, and mechanical transport improves the measurement.                                                  |                                      |      |                                        |      |                                       |      |
| Data Entry Data Adequacy | Annually<br>Medium –Interviewers have confidence what they reported, but this tracking remains a retroactive estimation. Admittedly several activities may have been forgotten/unaccounted for. There is also the possibility that double counting has occurred because some activities may have been accomplished in one vehicle trip. |                                      |      |                                        |      |                                       |      |
| Confidence 2012 Data     | Medium                                                                                                                                                                                                                                                                                                                                  |                                      |      |                                        |      |                                       |      |
|                          | Activity                                                                                                                                                                                                                                                                                                                                | No. of times motorized vehicles used |      | No. of times mechanical transport used |      | No. of times motorized equipment used |      |
|                          |                                                                                                                                                                                                                                                                                                                                         | ASIS                                 | CNWR | ASIS                                   | CNWR | ASIS                                  | CNWR |
|                          | Monitoring                                                                                                                                                                                                                                                                                                                              | 594                                  | 89   |                                        |      |                                       |      |
|                          | Research                                                                                                                                                                                                                                                                                                                                | 142                                  | 64   |                                        |      |                                       |      |
|                          | Other Biological Actions                                                                                                                                                                                                                                                                                                                | 234                                  |      |                                        |      | 126                                   |      |
|                          | Patrolling                                                                                                                                                                                                                                                                                                                              | 1220                                 | 800  |                                        |      |                                       |      |
|                          | Maintenance                                                                                                                                                                                                                                                                                                                             | 135                                  | 69   |                                        | 15   | 48                                    | 1    |
|                          | Mowing                                                                                                                                                                                                                                                                                                                                  | 14                                   | 16   |                                        | 8    |                                       |      |
|                          | TOTAL                                                                                                                                                                                                                                                                                                                                   | 2,339                                | 1038 | 0                                      | 23   | 174                                   | 1    |
| Condition                | Caution/Poor –There is a high frequency of motor vehicles in the wilderness                                                                                                                                                                                                                                                             |                                      |      |                                        |      |                                       |      |

Measure 3.8 Authorized Recreational Motor Vehicle Use

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                       |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Indicator Context        | Use of motor vehicles, motorized equipment, and mechanical transport<br>As of 2012, ASIS policy allows for recreationalists to use motor vehicles in two ways within the wilderness. If OSV users have a permit, they can drive their vehicles on the beach. During hunt season, hunters can enter their areas with their vehicles as well.                                                                                                                                                           |                       |
| Data Source              | Number of OSV users counted through gate entry automated counter. OSV use in the wilderness based on Katherina Forgue’s thesis. Hunter vehicles for duck hunting logged by check-in and hunter vehicles for deer hunting is professional judgment by Walt West.                                                                                                                                                                                                                                       |                       |
| Data collection process  | To calculate the OSV usage, use the total traffic count per month from August of the previous year to July of the current year. The assumption is that 10% of OSVs that enter the zone will travel to the wilderness zone. This assumption was derived from Katherina Forgues’ thesis observations. To calculate hunter vehicles in the wilderness, use a count of the sign in and sign out for duck hunting. For deer hunting use professional judgment of how many vehicles entered the wilderness. |                       |
| Significant Change       | +/- 10%. An increase of 10% of motorized vehicles, motorized equipment, and mechanical transport in the wilderness degrades the measurement while 10% less motorized vehicles, motorized equipment, and mechanical transport improves the measurement.                                                                                                                                                                                                                                                |                       |
| Data Entry Data Adequacy | Annually<br>Medium- While the traffic count for OSV should be accurate, how many OSV users enter the wilderness is an estimation. Duck hunting vehicle counts should be accurate but deer hunting vehicles is another estimation.                                                                                                                                                                                                                                                                     |                       |
| Confidence 2012 Data     | Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |
|                          | Use of Motor Vehicle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | No. of motor vehicles |
|                          | OSVs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2748                  |

|                       |      |
|-----------------------|------|
| Hunter Vehicles –Duck | 73   |
| Hunter Vehicles –Deer | <20  |
| TOTAL                 | 2841 |

Condition Poor /Unknown–Motor vehicles are prohibited in the wilderness. Do not know whether this is a high or low year of recreational use.

Measure 3.9 Type and amount of motor vehicles, motorized equipment, or mechanical transport use unauthorized by the Federal land manager

Indicator Context Use of motor vehicles, mechanical transport and motorized equipment  
Ref to measure 3.7 for motor vehicle, motorized equipment, and mechanical transport definitions. The use of these devices by any individuals, citizen groups or unauthorized Federal and state agencies will be listed here. The awareness of unauthorized use depends in part on the amount of monitoring and patrolling (which has its own wilderness impacts). At this time the amount of use of different types of transport and equipment will be given a score based on a range of frequency and extent. Recreational uses are also recorded here.

Data source Observations and professional judgment from law enforcement: Walt West, Jim Fair.  
Data collection process The use of unauthorized motorized and mechanical transportation and equipment will fall within frequency ranges. Staff will decide the range for frequency (week, month, and year) and then use observations and informed personal judgments to assign a score to the different type of uses.

| Category   | Frequency of unauthorized use | Score |
|------------|-------------------------------|-------|
| Public     | less than 5x per year         | 1     |
|            | 5x/year to 1x/month           | 2     |
|            | more than 1x/month            | 3     |
| Permittees | less than 5x per year         | 1     |
|            | 5x/year to 1x/month           | 2     |
|            | more than 1x/month            | 3     |
| Agencies   | less than 5x per year         | 1     |
|            | 5x/year to 1x/month           | 2     |
|            | more than 1x/month            | 3     |

Data Entry Significant Change Annual average of past five years  
+/- 3 points. If more unauthorized use of motorized vehicles, motorized equipment, or mechanical transport occurs this degrades the measurement, while less use improved the measurement.

Data Adequacy Confidence Medium –Unauthorized activities are not readily recorded and staff is only aware of it through chance observation.

2012 Data Medium

| Type of Use     | Category | Frequency Score |
|-----------------|----------|-----------------|
| Bikes (CNWR)    | Public   | 1               |
| Vehicles (ASIS) | Public   | 1               |

|           |      |
|-----------|------|
| Condition | Good |
|-----------|------|

#### 5.4 Solitude or Primitive and Unconfined Recreation

| Monitoring Question                                                                   | Indicator                                                                                                        | Measurement                                                                      | Freq. of Reporting                    |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------|
| What are the trends for outstanding opportunities for solitude within the wilderness? | Remoteness from sights and sounds of people inside the wilderness                                                | Percent of wilderness affected by access or travel routes inside the wilderness  | Every five years                      |
|                                                                                       |                                                                                                                  | Amount of litter on CNWR                                                         | Annually                              |
|                                                                                       | Remoteness from occupied and modified areas outside the wilderness                                               | Permanent Viewshed                                                               | Every five years                      |
|                                                                                       |                                                                                                                  | Temporary Viewshed                                                               | Every five years                      |
|                                                                                       |                                                                                                                  | Percent of wilderness affected by access or travel routes outside the wilderness | Every five years                      |
|                                                                                       | What are the trends for outstanding opportunities for primitive and unconfined recreation inside the wilderness? | Facilities that decrease self-reliant recreation                                 | Agency-provided recreation facilities |
| User-created recreation facilities                                                    |                                                                                                                  |                                                                                  | Every five years                      |
| Management restrictions on visitor behavior                                           |                                                                                                                  | Visitor restriction index                                                        | Every five years                      |
|                                                                                       |                                                                                                                  | Extent of management restrictions                                                | Every five years                      |

#### Measure 4.1 Percent of wilderness affected by access or travel routes inside the wilderness

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Indicator               | Remoteness from sights and sounds of people inside the wilderness                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |
| Context                 | The wilderness is intended as a place to feel isolated from the sites and sounds of people. It provides an opportunity for solitude with nature. Being within proximity to access or travel routes exposes visitors to people and motorized transport. For the purposes of this measurement, travel routes include active roads or routes used by vehicles, authorized or unauthorized. This includes routes in the sand typically used by OSVs. It does not include abandoned roads that are no longer used. |      |
| Data source             | Internal GIS records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |
| Data collection process | Staff will create a 35 ft buffer area around access or travel routes. The total of this buffer area calculated in GIS will be divided by the total wilderness area for the percent affected. Travel routes will include roads or routes that are actively being used by vehicles. It does not apply to foot traffic. Roads that are abandoned are no longer considered travel routes.                                                                                                                         |      |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |
| Significant Change      | +/-5% An increase of 5% from the last monitoring data point in the percent of wilderness affected degrades the measurement, while a decrease of 5% is an improvement.                                                                                                                                                                                                                                                                                                                                         |      |
| Data Adequacy           | High-Travel routes are known and mapped. The most up-to-date total acreage should be used.                                                                                                                                                                                                                                                                                                                                                                                                                    |      |
| Confidence              | High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |
| 2012 Data               | ASIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | CNWR |

|                  |                       |                       |
|------------------|-----------------------|-----------------------|
| Area Affected    | 443554 m <sup>2</sup> | 178191 m <sup>2</sup> |
| Percent Affected | 3%                    | 3%                    |

Condition Good

**Measure 4.2 Amount of litter on CNWR**

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |                            |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------|
| Indicator                     | Non-recreational structures, installations, and developments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |                            |
| Context                       | Litter is any discarded man-made materials. While litter from visiting individuals may be low, a noticeable amount of litter washes up on the shore from the ocean. From Mylar balloons to old tires, this garbage interrupts the natural landscape and may pose a threat to wildlife.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  |                            |
| Data source                   | Ocean Conservancy International Coastal Clean Up Summary Card. The beach cleanup is conducted on Chincoteague NWR by volunteers who are led by Jenny Owen, Volunteer Coordinator, or Sally Bowen.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                  |                            |
| Data collection               | Annually on CNWR there is a beach cleanup as part of the Ocean Conservancy. Since the wash up of trash from the ocean is a random process and not wilderness specific, this measure will track the amount of litter collected on the whole CNWR. The clean up occurs in mid-September. Data collected includes number of volunteers, the distanced cleaned at the site, the pounds of debris collected, and what that debris is composed of. For the purposes of this measure, the average weight of debris collected will be compared over each five year monitoring period. The number of volunteers and the distance cleaned will be listed also as a possible explanation for the amount of debris collected, but will not be included in the final measurement (average pounds of debris collected). |                                  |                            |
| Data Entry Significant Change | Annually<br>+/- 1500 pounds. The litter collected can be highly variable from year to year. The measurement is improved if litter decreases by 1,500 pounds or is degraded if litter increases by 1,500 pounds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |                            |
| Data Adequacy                 | Medium –This data is not specific to the wilderness and the amount of debris collected may be influenced by number of volunteers to area of beach cleaned. This data therefore does not precisely reflect the exact amount of litter in the wilderness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                  |                            |
| Confidence 2012 Data          | High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  |                            |
|                               | Annual Average for Pounds of Litter Collected on Chincoteague NWR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                  |                            |
|                               | Year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Volunteers                       | Distance cleaned (Miles)   |
|                               | 2006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 153                              | 16                         |
|                               | 2007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 139                              | 18                         |
|                               | 2008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Not collected due to a hurricane |                            |
|                               | 2009                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 117                              | 16                         |
|                               | 2010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 200                              | 12                         |
|                               | 2011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 137                              | 15.5                       |
|                               | Annual Average                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 151                              | 14.5                       |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | Pounds of litter collected |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | 6560                       |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | 15,660                     |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | 3280                       |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | 920                        |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | 4760                       |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | 4627*                      |
|                               | *Year 2007 is not included in the average because it is an extreme outlier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                  |                            |
| Condition                     | Unknown –The past five years is fairly scattered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                  |                            |

**Measure 4.3 Permanent Viewshed**

|           |                                                                                           |
|-----------|-------------------------------------------------------------------------------------------|
| Indicator | Remoteness from occupied and modified areas outside the wilderness                        |
| Context   | Visitors to the wilderness are not meant to feel surrounded by civilization. A visitor to |

|                     | the wilderness ideally should only see a natural landscape. Visible developments outside of the wilderness boundary detract from a feeling of solitude. This measure tracks permanent man-made structures within view of the wilderness. While some structures may come and go, if they are not seasonal or temporary at the time of data collection, they are considered permanent. Across the bay, some houses are present but they are distant and indistinguishable so were not included in the count. Crab floats are also present in the bay, but also because of their small size and distance from the wilderness boundary, they are not included in the count. |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|--|------|------|---------------------|---|----|--------|---|----|-------|---|----|
| Data source         | Field count                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| Data collection     | Count number of man-made structures visible in wilderness that are permanent features through the on-the-ground surveys. A boat ride in the bay along the length of the wilderness will provide a count of visible structures. Effort is made to be as close to the shore as possible, but is limited by the water depth.                                                                                                                                                                                                                                                                                                                                               |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| Data Entry          | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| Significant Change  | +/-10% If the number of structures in the permanent viewshed increases by 10% since the last monitoring data point, then the measurement degrades. If the number of structures decreases by 10%, the measurement improves.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| Data Adequacy       | Medium- While this was a physical survey, it was limited by how close the boat could get to the border and what could be seen.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| Confidence          | Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| 2012 Data           | <table border="1"> <thead> <tr> <th rowspan="2">Type of Structure</th> <th colspan="2">No. of structures</th> </tr> <tr> <th>ASIS</th> <th>CNWR</th> </tr> </thead> <tbody> <tr> <td>House/oyster shacks</td> <td>2</td> <td>10</td> </tr> <tr> <td>Blinds</td> <td>2</td> <td>37</td> </tr> <tr> <td>TOTAL</td> <td>4</td> <td>47</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                                                                         | Type of Structure | No. of structures |  | ASIS | CNWR | House/oyster shacks | 2 | 10 | Blinds | 2 | 37 | TOTAL | 4 | 47 |
| Type of Structure   | No. of structures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
|                     | ASIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CNWR              |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| House/oyster shacks | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10                |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| Blinds              | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 37                |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| TOTAL               | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 47                |                   |  |      |      |                     |   |    |        |   |    |       |   |    |
| Condition           | Good                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                   |  |      |      |                     |   |    |        |   |    |       |   |    |

**Measure 4.4 Temporary Viewshed**

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator               | Remoteness from occupied and modified areas outside the wilderness                                                                                                                                                                                                                                                                                                                                                                                                 |
| Context                 | Some structures only pass by the wilderness, yet still interrupt a visitor's solitude experience. In this case, motor boats, OSVs, or aircraft may be within view of certain parts of the wilderness. For this measure, visible OSV will be included even though they are within the wilderness. This is because OSV is prohibited in wildernesses in general, and their presence is a distraction from the feeling of solitude and primitive recreation.          |
| Data source             | Field count                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Data collection process | A sample will be taken (15 min) of the number of temporary man-made structures that pass through the viewshed during a designated time (10:00 am) at a specified location, the state line fence. During the sample the monitor will list mobile structures that pass within view (not sound), how long it takes to pass, and how close the structures are based on a distance score (4-Just outside the boundary to 1-Distant, on the horizon or high in the sky). |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Significant Change      | +/-5 mobile structures. If the number of structures in the temporary viewshed increases by 5 since the last monitoring data point, then the measurement degrades. If the number of structures decreases by 5, the measurement improves.                                                                                                                                                                                                                            |
| Data Adequacy           | Low –This is one fifteen window in five years. While it provides a snap shot, it does not capture the whole picture. Data adequacy can be improved if more points were measured with greater frequency, but this requires greater time and effort from the staff.                                                                                                                                                                                                  |
| Confidence              | Confidence is data collected from protocol is high.                                                                                                                                                                                                                                                                                                                                                                                                                |

2012 Data

| Site              | Type of structure | No. of structures | Time in viewshed | Distance from viewer | TOTAL |
|-------------------|-------------------|-------------------|------------------|----------------------|-------|
| Stateline-Ocean   | OSV               | 2                 | 15 min           | 1                    | 30    |
| Stateline-Bayside | 0                 |                   |                  |                      |       |
| Bay view          | 0                 |                   |                  |                      |       |

Condition

Good



Photo: Taryn Sudol

**Measure 4.5** Percent of wilderness affected by access or travel routes outside the wilderness

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator          | Remoteness from occupied and modified areas outside the wilderness                                                                                                                                                                                                                                                                                                                                                                            |
| Context            | Being within proximity of travel routes can detract from a solitude experience even if the routes are not within the wilderness boundary. These travel routes are still accounted for. For the purposes of this measurement, travel routes include active roads or routes used by vehicles, authorized or unauthorized. This includes routes in the sand typically used by OSVs. It does not include abandoned roads that are no longer used. |
| Data source        | GIS data on travel routes determined to be adjacent to wilderness                                                                                                                                                                                                                                                                                                                                                                             |
| Data collection    | Staff will create a 35 ft buffer area around adjacent access or travel routes. The total of this buffer area calculated in GIS will be divided by the total wilderness area for the percent affected. Travel routes will include roads or routes that are actively being used by vehicles. It does not apply to foot traffic.                                                                                                                 |
| Data Entry         | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Significant Change | +/- 5%. If there is an increase of 5% of the percent affected since the last monitoring point, then this is degradation to the measurement. If there is a decrease of 5% of the percent affected, then this is an improvement.                                                                                                                                                                                                                |
| Data Adequacy      | High-Traveled routes are known and mapped. The most accurate, up to date acreage should be used.                                                                                                                                                                                                                                                                                                                                              |
| Confidence         | High                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|           |                  |                    |                      |
|-----------|------------------|--------------------|----------------------|
| 2012 Data |                  | ASIS               | CNWR                 |
|           | Area Affected    | 228 m <sup>2</sup> | 78945 m <sup>2</sup> |
|           | Percent Affected | >1%                | 1.13%                |
| Condition | Good             |                    |                      |

Measure 4.6 Agency-provided recreation facilities

| Indicator                   | Facilities that decrease self-reliant recreation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------|-------------------|--|------|------|----------------|---|--|------------|-----|--|--------|---|--|------------|---|--|---------------|----------------|--|---------|----------------|--|------------|----------------|--|
| Context                     | Recreation facilities reduce the feeling of primitive recreation, which is meant to be provided in a wilderness setting. Even though some visitors may enjoy or appreciate facilities, and in some cases the facilities are authorized by law, they are inconsistent with primitive recreation. As such, this measure tracks the number of ASIS and CNWR provided recreational facilities.                                                                                                                                                                                                                                   |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Data source                 | Internal staff inventory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Data collection             | The recreational facilities will be counted and organized by type.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Significant Change          | ANY change in the number of trails or campsites is significant. If the number of trails/campsites is reduced, then this improves the measurement. If the number of trails/campsites is increased, this degrades the measurement. If any combination of picnic tables, toilets or fire rings is greater than 3, this qualifies as a campsite. Two hunting blinds also qualifies as a campsite. The addition or removal of 15 white rods for hunting posts qualifies as a trail.                                                                                                                                               |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Data Adequacy               | CNWR does not provide campsites or recreational facilities in the proposed wilderness. ASIS has three back country campsite areas within the wilderness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| 2012 Data                   | <table border="1"> <thead> <tr> <th rowspan="2">Type of Recreation Facility</th> <th colspan="2">No. of facilities</th> </tr> <tr> <th>ASIS</th> <th>CNWR</th> </tr> </thead> <tbody> <tr> <td>Hunting Trails</td> <td>8</td> <td></td> </tr> <tr> <td>White Rods</td> <td>175</td> <td></td> </tr> <tr> <td>Blinds</td> <td>8</td> <td></td> </tr> <tr> <td>Campsites:</td> <td>3</td> <td></td> </tr> <tr> <td>Picnic Tables</td> <td>9 (3 per site)</td> <td></td> </tr> <tr> <td>Toilets</td> <td>9 (3 per site)</td> <td></td> </tr> <tr> <td>Fire Rings</td> <td>9 (3 per site)</td> <td></td> </tr> </tbody> </table> |      | Type of Recreation Facility | No. of facilities |  | ASIS | CNWR | Hunting Trails | 8 |  | White Rods | 175 |  | Blinds | 8 |  | Campsites: | 3 |  | Picnic Tables | 9 (3 per site) |  | Toilets | 9 (3 per site) |  | Fire Rings | 9 (3 per site) |  |
| Type of Recreation Facility | No. of facilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
|                             | ASIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CNWR |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Hunting Trails              | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| White Rods                  | 175                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Blinds                      | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Campsites:                  | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Picnic Tables               | 9 (3 per site)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Toilets                     | 9 (3 per site)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Fire Rings                  | 9 (3 per site)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |
| Condition                   | Unknown –This is a baseline. The state of recreational facilities has not changed much.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                             |                   |  |      |      |                |   |  |            |     |  |        |   |  |            |   |  |               |                |  |         |                |  |            |                |  |



Photo: Taryn Sudol

Measure 4.7 User-created recreation facilities

| Indicator                   | Facilities that decrease self-reliant recreation                                                                                                                                                                                                                                                                   |        |       |  |                             |                   |        |       |                       |    |  |  |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|--|-----------------------------|-------------------|--------|-------|-----------------------|----|--|--|
| Context                     | Some visitors may create their own recreation facilities, such as hunting blinds, but these detract from primitive recreation for them, other people who utilize them, and those who see them as man-made features. These user-created recreation facilities must also be tracked to the best available knowledge. |        |       |  |                             |                   |        |       |                       |    |  |  |
| Data source                 | Observations and professional judgment from law enforcement: Walt West, Jim Fair.                                                                                                                                                                                                                                  |        |       |  |                             |                   |        |       |                       |    |  |  |
| Data collection process     | Unauthorized recreational facilities will be counted and organized by type.                                                                                                                                                                                                                                        |        |       |  |                             |                   |        |       |                       |    |  |  |
| Significant Change          | +/- 3. If the users create 3 more new recreation facilities since the last monitoring data point, then this is a degradation of the measurement. A decrease of 3 since the last monitoring data point would be an improvement of the measurement.                                                                  |        |       |  |                             |                   |        |       |                       |    |  |  |
| Data Adequacy               | Medium –This count is gained only through chance observation rather than a complete survey. The general feeling is that user-created facilities are few. Hunting blinds/aids may be created each year.                                                                                                             |        |       |  |                             |                   |        |       |                       |    |  |  |
| Confidence                  | Medium                                                                                                                                                                                                                                                                                                             |        |       |  |                             |                   |        |       |                       |    |  |  |
| 2012 Data                   | <table border="1"> <thead> <tr> <th>Type of recreation facility</th> <th>No. of facilities</th> <th>Weight</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Temporary tree stands</td> <td>~7</td> <td></td> <td></td> </tr> </tbody> </table>                                                                  |        |       |  | Type of recreation facility | No. of facilities | Weight | Total | Temporary tree stands | ~7 |  |  |
| Type of recreation facility | No. of facilities                                                                                                                                                                                                                                                                                                  | Weight | Total |  |                             |                   |        |       |                       |    |  |  |
| Temporary tree stands       | ~7                                                                                                                                                                                                                                                                                                                 |        |       |  |                             |                   |        |       |                       |    |  |  |
|                             | Law enforcement on ASIS believes that maybe 5-10 temporary tree stands for hunters are found each year.                                                                                                                                                                                                            |        |       |  |                             |                   |        |       |                       |    |  |  |
| Condition                   | Unknown –This is a baseline. A 5-10 range might be good or it could be reduced?                                                                                                                                                                                                                                    |        |       |  |                             |                   |        |       |                       |    |  |  |

Measure 4.8 Visitor Restrictions Index

| Indicator         | Management restrictions on visitor behavior                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--|----------|---------------------|-------|---------|----------------|---|--------------------------------------|---|-------------------|---|-----------|----------------|---|----------------------------------------------|---|-------------------|---|------|---------|---|------------------------------------|---|------------------------------|---|----------------|-----------------------------------|---|------------------------|---|-------------------|----------------|---|----------------------------|---|
| Context           | Being in a wilderness an opportunity to experience freedom or be unconfined. Restrictions on activities will be tracked as degradation to unconfined recreation. While regulations in most cases serve to protect resources in the wilderness, a decrease in the level of restrictions indicates an improvement in unconfined creation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
| Data source       | Internal records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
| Data collection   | A score will be given to ASIS and CNWR based on the type of restrictions. These restrictions will be organized by category and the score assigned based on if there is no regulation or total prohibition. The higher the sum of the scores the more restrictions exist in the wilderness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | <table border="1"> <thead> <tr> <th>Category</th> <th>Type of Restriction</th> <th>Score</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Camping</td> <td>No Restriction</td> <td>0</td> </tr> <tr> <td>Designated site or mandatory setback</td> <td>1</td> </tr> <tr> <td>Total prohibition</td> <td>2</td> </tr> <tr> <td rowspan="3">Campfires</td> <td>No Restriction</td> <td>0</td> </tr> <tr> <td>Any mandatory setback (e.g. designated site)</td> <td>1</td> </tr> <tr> <td>Total prohibition</td> <td>2</td> </tr> <tr> <td rowspan="3">Fees</td> <td>No Fees</td> <td>0</td> </tr> <tr> <td>Fees charged of selected user type</td> <td>1</td> </tr> <tr> <td>Fees charged of all visitors</td> <td>2</td> </tr> <tr> <td rowspan="2">Length of Stay</td> <td>No restrictions on length of stay</td> <td>0</td> </tr> <tr> <td>Length of stay limited</td> <td>1</td> </tr> <tr> <td rowspan="2">Group size limits</td> <td>No restriction</td> <td>0</td> </tr> <tr> <td>Group size limits in place</td> <td>1</td> </tr> </tbody> </table> |       |  | Category | Type of Restriction | Score | Camping | No Restriction | 0 | Designated site or mandatory setback | 1 | Total prohibition | 2 | Campfires | No Restriction | 0 | Any mandatory setback (e.g. designated site) | 1 | Total prohibition | 2 | Fees | No Fees | 0 | Fees charged of selected user type | 1 | Fees charged of all visitors | 2 | Length of Stay | No restrictions on length of stay | 0 | Length of stay limited | 1 | Group size limits | No restriction | 0 | Group size limits in place | 1 |
| Category          | Type of Restriction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Score |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
| Camping           | No Restriction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Designated site or mandatory setback                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Total prohibition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
| Campfires         | No Restriction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Any mandatory setback (e.g. designated site)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Total prohibition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
| Fees              | No Fees                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Fees charged of selected user type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Fees charged of all visitors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
| Length of Stay    | No restrictions on length of stay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Length of stay limited                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
| Group size limits | No restriction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |
|                   | Group size limits in place                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1     |  |          |                     |       |         |                |   |                                      |   |                   |   |           |                |   |                                              |   |                   |   |      |         |   |                                    |   |                              |   |                |                                   |   |                        |   |                   |                |   |                            |   |

|                                                                                           |                                                                                                                                                                    |                              |            |
|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------|
| Significant Change<br>Data Entry<br>Data Adequacy<br>Confidence<br>2012 Data<br>Condition | Leash requirement                                                                                                                                                  | No restriction               | 0          |
|                                                                                           |                                                                                                                                                                    | Pets required to be on leash | 1          |
|                                                                                           |                                                                                                                                                                    | Total prohibition            | 2          |
|                                                                                           | Hunting Restrictions                                                                                                                                               | No restriction               | 0          |
|                                                                                           |                                                                                                                                                                    | Designated Season            | 1          |
|                                                                                           |                                                                                                                                                                    | Total prohibition            | 2          |
|                                                                                           | ANY change in the visitor restriction score is significant. A higher score is degradation to the measure while a lower score is an improvement to the measurement. |                              |            |
|                                                                                           | Every five years                                                                                                                                                   |                              |            |
|                                                                                           | High-Management policies are definite                                                                                                                              |                              |            |
|                                                                                           | High                                                                                                                                                               |                              |            |
| Type of Restriction                                                                       |                                                                                                                                                                    | ASIS Score                   | CNWR Score |
| Camping                                                                                   |                                                                                                                                                                    | 1                            | 2          |
| Campfire                                                                                  |                                                                                                                                                                    | 1                            | 2          |
| Fees                                                                                      |                                                                                                                                                                    | 2                            | 2          |
| Length of Stay                                                                            |                                                                                                                                                                    | 1                            | 1          |
| Group Size Limits                                                                         |                                                                                                                                                                    | 1                            | 0          |
| Leash Requirement                                                                         |                                                                                                                                                                    | 2                            | 2          |
| Hunting Restrictions                                                                      |                                                                                                                                                                    | 1                            | 1          |
| TOTAL SCORE                                                                               |                                                                                                                                                                    | 9                            | 10         |
| Caution –The maximum score possible in this index is 12.                                  |                                                                                                                                                                    |                              |            |

**Measure 4.9** Percent of wilderness closed to public access year-round

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                         |                         |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|
| Indicator          | Management restrictions on visitor behavior                                                                                                                                                                                                                                                                                                                                                                                          |                         |                         |
| Context            | If areas of the wilderness are closed off there is a restriction in visitor behavior. This measure focuses on the percent of wilderness closed to public access over a certain number of days. In general, CNWR restricts visitors to the service road and wet beach except during the hunting season. Predator exclosures for nest are also blocked off in ASIS and CNWR but these are small enough to be considered insignificant. |                         |                         |
| Data source        | Internal records –GIS layer delineation of wilderness area and roadways.                                                                                                                                                                                                                                                                                                                                                             |                         |                         |
| Data collection    | This is a GIS calculation of the accessible travel routes area within the wilderness. All area outside these travel routes is restricted in the CNWR portion of the land. This number (area restricted/total area) is then compared to the number of days it is prohibited (year minus hunting season). Restricted areas in ASIS include retention structures and research plots.                                                    |                         |                         |
| Data Entry         | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                     |                         |                         |
| Significant Change | If a greater amount of the wilderness is prohibited, then this degrades the measurement. If less of the wilderness is prohibited, then this improves the measurement.                                                                                                                                                                                                                                                                |                         |                         |
| Data Adequacy      | High –Management policies are clear and the calculation is reliable in GIS.                                                                                                                                                                                                                                                                                                                                                          |                         |                         |
| Confidence         | High                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |                         |
| 2012 Data          |                                                                                                                                                                                                                                                                                                                                                                                                                                      | Percent area restricted | Days area is restricted |
|                    | ASIS                                                                                                                                                                                                                                                                                                                                                                                                                                 | <1%                     | 365                     |
|                    | CNWR                                                                                                                                                                                                                                                                                                                                                                                                                                 | 99%                     | 315                     |
| Condition          | Good for ASIS. Poor for CNWR.                                                                                                                                                                                                                                                                                                                                                                                                        |                         |                         |

5.5 Other Features

| Monitoring Question | Indicator                                                                    | Measurement                                                                                                                  | Freq. of Reporting                |
|---------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Other Features      | Deterioration or loss of cultural resources integral to wilderness character | Number of actions that result in disturbances to cultural resources (looting, trespass activities, non-compliance with NHPA) | Annual average of past five years |

**Measure 5.1** Number of actions that result in disturbances or improvements to cultural resources

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|
| Indicator               | Deterioration or loss of cultural resources integral to wilderness character                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |          |       |
| Context                 | Certain sites in the wilderness have cultural significance. Any damage or disturbance of these sites, including unauthorized activities such as looting, would result in a loss of Assateague's wilderness character. If actions are taken to preserve or restore these cultural sites, this will improve the measurement. These sites include the graveyard, Green Run Hunting Lodge, and shipwrecks. If any cultural feature emerges in the future, any damages or preservation actions to it must also be tracked.                                     |          |       |
| Data source             | Internal staff consultation of associated activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |       |
| Data collection process | An inventory of the cultural sites will be created then any actions that occur on these sites will be listed. If the activity is damaging it will receive a negative score. If the activity preserves or restores the site it will receive a positive score. The sum of the activities will be tracked during the five year monitoring period.                                                                                                                                                                                                            |          |       |
| Significant Change      | ANY change in the number of actions that disrupt or improve cultural resources is significant. If more actions have disrupted cultural sites since the last monitoring data point, then this degrades to the measurement. If fewer actions have disrupted since the last monitoring data point or more actions have improved the cultural site, then this improves the measurement. If the score for a subsequent monitoring period is less because fewer improvements were made but no damaging activities occurred, this is not degradation but stable. |          |       |
| Data Entry              | Annual Average of past five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |          |       |
| Data Adequacy           | High- Cultural sites and activities associated with them are well tracked.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |       |
| Confidence              | High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |       |
| 2012 Data               | Cultural Site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Activity | Score |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0        |       |
| Condition               | Good                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |       |

### 5.6 Measures under Development

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicator | Biophysical processes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Measure   | Salt Marsh Integrity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Context   | Salt marshes, or coastal wetlands, are unique ecosystems comprising of flora and fauna that have adapted and evolved to extreme conditions of hydrology, soils, and salinity. Numerous wildlife species are highly dependent on salt marshes as breeding, feeding, migratory, or wintering habitat. Unfortunately, the majority of salt marshes have experienced some form of anthropogenic alteration such as oil spills, chemical mosquito control, drainage for mosquito control, salt hay farming, introduction of invasive species, restricted tidal flow, road construction, or channelization. These |

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | alterations impact both the intrinsic value of salt marshes as well as the quality of salt marsh habitat for the unique wildlife they support. Among the most important anthropogenic changes operating at the landscape/regional scale are the threats posed by global climate change. Sea level rise is a specific consequence of global climate change, and as sea-level rise accelerates and inundates some salt marshes, migration/creation of new salt marshes will be severely hampered by human development of adjoining lands.                                                                                                                                                                                                     |
| Data source             | Internal Survey documents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Data collection process | A series of metrics have been identified for Salt Marsh Integrity (Tidal flushing, natural butter, nekton density, bird abundance, salinity, etc). For each metric a utility function has been devised based on values from the literature and fieldwork. Based off these utility functions (graphical relationships: linear, parabolic, logarithmic), the measure in the field is converted to a score between 0-1 (good, bad or ugly). The sum of these scores is the Salt Marsh Integrity. This rank can be compared over time or between salt marshes, and is meant to be measured on a 3-5 year rotation. Since this is the first year (2012) that data is being collected, utility functions and scores may still require adjustment. |
| Data Entry              | Every five years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Significant Change      | Cannot yet be determined                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Data Adequacy           | High-Protocol is functioning on a regional level and has been studied/tested for a balance between feasibility and accuracy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Measure                 | Night Sky Visibility                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Indicator               | Remoteness from occupied and modified areas outside the wilderness                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Context                 | Light pollution by artificial light sources reduces visibility of stars and nebulae. A visible night sky can be associated with feelings of humility and being part of something larger. Also, light pollution can disorient wildlife.<br>ASIS and CNWR have limited control of light pollution from the surrounding areas but they may take action at administrative sites and work with local communities. As light pollution increases only the brightest stars remain visible. Based on how many stars are visible on a clear night, the park and refuge can estimate night sky visibility and compare over time.                                                                                                                       |
| Data source             | Staff observation. Protocol derived from GLOBE at Night<br><a href="http://www.globeatnight.org/observe_magnitude_orion.html">http://www.globeatnight.org/observe_magnitude_orion.html</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Data collection process | An hour after sunset on a clear night, a staff/volunteer will travel to point within the wilderness and locate the Orion constellation. The amount of visible stars associated with this constellation will be compared to magnitude charts provided by GLOBE at Night. The visible constellation that is most similar to whichever magnitude chart (1-7) will receive that magnitude score. The higher the magnitude score, the better night sky visibility. Higher night sky visibility increases the remoteness of people within the wilderness.                                                                                                                                                                                         |
| Significant Change      | ANY change in the magnitude score is significant. If the magnitude score increases since the last monitoring data point, this improves the measurement. If the magnitude score decreases, this degrades the measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Data Adequacy           | Medium –The protocol is simple and requires low resources but can be influenced by weather and subjective estimations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2012 Data               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## 5.7 Measures Not Used

| Measures Not Used                                      |                                                                    |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quality                                                | Indicator                                                          | Measure                               | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Natural</b>                                         | Plant and Animal Species Communities                               | Composition of habitat types          | It was ultimately decided that under no circumstances would the loss of habitat types suggest that the wilderness is less natural than it was before                                                                                                                                                                                                                                                                                                                               |
| <b>Natural</b>                                         | Biophysical                                                        | Change in Natural Fire Regime         | Fire has not been historical disturbance on the island. It is a rare event caused by lightning or human ignitions                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Natural</b>                                         | Biophysical                                                        | Subsidence Rate                       | At this time it is not possible to distinguish between the island subsiding and a rise in the surround ocean. It would be useless to separate the between sea level rise and subsidence because sea level rise is caused by more global processes while subsidence is caused by a reduction in the groundwater aquifers.                                                                                                                                                           |
| <b>Natural</b>                                         | Biophysical                                                        | Volume of Sand                        | On further consideration, it would be impossible to attribute whether the island is changing due to natural processes or man-made events. As such, any shape of the island with whatever volume of sand is considered natural.                                                                                                                                                                                                                                                     |
| <b>Natural</b>                                         | Plant and Animal Communities                                       | Status of Species of Concern          | Species of concern have populations that are too variable to allow for trends for improvements or decreases. They are dependent on available habitat. At the moment wilderness areas particularly do not offer prime habitat compared to other portions of the island                                                                                                                                                                                                              |
| <b>Solitude or Primitive and Unconfined Recreation</b> | Remoteness from modified and occupied areas outside the wilderness | Seasonal Viewshed                     | At this point in time, there are two possible seasonal features in the bay: blinds and crab floats. It was determined that crab floats are not visible in the viewshed. There is no current knowledge of which blinds are seasonal. If this is determined these temporary blinds will be accounted of the permanent viewshed but will receive a lesser weight (the fraction of the year it occupies the viewshed).                                                                 |
| <b>Solitude or Primitive and Unconfined Recreation</b> | Remoteness from sights and sounds of people inside the wilderness  | Number of Hunters in Wilderness Zones | Hunters may choose to hunt in zones that are within the wilderness in order to have a solitude experience. This measure attempted to quantify the number of hunters per zone, however, data was not available on the number of hunters in each zone per day. Management does not intend to reduce the number of hunters in the wilderness nor discourage hunters from accessing the wilderness. The measure therefore would be sporadic and not experience administrative actions. |

## Section 6. Issues and Conclusion

The 2012 wilderness character baseline assessment designed 35 measures to be monitored into the future. Three measures are under development and should be incorporated by the next monitoring period. If new technologies make more sophisticated and precise measures possible, these measures may be revised.

The completed measures, and those soon to be implemented, comprehensively represent trends in the five wilderness character qualities. Tracking these measures over time will indicate whether the wilderness remains stable, improves, or degrades. Given that some measures may be more variable than others, management on ASIS and CNWR may target certain measures for improvement or address measures that continually face challenges.

One issue of environmental concern is that the barrier island may undergo significant alterations from future climate change. There may be pressures for dramatic intervention to preserve the island at a certain state. When deciding on how to treat the barrier island dynamics, consideration should also be given to wilderness character.

In Maryland, it is currently permissible for permit-holders to access the wilderness on OSVs, yet, a minimal number of motorized vehicles best represents primitive recreation. OSV usage can be a contentious issue. As mentioned in the ASIS General Management Plan update, "OSVs are the greatest obstacle to public acceptance of wilderness designation and the most serious impact to wilderness character." When considering the alternatives to the present OSV access, the impact they have on wilderness character should hopefully be reflected in the designed wilderness measures.

A ranking of Good, Caution, Poor or Unknown described the condition for each measure in 2012. While many of the measures are in good condition, a few measures are in danger of becoming poor. For these measures, which include authorized actions, authorized developments and authorized motorize vehicles, Minimum Requirement Analysis may guide which management alternatives are most appropriate in the wilderness.

This baseline assessment may serve as a tool to develop awareness of the proposed wilderness and key features within it. Staff can communicate to the public the state of the wilderness and the opportunities they have to experience it. Additionally, because the proposed Assateague Island wilderness is managed by both USFWS and NPS, there is the opportunity to coordinate management approaches so that this area is treated as one wilderness. As it stands, actions taken on one side of the state line may affect the experiences visitors may have on the other side.

In sum, the developed wilderness measures encompass wilderness character for the proposed Assateague Island wilderness. Commitment to monitoring these measures will track wilderness status. This can then inform management plans and encourage public appreciation for the wilderness.

## Appendix A. Wilderness Act

**WILDERNESS ACT**  
**Public Law 88-577 (16 U.S. C. 1131-1136)**  
**88<sup>th</sup> Congress, Second Session**  
**September 3, 1964**  
**AN ACT**

**To establish a National Wilderness Preservation System for the permanent good of the whole people, and for other purposes.**

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.

**Short Title**

**Section 1.** This Act may be cited as the "Wilderness Act."

**WILDERNESS SYSTEM ESTABLISHED STATEMENT OF POLICY**

**Section 2.(a)** In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness. For this purpose there is hereby established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas", and these shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness; and no Federal lands shall be designated as "wilderness areas" except as provided for in this Act or by a subsequent Act.

**(b)** The inclusion of an area in the National Wilderness Preservation System notwithstanding, the area shall continue to be managed by the Department and agency having jurisdiction thereover immediately before its inclusion in the National Wilderness Preservation System unless otherwise provided by Act of Congress. No appropriation shall be available for the payment of expenses or salaries for the administration of the National Wilderness Preservation System as a separate unit nor shall any appropriations be available for additional personnel stated as being required solely for the purpose of managing or administering areas solely because they are included within the National Wilderness Preservation System.

**DEFINITION OF WILDERNESS**

**(c)** A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

**NATIONAL WILDERNESS PRESERVATION SYSTEM - EXTENT OF SYSTEM**

**Section 3.(a)** All areas within the national forests classified at least 30 days before September 3, 1964 by the Secretary of Agriculture or the Chief of the Forest Service as "wilderness", "wild", or "canoe" are hereby designated as wilderness areas. The Secretary of Agriculture shall - **(1)** Within one year after September 3, 1964, file a map and legal description of each wilderness area with the Interior and Insular Affairs Committees of the United States Senate and the House of Representatives, and such descriptions shall have the same force and effect as if included in this Act: Provided, however, That correction of clerical and typographical errors in such legal descriptions and maps may be made.

**(2)** Maintain, available to the public, records pertaining to said wilderness areas, including maps and legal descriptions, copies of regulations governing them, copies of public notices of, and reports submitted to Congress regarding pending additions, eliminations, or modifications. Maps, legal descriptions, and regulations pertaining to wilderness areas within their respective jurisdictions also shall be available to the public in the offices of regional foresters, national forest supervisors, and forest rangers.

**Classification. (b)** The Secretary of Agriculture shall, within ten years after September 3, 1964, review, as to its suitability or nonsuitability for preservation as wilderness, each area in the national forests classified on September 3, 1964 by the Secretary of Agriculture or the Chief of the Forest Service as "primitive" and report his findings to the President.

**Presidential recommendation to Congress.** The President shall advise the United States Senate and House of Representatives of his recommendations with respect to the designation as "wilderness" or other reclassification of each area on which review has been completed, together with maps and a definition of boundaries. Such advice shall be given with respect to not less than one-third of all the areas now classified as "primitive" within three years after September 3, 1964, not less than two-thirds within seven years after September 3, 1964, and the remaining areas within ten years after September 3, 1964.

**Congressional approval.** Each recommendation of the President for designation as "wilderness" shall become effective only if so provided by an Act of Congress. Areas classified as "primitive" on September 3, 1964 shall continue to be administered under the rules and regulations affecting such areas on September 3, 1964 until Congress has determined otherwise. Any such area may be increased in size by the President at the time he submits his recommendations to the Congress by not more than five thousand acres with no more than one thousand two hundred and eighty acres of such increase in any one compact unit; if it is proposed to increase the size of any such area by more than five thousand acres or by more than one thousand two hundred and eighty acres in any one compact unit the increase in size shall not become effective until acted upon by Congress. Nothing herein contained shall limit the President in proposing, as part of his recommendations to Congress, the alteration of existing boundaries of primitive areas or recommending the addition of any contiguous area of national forest lands predominantly of wilderness value. Notwithstanding any other provisions of this Act, the Secretary of Agriculture may complete his review and delete such area as may be necessary, but not to exceed seven thousand acres, from the southern tip of the Gore Range-Eagles Nest Primitive Area, Colorado, if the Secretary determines that such action is in the public interest.

**Report to President. (c)** Within ten years after September 3, 1964 the Secretary of the Interior shall review every roadless area of five thousand contiguous acres or more in the national parks, monuments and other units of the national park system and every such area of, and every roadless island within the national wildlife refuges and game ranges, under his jurisdiction on September 3, 1964 and shall report to the President his recommendation as to the suitability or nonsuitability of each such area or island for preservation as wilderness.

**Presidential recommendation to Congress.** The President shall advise the President of the Senate and the Speaker of the House of Representatives of his recommendation with respect to the designation as wilderness of each such area or island on which review has been completed, together with a map thereof and a definition of its boundaries. Such advice shall be given with respect to not less than one-third of the areas and islands to be reviewed under this subsection within three years after September 3, 1964, not less than two-thirds within seven years of September 3, 1964 and the remainder within ten years of September 3, 1964.

**Congressional approval.** A recommendation of the President for designation as wilderness shall become effective only if so provided by an Act of Congress. Nothing contained herein shall, by implication or otherwise, be construed to lessen the present statutory authority of the Secretary of the Interior with respect to the maintenance of roadless areas within units of the national park system.

**Suitability. (d)(1)** The Secretary of Agriculture and the Secretary of the Interior shall, prior to submitting any recommendations to the President with respect to the suitability of any area for preservation as wilderness –

**Publication in Federal Register. (A)** give such public notice of the proposed action as they deem appropriate, including publication in the Federal Register and in a newspaper having general circulation in the area or areas in the vicinity of the affected land;

**Hearings. (B)** hold a public hearing or hearings at a location or locations convenient to the area affected. The hearings shall be announced through such means as the respective Secretaries involved deem appropriate, including notices in the Federal Register and in newspapers of general circulation in the area: Provided, That if the lands involved are located in more than one State, at least one hearing shall be held in each State in which a portion of the land lies;

**(C)** at least thirty days before the date of a hearing advise the Governor of each State and the governing board of each county, or in Alaska the borough, in which the lands are located, and Federal departments and agencies concerned, and invite such officials and Federal agencies to submit their views on the proposed action at the hearing or by no later than thirty days following the date of the hearing.

Any views submitted to the appropriate Secretary under the provisions of (1) of this subsection with respect to any area shall be included with any recommendations to the President and to Congress with respect to such area.

**Proposed modification. (e)** Any modification or adjustment of boundaries of any wilderness area shall be recommended by the appropriate Secretary after public notice of such proposal and public hearing or hearings as provided in subsection (d) of this section. The proposed modification or adjustment shall then be recommended with map and description thereof to the President. The President shall advise the United States Senate and the House of Representatives of his recommendations with respect to such modification or adjustment and such recommendations shall become effective only in the same manner as provided for in subsections (b) and (c) of this section.

#### **USE OF WILDERNESS AREAS**

**Section 4.(a)** The purposes of this Act are hereby declared to be within and supplemental to the purposes for which national forests and units of the national park and national wildlife refuge systems are established and administered and -

**(1)** Nothing in this Act shall be deemed to be in interference with the purpose for which national forests are established as set forth in the Act of June 4, 1897 (30 Stat. 11), and the Multiple-Use Sustained-Yield Act of June 12, 1960 (74 Stat. 215) (16 U.S.C. 528-531).

**(2)** Nothing in this Act shall modify the restrictions and provisions of the Shipstead-Nolan Act (Public Law 539, Seventy-first Congress, July 10, 1930; 46 Stat. 1020), the Thye–Blatnik Act (Public Law 733, Eightieth Congress, June 22, 1948; 62 Stat. 568), and the Humphrey-Thye-Blatnik-Andresen Act (Public Law 607, Eighty-Fourth Congress, June 22, 1956; 70 Stat. 326), as applying to the Superior National Forest or the regulations of the Secretary of Agriculture.

**(3)** Nothing in this Act shall modify the statutory authority under which units of the national park system are created. Further, the designation of any area of any park, monument, or other unit of the national park system as a wilderness area pursuant to this Act shall in no manner lower the standards evolved for the use and preservation of such park, monument, or other unit of the national park system in accordance with sections 1, 2, 3, and 4 of this title, the statutory authority under which the area was created, or any other Act of Congress which might pertain to or affect such area, including, but not limited to, the Act of June 8, 1906 (34 Stat. 225; 16 U.S.C. 432 et seq.); section 3(2) of the Federal Power Act (16 U.S.C. 796(2)); and the Act of August 21, 1935 (49 Stat. 666; 16 U.S.C. 461 et seq.).

**(b)** Except as otherwise provided in this Act, each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character. Except as otherwise provided in this Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use.

#### **PROHIBITION OF CERTAIN USES**

**(c)** Except as specifically provided for in this Act, and subject to existing private rights, there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and, except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.

#### **SPECIAL PROVISIONS**

**(d)** The following special provisions are hereby made:

**(1)** Within wilderness areas designated by this Act the use of aircraft or motorboats, where these uses have already become established, may be permitted to continue subject to such restrictions as the Secretary of Agriculture deems desirable. In addition, such measures may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable.

**(2)** Nothing in this Act shall prevent within national forest wilderness areas any activity, including prospecting, for the purpose of gathering information about mineral or other resources, if such activity is carried on in a manner compatible with the preservation of the wilderness environment. Furthermore, in accordance with such program as the Secretary of the Interior shall develop and conduct in consultation with the Secretary of Agriculture, such areas shall be surveyed on a planned, recurring basis consistent with the concept of wilderness preservation by the United States Geological Survey and the United States Bureau of Mines to determine the mineral values, if any, that may be present; and the results of such surveys shall be made available to the public and submitted to the President and Congress.

**Mineral leases, claims, etc. (3)** Notwithstanding any other provisions of this Act, until midnight December 31, 1983, the United States mining laws and all laws pertaining to mineral leasing shall, to the extent as applicable prior to September 3, 1964, extend to those national forest lands designated by this Act as "wilderness areas"; subject, however, to such reasonable regulations governing ingress and egress as may be prescribed by the Secretary of Agriculture consistent with the use of the land for mineral location and development and exploration, drilling, and production, and use of land for transmission lines, waterlines, telephone lines, or facilities necessary in exploring, drilling, producing, mining, and processing operations, including where essential the use of mechanized ground or air equipment and restoration as near as practicable of the surface of the land disturbed in performing prospecting, location, and , in oil and gas leasing, discovery work, exploration, drilling, and production, as soon as they have served their purpose. Mining locations lying within the boundaries of said wilderness areas shall be held and used solely for mining or processing operations and uses reasonably incident thereto; and hereafter, subject to valid existing rights, all patents issued under the mining laws of the United States affecting national forest lands designated by this Act as wilderness areas shall convey title to the mineral deposits within the claim, together with the right to cut and use so much of the mature timber therefrom as may be needed in the extraction, removal, and beneficiation of the mineral deposits, if needed timber is not otherwise reasonably available, and if the timber is cut under sound principles of forest management as defined by the national forest rules and regulations, but each such patent shall reserve to the United States all title in or to the surface of the lands and products thereof, and no use of the surface of the claim or the resources therefrom not reasonably required for carrying on mining or prospecting shall be allowed except as otherwise expressly provided in this Act: Provided, That, unless hereafter specifically authorized, no patent

within wilderness areas designated by this Act shall issue after December 31, 1983, except for the valid claims existing on or before December 31, 1983. Mining claims located after September 3, 1964, within the boundaries of wilderness areas designated by this Act shall create no rights in excess of those rights which may be patented under the provisions of this subsection. Mineral leases, permits, and licenses covering lands within national forest wilderness areas designated by this Act shall contain such reasonable stipulations as may **32**

## Appendix B. Worksheet to Prioritize Measures

*In each row, write the indicator and potential measure in the left column. Use the following criteria and ranking guide to create an overall score for each measure. Those measures with the highest overall scores should be the highest priority for assessing trends in wilderness character.*

**A.** Level of importance (the measure is highly relevant to the quality and indicator of wilderness character, and is highly useful for managing the wilderness):

High = 3 points, Medium = 2 points, Low = 1 point

**B.** Level of vulnerability (measures an attribute of wilderness character that currently is at risk, or might likely be at risk over 10-15 years):

High = 3 points, Medium = 2 points, Low = 1 point

**C.** Degree of reliability (the measure can be monitored accurately with a high degree of confidence, and would yield the same result if measured by different people at different times):

High = 3 points, Medium = 2 points, Low = 1 point

**D.** Degree of reasonableness (the measure is related to an existing effort or could be monitored without significant additional effort):

High = 1 point, Low = 0 point

| Criteria for Prioritizing Potential Measures                                                                                                       |                                                                                                                                                |                                                                                                                                                                                  |                                                                                                                                                           |                                                                                                                                   |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                                                  | A. Importance                                                                                                                                  | B. Vulnerability                                                                                                                                                                 | C. Reliability                                                                                                                                            | D. Reasonableness                                                                                                                 | OVERALL SCORE |
| Indicator: Plant and animal species and communities<br><br>Measure: Composition of habitat types                                                   | 2 –<br><br>Diversity does not influence wilderness character. Further discussion (possibly lower)                                              | 2- Habitat areas will likely change but may not be significant (uncertainty esp of storms)                                                                                       | 3- If the protocol clearly specifies what habitat the land will fall under, this subjective determination can easily be duplicated in the GIS calculation | 0- This measure may have a fairly easy determination system, but requires time to classify in GIS, which has not been done before | 7             |
| Indicator: Plant and animal species and communities<br><br>Measure: Population dynamics of selected non-native plant species (phragmites and CAKO) | 3- Invasive, non-native plant species have the potential to dominant ecosystems and reduce biodiversity of indigenous species                  | 3- Unless invasives are managed for, their coverage may spread significantly                                                                                                     | 3-Protocols for invasive coverage are in place/ in development that involve ground surveying and GIS determination                                        | 1- Surveys already in place for monoculture stands only                                                                           | 10            |
| Indicator: Plant and animal species and communities<br><br>Measure: Population dynamics of wild horses                                             | 3- Current horse population is a severe detriment to natural barrier island ecosystems. Differentiate between Maryland (suite of wildlife) and | 2- Horses have been under an effective population management strategy for years, and not likely to explode (may be politically harder to reduce herd, if suspected it is now too | 3- Horse populations are closely monitored                                                                                                                | 1- Horse populations are currently being monitored islandwide (but not wilderness                                                 | 9             |

| Criteria for Prioritizing Potential Measures                                                            |                                                                                                                                                  |                                                                                                                                  |                                                                                                                                 |                                                                  |               |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|---------------|
| Potential Measure                                                                                       | A. Importance                                                                                                                                    | B. Vulnerability                                                                                                                 | C. Reliability                                                                                                                  | D. Reasonableness                                                | OVERALL SCORE |
|                                                                                                         | Virginia herd (exotic).                                                                                                                          | high). Would become low vulnerability if we reduce herd or remove from certain areas. (There is room for improvement).           |                                                                                                                                 | specific)                                                        |               |
| Indicator: Plant and animal species and communities<br>Measure: Population dynamics of Sika Deer        | 3- Sika have high population numbers and stress certain habitats                                                                                 | 3-Sika may be outcompeting white-tail deer and are already inhabiting the salt marsh. Hunting is a population control mechanism. | 1- Sika harvest may provide some estimate of population trends, but catch can be influenced by factors besides size.            | 1- Use of data that is already being collected                   | 8             |
| Indicator: Plant and animal species and communities<br>Measure: Number of extirpated indigenous species | 3- An extirpation is a significant event and may indicate a disruption of a functional ecosystem (unless evolutionary decline or climate change) | 2- No suspected imminent extirpations                                                                                            | 2- Professional judgment would be informed by inventories, but always a hard call to make if a species is completely extirpated | 1- Professional judgement does not require additional monitoring | 8             |
| Indicator: Physical Resources                                                                           | Monitored at a national level                                                                                                                    |                                                                                                                                  |                                                                                                                                 |                                                                  | High          |

| Criteria for Prioritizing Potential Measures                                                                                                                         |               |                  |                               |                   | OVERALL SCORE |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|-------------------------------|-------------------|---------------|
| Potential Measure                                                                                                                                                    | A. Importance | B. Vulnerability | C. Reliability                | D. Reasonableness |               |
| Measure: Visibility based on average deciview and sum of anthropogenic fine nitrate and sulfate                                                                      |               |                  |                               |                   |               |
| Indicator: Physical Resources<br><br>Measure: Ozone air pollution based on concentration of N100 episodic and W126 chronic ozone exposure affecting sensitive plants |               |                  | Monitored at a national level |                   | High          |
| Indicator: Physical Resources<br><br>Measure: Acid deposition based on concentration of sulfur and nitrogen in wet deposition                                        |               |                  | Monitored at a national level |                   | High          |

| Criteria for Prioritizing Potential Measures                           |                                                                             |                                                                                                        |                                                                                 |                                                                |               |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------|---------------|
| Potential Measure                                                      | A. Importance                                                               | B. Vulnerability                                                                                       | C. Reliability                                                                  | D. Reasonableness                                              | OVERALL SCORE |
| Indicator: Biophysical Processes<br>Measure: Salt Marsh Integrity      | 3- Salt Marshes are very productive ecosystems                              | 3- Salt marshes face multiple threats                                                                  | 3- These are established protocols in the FWS Region 5. Led by Susan Adamowicz. | 1- Protocols in development                                    | 10            |
| Indicator: Biophysical Processes<br>Measure: Mean Sea Level Rise       | 3- Sea level rise is a major influence on island dynamics                   | 2-Sea level will likely rise although there is uncertainty about the amount or the effects             | 2- Taken from NOAA but data not collected on site                               | 1-Data retrieved from outside source, not internal monitoring  | 8             |
| Indicator: Biophysical Processes<br>Measure: Subsidence Rate           | 3- Subsidence is a contributing factor when calculating sea level rise.     | 3-Subsidence is occurring faster than sea level rise.                                                  | 3-Established protocol and measures                                             | 1-Already being monitored                                      | 10            |
| Indicator: Biophysical Processes<br>Measure: Frequency of storm events | 3- Storm events are major influences on island habitats and system dynamics | 3-Uncertainty as well as randomness of whether storm events will occur. High suspicion of more storms. | 3-Taken from NOAA                                                               | 1- Data retrieved from outside source, not internal monitoring | 10            |
| Indicator: Biophysical                                                 | 3- Measure considers island as a whole and                                  | 1-Not sure if a major enough change will alter                                                         | 3-Accurate                                                                      | 1-Simple GIS                                                   | 8             |

| Criteria for Prioritizing Potential Measures                                                                                                                                                       |                                        |                                                                                                                                 |                                                                                                                                     |                                          |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------|
| Potential Measure                                                                                                                                                                                  | A. Importance                          | B. Vulnerability                                                                                                                | C. Reliability                                                                                                                      | D. Reasonableness                        | OVERALL SCORE |
| Processes<br><br>Measure: Volume of Sand on Island                                                                                                                                                 | whether it has been reduced or growing | island in next 10-15 years                                                                                                      | measurements in GIS                                                                                                                 | calculation                              |               |
| Indicator: Actions authorized by the Federal land manager that manipulates biophysical the environment<br><br>Measure: Number of actions to manage plants, animals, pathogens, soil, water or fire | 3-Directly relevant to the indicator   | 3-Actions likely to vary from year to year, and can potentially managed to reduce/minimize                                      | 2-Actions may be estimated rather than detailed recording. Some actions likely to be missed. (Can keep better track after baseline) | 1-Time only necessary to record actions  | 9             |
| Indicator: Actions authorized by the Federal land manager that manipulates the biophysical environment<br><br>Measure: Actions used to maintain dunes                                              | 3-Directly relevant to the indicator   | 2-Dunes are not intended to be maintained so any actions would be a major event. Could be told to build them again by Congress. | 3- Since dune maintenance is rare, it should be easy to keep track of                                                               | 1 –Time only necessary to record actions | 9             |

| Criteria for Prioritizing Potential Measures                                                                                                                                                                                                  |                                       |                                                                         |                                                                                                                                            |                                                                  |               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                                                                                                                                             | A. Importance                         | B. Vulnerability                                                        | C. Reliability                                                                                                                             | D. Reasonableness                                                | OVERALL SCORE |
| <p>Indicator: Actions authorized by Federal land manager that manipulates the biophysical environment</p> <p>Measure: Action to Control Fire</p>                                                                                              | 3- Directly relevant to the indicator | 1- Fire is an infrequent event                                          | 3-Since fire is infrequent, it should be easy to keep track of                                                                             | 1-Time only necessary to record actions                          | 9             |
| <p>Indicator: Actions not authorized by the Federal land manager that manipulate the biophysical environment</p> <p>Measure: Number of unauthorized actions to manipulate plant, wildlife, insects, fish, pathogens, soil, water, or fire</p> | 3-Directly relevant to the indicator  | 2-Not suspected that many unauthorized actions occur                    | 2-Impossible to monitor or patrol all unauthorized actions. Must make estimations (although there could be high confidence in estimations) | 1-Time only necessary to make estimations                        | 8             |
| <p>Indicator: Non-recreational structures, installations, and developments</p> <p>Measure: Index of authorized physical</p>                                                                                                                   | 3-Directly relevant to indicator      | 2-Not anticipating addition of many physical features. May remove some. | 3-Should be possible to track all physical features                                                                                        | 1-Initial research may take time, if features not already mapped | 9             |

| Criteria for Prioritizing Potential Measures                                                                                                                  |                                  |                                                                                                           |                                                                                     |                                                                                          |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                                                             | A. Importance                    | B. Vulnerability                                                                                          | C. Reliability                                                                      | D. Reasonableness                                                                        | OVERALL SCORE |
| structures, installations, or developments                                                                                                                    |                                  |                                                                                                           |                                                                                     |                                                                                          |               |
| Indicator: Non-recreational structures, installations, and developments<br>Measure: Length of active roads and fence                                          | 3-Directly relevant to indicator | 2-Not anticipating addition of many physical features.                                                    | 3-Should be possible to track all physical features                                 | 1-Roads mapped, fences accounted for                                                     | 9             |
| Indicator: Non-recreational structures, installations, and developments<br>Measure: Index of unauthorized physical structures, installations, or developments | 3-Directly relevant to indicator | 2-Not anticipating major change in unauthorized habits                                                    | 2-Unless visible on Google Earth, harder to survey on-the-ground.                   | 0-Research required about any additional features that are likely unreported             | 7             |
| Indicator: Non-recreational structures, installations, and developments<br>Measure: Index of abandoned structures                                             | 3-Directly relevant to indicator | 2-Abandoned structures should be stable unless removed, decomposed, or active structures become abandoned | 3-Should be mostly aware of abandoned structures as they've been present for awhile | 0-Initial inventory must be made for unmapped structures and determination of when to be | 8             |

| Criteria for Prioritizing Potential Measures                                                                                 |                                  |                                                                                                           |                                                                          |                                                                     |               |
|------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                            | A. Importance                    | B. Vulnerability                                                                                          | C. Reliability                                                           | D. Reasonableness                                                   | OVERALL SCORE |
|                                                                                                                              |                                  |                                                                                                           |                                                                          | decomposed.<br>Future tracking<br>should take less<br>time.         |               |
| Indicator: Non-recreational structures, installations, and developments<br><br>Measure: Length of abandoned roads and fences | 3-Directly relevant to indicator | 2-Abandoned structures should be stable unless removed, decomposed, or active structures become abandoned | 3-Should be mostly aware of abandoned structures                         | 1-Old roads are mapped                                              | 9             |
| Indicator: Inholdings<br><br>Measure: Index of inholdings with wilderness                                                    | 1-Does not pertain to us         | 1-No inholdings now or in unforeseeable future                                                            | 3-Easily tracked                                                         | 1-Easily tracked                                                    | 6             |
| Indicator: Inholdings<br><br>Measure: Miles of road associated with inholdings                                               | 1-Does not pertain to us         | 1-No inholding roads now or in foreseeable future                                                         | 3-Easily tracked                                                         | 1-Easily tracked                                                    | 6             |
| Indicator: Use of motor vehicles, motorized equipment, and                                                                   | 3-Directly relevant to indicator | 3-Variable amount of motorized/mechanical uses. OSV use a management issue.                               | 2-Try to estimate usage based on activity. Difficult to track all usage, | 0-Should use existing data of planned activities, but requires time | 8             |

| Criteria for Prioritizing Potential Measures                                                                                                                                                                                                         |                                                  |                                                                                    |                                                                                                                  |                                                                       |               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                                                                                                                                                    | A. Importance                                    | B. Vulnerability                                                                   | C. Reliability                                                                                                   | D. Reasonableness                                                     | OVERALL SCORE |
| mechanical transport<br><br>Measure: Type and amount of administrative use of motor vehicles, motorized equipment, or mechanical transport                                                                                                           |                                                  | Multiple pressures applied to usage or not                                         | especially unplanned trips.                                                                                      | for organization, interviews, and brainstorming                       |               |
| Indicator: Use of motor vehicles, motorized equipment, and mechanical transport<br><br>Measure: Type and amount of administrative use of motor vehicles, motorized equipment, or mechanical transport use not authorized by the Federal land manager | 3-Directly relevant to indicator                 | 2-Authorized use occurs more often than unauthorized.                              | 2-Difficult to track all usage. Estimations not as accurate as detailed recordings, but may show high confidence | 1-Time spent on estimations. Use best judgment and known occurrences. | 8             |
| Indicator: Remoteness from sights and sounds of people inside the                                                                                                                                                                                    | 3- OSV route is having significant effect on the | 3- OSV boundary may change which will produce a significant effect on the measure. | 3-Simple GIS calculation                                                                                         | 1-Simple GIS calculation                                              | 10            |

| Criteria for Prioritizing Potential Measures                                                                        |                                                                                             |                                               |                                                  |                                                                                      |               |
|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                   | A. Importance                                                                               | B. Vulnerability                              | C. Reliability                                   | D. Reasonableness                                                                    | OVERALL SCORE |
| wilderness<br><br>Measure: Percent of wilderness affected by access or travel routes inside the wilderness          | wilderness.                                                                                 | to                                            |                                                  |                                                                                      |               |
| Indicator: Remoteness from sights and sounds of people inside the wilderness<br><br>Measure: Hunter use in Virginia | 2-Hunters make up just one type of visitor. Currently low hunter density in zones 8,9, & 10 | 1-No anticipated change in hunter density     | 3-Easy to track hunters in CNWR wilderness zones | 1-Data available                                                                     | 7             |
| Indicator: Remoteness from occupied and modified areas outside the wilderness<br><br>Measure: Permanent Viewshed    | 2-Viewshed should influence only the perimeter of wilderness                                | 1-Not expecting rapid development in viewshed | 3-Easy to track                                  | 1-Will require a reevaluation every five years, but additions shouldn't be too high. | 7             |

| Criteria for Prioritizing Potential Measures                                                                                                                                   |                                                                              |                                                                        |                                                                                                  |                                                                       |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                                                                              | A. Importance                                                                | B. Vulnerability                                                       | C. Reliability                                                                                   | D. Reasonableness                                                     | OVERALL SCORE |
| Indicator: Remoteness from occupied and modified areas outside the wilderness<br><br>Measure: Seasonal Viewshed                                                                | 2-Viewshed should influence only perimeter of wilderness                     | 1-Not expecting significant change in seasonal structures              | 2-Requires more vigilant monitoring at different times of year                                   | 0-Requires tracking of whole year of probably unauthorized structures | 5             |
| Indicator: Remoteness from occupied and modified areas outside the wilderness<br><br>Measure: Temporary Viewshed                                                               | 2-Viewshed will mostly influence perimeter (boats) and aircrafts fairly rare | 2-Motorboats and aircrafts usage may change. More variable.            | 2-Protocol is consistent, but only a sample once every five years at limited locations and times | 1-Will require limited monitoring every five years                    | 7             |
| Indicator: Remoteness from occupied and modified areas outside the wilderness<br><br>Measure: Percent of wilderness affected by access or travel routes outside the wilderness | 3- OSV usage may significantly affect feeling of remoteness                  | 3-Likely that OSV boundary may be considered outside of the wilderness | 3-Simple GIS calculation                                                                         | 1-Simple GIS calculation                                              | 10            |

| Criteria for Prioritizing Potential Measures                                                                      |                                |                                                                                                                                                                           |                                                                          |                                                                                              |               |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------|
| Potential Measure                                                                                                 | A. Importance                  | B. Vulnerability                                                                                                                                                          | C. Reliability                                                           | D. Reasonableness                                                                            | OVERALL SCORE |
| Indicator: Facilities that decrease self-reliant recreation<br><br>Measure: Agency-provided recreation facilities | 3-Directly relevant to measure | 1-No anticipated additional facilities or removal of facilities, but new access points and distribution of trails/roads, safety/personal facilities, staff infrastructure | 3-Easy to keep track of                                                  | 1-Retrieved from already available data                                                      | 9             |
| Indicator: Facilities that decrease self-reliant recreation<br><br>Measure: User-created recreation facilities    | 3-Directly relevant to measure | 2-May change more so than provided facilities                                                                                                                             | 2-Hard to be fully aware of any user created facilities (hunting blinds) | 0-Will require review each five years                                                        | 7             |
| Indicator: Facilities that decrease self-reliant recreation<br><br>Measure: Abandoned recreational structures     | 3-Directly relevant to measure | 1-No anticipated additional facilities, may degrade over time.                                                                                                            | 3-Easy to keep track of because they're more persistent                  | 1-Should have data of agency facilities abandoned. Harder to monitor user created abandoned. | 8             |
| Indicator: Management restrictions on visitor                                                                     | 3-Directly relevant to         | 1-Policies are mostly set                                                                                                                                                 | 3-Staff determinations.                                                  | 1- already available                                                                         | 9             |

| Criteria for Prioritizing Potential Measures                                                                                                         |                                |                                         |                                                                    |                                                 |               |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------------------------|--------------------------------------------------------------------|-------------------------------------------------|---------------|
| Potential Measure                                                                                                                                    | A. Importance                  | B. Vulnerability                        | C. Reliability                                                     | D. Reasonableness                               | OVERALL SCORE |
| behavior<br>Measure: Type of management restrictions                                                                                                 | measure                        | in place                                | Should be documented                                               | data                                            |               |
| Indicator: Management restrictions on visitor behavior<br>Measure: Percent of area restricted                                                        | 3-Directly relevant to measure | 1-Policies are mostly set in place      | 3-Staff determinations.                                            | 1-Already available data. Requires calculation. | 9             |
| Indicator: Deterioration or loss of cultural resources integral to wilderness character<br>Measure: Number of actions that affect cultural resources | 3-Directly relevant to measure | 1-Minimal activities on cultural sights | 2-Hard to track unauthorized activities, but smaller area to track | 1-Will be based on of known occurrences         | 7             |

Names of team members filling out this worksheet:

- Taryn Sudol
- Kevin Holcomb
- Jack Kumer

## Appendix C. Summary of Measures

| Measure                                                             | Priority (H, M, or L) | Detailed Description of the Data Source(s) and How the Data Were Gathered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Natural</b>                                                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>1.1 Population dynamics of selected non-native plant species</b> | H                     | <i>Source:</i> Internal survey documents and professional judgment<br><i>Protocol:</i> A list is compiled for selected non-native plant species. Scouting and vegetative surveys provide the acreage occupied for the selected non-native plants. This is limited to monotypic stands rather than interspersed species. The total measure will be the sum of each specie's "Percent of acreage occupied" score. See measure 1.2 for acreage occupied score.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>1.2 Population dynamics of non-native wild horses</b>            | H                     | <i>Source:</i> Internal records –Bill Hulslander, Kim Halpin<br><i>Protocol:</i> The adult horse population (including foals bought back during the Chincoteague Volunteer Fire Company (CVFC auction) for the entire island (herds in both Assateague NS and Chincoteague NWR except the CNWR southern herd which does not have wilderness access) will serve as a surrogate measure for the horses' wilderness presence. These horses have access to large parts of the island including the wilderness area. ASIS monitors their horse population through routine surveys and manages their population through a fertility control program, while the CVFC keeps a number of the CNWR herds. Of the total horse population in CNWR, about two-thirds reside in the North herd which has access to the wilderness. This number may change as horses are transferred from one herd to the other. |
| <b>1.3 Population dynamics of non-native sika deer</b>              | M                     | <i>Source:</i> Distance sampling data, Mark Sturm, professional judgment, Jack Kumer<br><i>Protocol:</i> ASIS has four years of distance sampling data that is able to provide an estimated range for the Sika population as part of a study on ungulate grazing effects on vegetation by Mark Sturm. In the future, ASIS hopes to have new technology or population density methods so that the distance sampling technique does not have to be repeated but will provide comparable statistical results.                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>1.4 Number of extirpated indigenous species</b>                  | M                     | <i>Source:</i> Internal survey documents and professional judgment, Kevin Holcomb, Jack Kumer<br><i>Protocol:</i> Based off an inventory of flora and fauna and professional judgment, a count is maintained of any indigenous species no longer believed to be present on the island within the past five years.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>1.5 Visibility</b>                                               | H                     | <i>Source:</i> USFWS National Air Quality Office<br><i>Protocol:</i> To evaluate the condition of each indicator we used all available monitoring data (from NPS, EPA, FS, FWS, state, tribal, and local monitors) to generate interpolations, averaged over five years, to derive estimates of air quality at NPS and FWS units located within the continental United States. Estimates for NPS areas are available at <a href="http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm">http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm</a> . Estimates for FWS areas are available from the NPS Air Resources Division (contact <a href="mailto:ellen_porter@nps.gov">ellen_porter@nps.gov</a> ).                                                                                                                                                                            |
| <b>1.6 Ozone air</b>                                                | H                     | <i>Source:</i> USFWS National Air Quality Office                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                                                                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>pollution</b>                                                                  |   | <i>Protocol:</i> To evaluate the condition of each indicator we used all available monitoring data (from NPS, EPA, FS, FWS, state, tribal, and local monitors) to generate interpolations, averaged over five years, to derive estimates of air quality at NPS and FWS units located within the continental United States. Estimates for NPS areas are available at <a href="http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm">http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm</a> . Estimates for FWS areas are available from the NPS Air Resources Division (contact <a href="mailto:ellen_porter@nps.gov">ellen_porter@nps.gov</a> ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>1.7 Total Nitrogen and Total Sulfur Deposition</b>                             | H | <i>Source:</i> USFWS National Air Quality Office<br><i>Protocol:</i> To evaluate the condition of each indicator we used all available monitoring data (from NPS, EPA, FS, FWS, state, tribal, and local monitors) to generate interpolations, averaged over five years, to derive estimates of air quality at NPS and FWS units located within the continental United States. Estimates for NPS areas are available at <a href="http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm">http://www.nature.nps.gov/air/Maps/AirAtlas/IM_materials.cfm</a> . Estimates for FWS areas are available from the NPS Air Resources Division (contact <a href="mailto:ellen_porter@nps.gov">ellen_porter@nps.gov</a> ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>1.8 Mean Sea Level Rise</b>                                                    | M | <i>Source:</i> NOAA Mean Sea Level Trend, Ocean City Inlet, MD<br><a href="http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8570283">http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8570283</a><br><i>Protocol:</i> The mean sea level trend and a plot (from 1900 to 2010) shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. This data is taken from NOAA Tides and Currents at the Ocean City Inlet, MD, which is the nearest station to Assateague Island.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>1.9 Significance of storm events</b>                                           | H | <i>Source:</i> Hurricanes/Tropical Storms/Tropical Depressions are logged at NOAA Historical Hurricane Tracks <a href="http://csc.noaa.gov/hurricanes/index.html">http://csc.noaa.gov/hurricanes/index.html</a> and Nor'easters are logged at National Weather Service Forecast Office: Wakefield VA <a href="http://www.erh.noaa.gov/er/akq/EREVIEW.php">http://www.erh.noaa.gov/er/akq/EREVIEW.php</a><br><i>Protocol:</i> Hurricane/Tropical Storms/Tropical Depressions are recorded at NOAA's website above. Locations, Chinoteague and ASIS, are entered in and the storm events are recorded for the five year monitoring period or annually. To learn about Nor'easters go to the National Weather Service Forecast Office for Wakefield VA and see if any Historical Winter Storm Graphics/Events are labeled as Nor'easters in the drop down menu. If so, check the Nor'easter data to make sure it affected the ASIS/CNWR wilderness. As monitoring continues, other weather events that appear to have significantly affected the landscape can be included in this measure so long as it is confirmed and titled consistently with NOAA or the Wakefield Forecast Office. |
| <b>Untrammelled</b>                                                               |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>2.1 Number of actions to manage plants, animals, pathogens, soil, water or</b> | H | <i>Source:</i> Internal staff inventory of actions: Charlene/Drizz, Eva Savage, Jim Fair and Ish Ennis, Jack Kumer, Walt West<br><i>Protocol:</i> Actions are counted annually and entered into the database each year. The time spent on each activity (recorded as number of days that staff entered the wilderness and worked some period of time on the activity) is listed. It is assumed that the more time spent conducting the action, the more trammeling has occurred (this is not always the case but given the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                                                                                                                         |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>fire</b>                                                                                                             |   | breath of activities, the generalization applies). This table is condensed, but a detailed list of specific activities for monitoring, maintenance, etc is located in Appendix D.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>2.2 Number of actions to manipulate fire</b>                                                                         | H | <i>Source:</i> Internal staff inventory of actions as well as outside fire crews<br><i>Protocol:</i> Actions are counted annually and entered into the database each year. Refer to measure 2.1. For this measurement, two types of activities are expected: fire suppression or fire containment, in which fire is allowed within a designated area but prevented from spreading to undesirable areas.                                                                                                                                                                                                                                                                                                                       |
| <b>2.3 Number of actions for dune maintenance</b>                                                                       | H | <i>Source:</i> Internal staff inventory of actions<br><i>Protocol:</i> Actions are counted annually and entered into the database each year. Refer to measure 2.1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>2.4 Number of unauthorized actions to manipulate plant, wildlife, insects, fish, pathogens, soil, water, or fire</b> | M | <i>Source:</i> Internal staff observations and personal judgment of different actions and occurrences.<br><i>Protocol:</i> Actions are counted annually and entered into the database each year. Actions are organized by type of activity and number of times this activity was reported or estimated.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Undeveloped</b>                                                                                                      |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>3.1 Index of authorized physical structures, installations, or developments</b>                                      | H | <i>Source:</i> Internal documentation/GIS/knowledge of structures: Eva Savage, Jack Kumer<br><i>Protocol:</i> A list of structures, installations, and developments will be created based off of inventories already present in GIS as well as any unmapped features known to be on the ground. The list of structures, installations, and developments are multiplied by the weight defined in an index. This weight includes the magnitude of the structure and how long the structure was in place. The sum of the product of structure, installations, and developments and weight will be the measure each year. A detailed list of known structures is in Appendix F, which is intended to help track added structures. |
| <b>3.2 Length of authorized physical structures, installations, and developments</b>                                    | H | <i>Source:</i> Internal documentation/GIS/knowledge of structures: Jack Kumer<br><i>Protocol:</i> Features that are measured by length, primarily roads and fences, are listed below. The sum of roads and fences will be compared every five years. Roads and fences are not weighted because while the roads may have a greater footprint, they are unpaved and access routes and fences cause barriers.                                                                                                                                                                                                                                                                                                                    |
| <b>3.3 Index of unauthorized physical structures, installations,</b>                                                    | M | <i>Source:</i> Internal documentation/knowledge of structures, etc.<br><i>Protocol:</i> A list of unauthorized features will be developed based off any maps and on the ground observations. The list of structures, installations, and developments multiplied by the weight defined in an index. The sum of the product of structure, installations, and developments and weight will be                                                                                                                                                                                                                                                                                                                                    |

|                                                                                                                  |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| or<br>developments                                                                                               |   | the measure for the five year monitoring period.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>3.4 Index of abandoned structures</b>                                                                         | M | <i>Source:</i> Internal documentation/GIS/knowledge of structures, etc.<br><i>Protocol:</i> This list will be created based off maps and on the ground observations. The list of structures, installations, and developments is multiplied by the weight defined in an index. This list will be limited to abandoned structures that may be both authorized and unauthorized. Recreational structures that are now abandoned are also included in this measure because they no longer serve a recreational function. The sum of the product of structure, installations, and developments and weight will be the measure for the five year monitoring period.                                                                                                                                            |
| <b>3.5 Length of abandoned physical structures,</b>                                                              | M | <i>Source:</i> Internal documentation/GIS/knowledge of structures, etc.<br><i>Protocol:</i> Refer to measure 3.4. The same protocol is followed except that applicable structures are measured by length in meters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>3.6 Index of inholdings with wilderness</b>                                                                   | L | <i>Source:</i> Internal inventory<br><i>Protocol:</i> A count of each inholding and its acreage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>3.7 Type and amount of administrative use of motor vehicles, motorized equipment, or mechanical transport</b> | M | <i>Source:</i> Internal staff reporting of activities and associated transport/equipment. CNWR: Charlene and Drizz, Eva Savage and Jim Fair. ASIS: Ish Ennis, Jack Kumer, and Walt West.<br><i>Protocol:</i> Use of motorized vehicles and equipment and mechanical transport is recorded based on activity, the number of times it was used (a “time” means if it entered and exited the wilderness. A time does not exceed one whole day in length, but otherwise this does not indicate the length the vehicle or equipment was in use). Transportation and equipment used is assumed based on the activity done. Refer to Appendix G for a detailed list of activities.                                                                                                                              |
| <b>3.8 Authorized Recreational Motor Vehicle Use</b>                                                             | M | <i>Source:</i> Number of OSV users counted through gate entry automated counter. OSV use in the wilderness based on Katherina Forgue’s thesis. Hunter vehicles for duck hunting logged by check-in and hunter vehicles for deer hunting is professional judgment by Walt West.<br><i>Protocol:</i> To calculate the OSV usage, use the total traffic count per month from August of the previous year to July of the current year. The assumption is that 10% of OSVs that enter the zone will travel to the wilderness zone. This assumption was derived from Katherina Forgues’ thesis observations. To calculate hunter vehicles in the wilderness, use a count of the sign in and sign out for duck hunting. For deer hunting use professional judgment of how many vehicles entered the wilderness. |
| <b>3.11 Type and amount of motor vehicles, motorized</b>                                                         | M | <i>Source:</i> Observations and professional judgment from law enforcement: Jim Fair, Walt West.<br><i>Protocol:</i> The use of unauthorized motorized and mechanical transportation and equipment will fall within frequency ranges. Staff will decide the range for frequency (week, month, year) and then use observations and informed                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                                                                            |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| equipment, or mechanical transport use not authorized by the Federal land manager          |   | personal judgments to assign a score to the different type of uses. Refer to measure for score table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Solitude or Primitive and Unconfined Recreation</b>                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>4.1 Percent of wilderness affected by access or travel routes inside the wilderness</b> | H | <p><i>Source:</i> Internal GIS records</p> <p><i>Protocol:</i> Staff will create a 35 ft buffer area around access or travel routes. The total of this buffer area calculated in GIS will be divided by the total wilderness area for the percent affected. Travel routes will include roads or routes that are actively being used by vehicles. It does not apply to foot traffic. Roads that are abandoned are no longer considered travel routes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>4.2 Amount of litter on the Refuge's coast</b>                                          |   | <p><i>Source:</i> Ocean Conservancy International Coastal Clean Up Summary Card. The beach cleanup is conducted on Chincoteague NWR by volunteers who are led by Jenny Owen, Volunteer Coordinator, or Sally Bowen.</p> <p><i>Protocol:</i> Annually on CNWR there is a beach clean up as part of the Ocean Conservancy. Since the wash up of trash from the ocean is a random process and not wilderness specific, this measure will track the amount of litter collected on the whole CNWR. The clean up occurs in mid-September. Data collected includes number of volunteers, the distanced cleaned at the site, the pounds of debris collected, and what that debris is composed of. For the purposes of this measure, the average weight of debris collected will be compared over each five year monitoring period. The number of volunteers and the distance cleaned will be listed also as a possible explanation for the amount of debris collected, but will not be included in the final measurement (average pounds of debris collected).</p> |
| <b>4.3 Permanent Viewshed</b>                                                              | M | <p><i>Source:</i> Field count</p> <p><i>Protocol:</i> Count number of man-made structures visible in wilderness that are permanent features through the on-the-ground surveys. A boat ride in the bay along the length of the wilderness will provide a count of visible structures. Effort is made to be as close to the shore as possible, but is limited by the water depth.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>4.4 Temporary Viewshed</b>                                                              | M | <p><i>Source:</i> Field count</p> <p><i>Protocol:</i> A sample will be taken (15 min) of the number of temporary man-made structures that pass through the viewshed during a designated time (10:00 am) at a specified location (state line). During the sample the monitor will list mobile structures that pass within view (not sound), how long it takes to pass, and how close the structures are based on a distance score (4-Just outside the boundary to 1-Distant, on the horizon or high in the sky).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>4.5 Percent of wilderness affected by access or</b>                                     | H | <p><i>Source:</i> GIS data on travel routes determined to be adjacent to wilderness</p> <p><i>Protocol:</i> Staff will create a 35 ft buffer area around adjacent access or travel routes. The total of this buffer area calculated in GIS will be divided by the total wilderness area for the percent affected. Travel routes will include</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                                                                                                                         |   |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>travel routes outside the wilderness</b>                                                                                             |   | roads or routes that are actively being used by vehicles. It does not apply to foot traffic.                                                                                                                                                                                                                                                                                                                                           |
| <b>4.6 Agency-provided recreation facilities</b>                                                                                        | H | <i>Source:</i> Internal staff inventory<br><i>Protocol:</i> The recreational facilities will be counted and organized by type.                                                                                                                                                                                                                                                                                                         |
| <b>4.7 User-created recreation facilities</b>                                                                                           | M | <i>Source:</i> Observations and professional judgment from law enforcement: Walt West, Jim Fair.<br><i>Protocol:</i> Unauthorized recreational facilities will be counted and organized by type.                                                                                                                                                                                                                                       |
| <b>4.8 Visitor Restriction Index</b>                                                                                                    | H | <i>Source:</i> Internal records<br><i>Protocol:</i> A score will be given to ASIS and CNWR based on the type of restrictions. These restrictions will be organized by category and the score assigned based on if there is no regulation or total prohibition. The higher the sum of the scores the more restrictions exist in the wilderness. Refer to measure for score table.                                                       |
| <b>4.9 Extent of management restrictions</b>                                                                                            | H | <i>Source:</i> Internal records –GIS layer delineation of wilderness area and roadways.<br><i>Protocol:</i> This is a GIS calculation of the accessible travel routes area within the wilderness. All area outside these travel routes is restricted in the CNWR portion of the land. This number (area restricted/total area) is then compared to the number of days it is prohibited (year minus hunting season).                    |
| <b>Other Features</b>                                                                                                                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>5.1 Number of actions that result in disturbances to cultural resources (looting, trespass activities, non-compliance with NHPA)</b> | M | <i>Source:</i> Internal staff consultation of associated activities<br><i>Protocol:</i> An inventory of the cultural sites will be created then any actions that occur on these sites will be listed. If the activity is damaging it will receive a negative score. If the activity preserves or restores the site it will receive a positive score. The sum of the activities will be tracked during the five year monitoring period. |

## Appendix D. Effort

| Effort Required for Wilderness Character Monitoring                                     |                                          |                                                          |                                                                                                                        |                                                                 |                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FWS Wilderness Fellows, 2012                                                            |                                          |                                                          |                                                                                                                        |                                                                 |                                                                                                                                                                                      |
| Table completed by: <b>TARYN SUDOL</b>                                                  |                                          |                                                          |                                                                                                                        |                                                                 |                                                                                                                                                                                      |
| Refuge: <b>CHINCOTEAGUE NATIONAL WILDLIFE REFUGE &amp; ASSATEAGUE NATIONAL SEASHORE</b> |                                          |                                                          |                                                                                                                        |                                                                 |                                                                                                                                                                                      |
| Quality                                                                                 | Indicator                                | Measure                                                  | Were data gathered from office paper files, computer files, or field work (professional judgment <u>is</u> an option)? | Time you spent gathering data for each measure (in whole hours) | Comments                                                                                                                                                                             |
| <b>Natural</b>                                                                          | Plant and Animal species and communities | Population dynamics of selected non-native plant species | paper, computer, GIS                                                                                                   | 3                                                               | Keep in mind that the time estimations include discussion and data collection among both ASIS and CNWR. This does not include time to identify or write the measures for the report. |
|                                                                                         |                                          | Population dynamics of non-native wild horses            | professional judgment                                                                                                  | 1                                                               |                                                                                                                                                                                      |
|                                                                                         |                                          | Population dynamics of non-native sika deer              | paper, office paper files on harvest                                                                                   | 2                                                               |                                                                                                                                                                                      |
|                                                                                         |                                          | Number of extirpated indigenous species                  | professional judgment                                                                                                  | 1                                                               |                                                                                                                                                                                      |
|                                                                                         | Physical Resources                       | Visibility based on average deciview and sum of          | National office                                                                                                        |                                                                 |                                                                                                                                                                                      |

|                     |                                                                 |                                                                                                                        |                                      |   |                                                            |
|---------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---|------------------------------------------------------------|
|                     |                                                                 | anthropogenic fine nitrate and sulfate                                                                                 |                                      |   |                                                            |
|                     |                                                                 | Ozone air pollution based on concentration of N100 episodic and W126 chronic ozone exposure affecting sensitive plants | National office                      |   |                                                            |
|                     |                                                                 | Acid deposition based on concentration of sulfur and nitrogen in wet deposition                                        | National office                      |   |                                                            |
|                     | Biophysical Processes                                           | Mean Sea Level Rise                                                                                                    | Computer, NOAA                       | 2 |                                                            |
|                     |                                                                 | Significance of storm events                                                                                           | Computer, NOAA                       | 4 |                                                            |
| <b>Untrammelled</b> | Actions authorized by the Federal land manager that manipulates | Number of actions to manage plants, animals, pathogens, soil, water or fire                                            | Computer file, professional judgment | 7 | This includes all the interviews plus organizing the data. |
|                     |                                                                 | Number of actions to manipulate fire                                                                                   | Professional judgment                | 1 |                                                            |

|             |                                                                                                |                                                                                                              |                                           |   |
|-------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------|---|
|             | biophysical the environment                                                                    | Number of actions for dune maintenance                                                                       | professional judgment                     | 1 |
|             | Actions not authorized by the Federal land manager that manipulate the biophysical environment | Number of unauthorized actions to manipulate plant, wildlife, insects, fish, pathogens, soil, water, or fire | professional judgment                     | 3 |
| Undeveloped | Non-recreational structures, installations, and developments                                   | Index of authorized physical structures, installations, or developments                                      | Computer file, GIS, professional judgment | 6 |
|             |                                                                                                | Length of active roads and fences                                                                            | Computer file, GIS                        | 2 |
|             |                                                                                                | Index of unauthorized physical structures, installations, or developments                                    | professional judgment                     | 3 |
|             |                                                                                                | Index of abandoned structures                                                                                | Computer file, GIS, professional judgment | 5 |
|             |                                                                                                | Length of abandoned roads and fence                                                                          | Computer file, GIS                        | 1 |
|             | Inholdings                                                                                     | Index of inholdings with wilderness                                                                          | Computer file                             | 1 |

|                                                        |                                                                      |                                                                                                                                |                                                                   |   |
|--------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|---|
|                                                        | Use of motor vehicles, motorized equipment, and mechanical transport | Type and amount of administrative use of motor vehicles, motorized equipment, or mechanical transport                          | professional judgment                                             | 6 |
|                                                        |                                                                      | Authorized Recreational Motor Vehicle Use                                                                                      | Traffic counter, sign in –sign out sheets, professional judgement | 3 |
|                                                        |                                                                      | Type and amount of motor vehicles, motorized equipment, or mechanical transport use not authorized by the Federal land manager | professional judgment                                             | 2 |
| <b>Solitude or Primitive and Unconfined Recreation</b> | Remoteness from sights and sounds of people inside the wilderness    | Percent of wilderness affected by access or travel routes inside the wilderness                                                | Computer file, GIS                                                | 3 |
|                                                        |                                                                      | Amount of Litter on CNWR                                                                                                       | Data sheet from cleanup                                           | 1 |
|                                                        | Remoteness from occupied and modified areas outside                  | Permanent Viewshed                                                                                                             | Field data collection                                             | 5 |
|                                                        |                                                                      | Temporary Viewshed                                                                                                             | Field data collection                                             | 4 |

|                       |                                                                              |                                                                                                           |                                            |   |
|-----------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------|---|
|                       | the wilderness                                                               | Percent of wilderness affected by access or travel routes outside the wilderness                          | Computer file, GIS                         | 3 |
|                       | Facilities that decrease self-reliant recreation                             | Agency-provided recreation facilities                                                                     | Computer file, GIS, professional judgement | 3 |
|                       |                                                                              | User-created recreation facilities                                                                        | professional judgement                     | 2 |
|                       | Management restrictions on visitor behavior                                  | Visitor restriction index                                                                                 | professional judgement, known policies     | 2 |
|                       |                                                                              | Extent of management restrictions                                                                         | Known policies, GIS                        | 2 |
| <b>Other Features</b> | Deterioration or loss of cultural resources integral to wilderness character | Number of actions that affect cultural resources (looting, trespass activities, non-compliance with NHPA) | Professional judgment                      | 2 |

**Effort Required for Wilderness Character Monitoring**

**FWS Wilderness Fellows, 2012**

Table completed by: Taryn Sudol

Refuge: Chincoteague National Wildlife Refuge and Assateague National Seashore

| Title of staff involved in identifying, prioritizing, and selecting measures | Staff time to identify, prioritize, and select measures (in whole hrs) | Comments                                               |
|------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------|
| Lou Hinds                                                                    | 10                                                                     | Conference call, initial meeting with ASIS, interviews |

|                   |    |                                                                                           |
|-------------------|----|-------------------------------------------------------------------------------------------|
| Kim Halpin        | 10 | Conference call, initial meeting with ASIS, interviews                                    |
| Kevin Holcomb     | 32 | Conference call, initial meeting with ASIS, interviews, second ASIS visit, outside time?? |
| Emarie Ayala      | 2  | Interview                                                                                 |
| Eva Savage        | 1  | Interview, harvest data                                                                   |
| Janelle Walters   | 1  | Interview                                                                                 |
| Charlene Swartz   | 1  | Interview                                                                                 |
| Drizz Wilgus Jr.  | 1  | Interview                                                                                 |
| Jim Fair          | 1  | Interview                                                                                 |
| Aubrey Hall       | 1  | Hunter questions                                                                          |
| Trish Kicklighter | 3  | Initial meeting with CNWR                                                                 |
| Bill Hulslander   | 15 | Initial meeting with CNWR, second visit, interview, outside time??                        |
| Jack Kumer        | 29 | Identify measures, interview, compose and organize activity table                         |
| Brian Sturgis     | 4  | Identify measures                                                                         |
| Neil Winn         | 5  | Identify measures, compile data                                                           |
| Walt West         | 1  | Interview                                                                                 |
| Ish Ennis         | 1  | Interview                                                                                 |

### Effort Required for Wilderness Character Monitoring

#### FWS Wilderness Fellows, 2012

Table completed by: Taryn Sudol

#### Refuge: Chincoteague National Wildlife Refuge and Assateague National Seashore

| Time you spent to identify, prioritize, and select all the measures (in whole hours) | Time you spent to learn how to enter data into the WCM database application (in whole hours) | Time you spent to enter all data into the WCM database application (in whole hours) | Time you spent on other tasks directly related to WCM (e.g., reading CCP, giving presentations, talking with staff) (in whole hours) | Time you spent doing other Refuge tasks not directly related to WCM (in whole hours) |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 156                                                                                  | 3                                                                                            | 5                                                                                   | 18                                                                                                                                   | 77                                                                                   |

## Appendix E. Actions –Detailed

| Action                                        | Days Spent to Complete Action |      |
|-----------------------------------------------|-------------------------------|------|
|                                               | ASIS                          | CNWR |
| <b>Set up for monitoring:</b>                 |                               |      |
| Piping plover management                      | 15                            |      |
| Bald Eagle management                         | 5                             |      |
| Breeding bird signage                         | 4                             |      |
| Deer monitoring set up/ fence repair          | 8                             |      |
| Set up amaranth cages                         | 12                            |      |
| Post signs after marsh restoration            | 30                            |      |
| Install instruments in pond marsh             | 10                            |      |
| Marsh bird monitoring installations           | 2                             |      |
| Set up for fox ecology study                  | 12                            |      |
| Soil analysis set up                          | 1                             |      |
| Groundwater monitoring set up                 | 4                             |      |
| Erect nest exclosures                         |                               | 3    |
| Salt Marsh Monitoring set up                  |                               | 10   |
| <b>Installing informational signs:</b>        |                               |      |
| Put up signs                                  | 9                             |      |
| OSV trail boundary signs                      | 15                            |      |
| White rods on hunting trails                  | 14                            |      |
| Post biological signs                         |                               | 1    |
| <b>Maintaining existing structures:</b>       |                               |      |
| Horse fence repair                            | 4                             |      |
| Horse/deer grazing fences                     | 6                             |      |
| Stateline fence                               | 14                            |      |
| Pony fence repair                             |                               | 5    |
| <b>Mowing:</b>                                |                               |      |
| Cross island roads                            | 14                            |      |
| Service road                                  |                               | 5    |
| Weather station                               |                               | 2    |
| <b>Other:</b>                                 |                               |      |
| Jeep trail                                    |                               | 1    |
| Horse Management                              | 25                            | 4    |
| Treating Phragmites                           | 60                            |      |
| Marsh Restoration                             | 100                           |      |
| Survey Benchmark installation and maintenance | 15                            |      |
| Trapping                                      |                               | 60   |
| <b>TOTAL</b>                                  |                               |      |

## Appendix F. List of Authorized Developments

| Feature               | Name of Components                         |
|-----------------------|--------------------------------------------|
| <b>Bridge</b>         | Valentine's Road Bridge                    |
| <b>Gates</b>          | Backtrail/ Cable                           |
|                       | Pope Bay Road/Cable                        |
|                       | Backtrail/ Cable                           |
|                       | Boat Launch Road/Road Q /Single Wooden Arm |
|                       | Green Run Road/ Cable                      |
|                       | Valentine's Road/ Single Wooden Arm        |
| <b>Duckblinds</b>     | A-17                                       |
|                       | A-18                                       |
|                       | A-19                                       |
|                       | B-21                                       |
|                       | A-23                                       |
|                       | B-22                                       |
|                       | B-24                                       |
|                       | B-25                                       |
| <b>Old Roads</b>      | Dune Crossing 9                            |
|                       | Dune Crossing 11                           |
|                       | Dune Crossing 12                           |
|                       | Dune Crossing 14                           |
|                       | Dune Crossing 16                           |
|                       | Peoples/Lynch Road                         |
|                       | Backtrail                                  |
|                       | Road P                                     |
|                       | Jims Gut Campsite                          |
|                       | Blind 18 Access Road                       |
|                       | Valentines Road                            |
|                       | Road Scar                                  |
|                       | Mussers Road                               |
|                       | Clements Road                              |
| <b>Current Roads</b>  | OSV Zone                                   |
|                       | Fox Hills Road                             |
|                       | Green Run Road                             |
|                       | Clements Boathouse Road                    |
|                       | Valentines Road                            |
|                       | Backtrail                                  |
|                       | Big Levels Road                            |
|                       | Pope Bay Access Road                       |
|                       | State Line Road                            |
|                       | Back Country Road                          |
| <b>Hunting Trails</b> | Peoples/Lynch                              |
|                       | B-22                                       |
|                       | B-24                                       |

|                             |                     |
|-----------------------------|---------------------|
|                             | B-25                |
|                             | B-21                |
|                             | A-23                |
|                             | A-20                |
|                             | A-17                |
|                             | A-18                |
| <b>Retention Structures</b> | Valentines          |
|                             | People's Lynch      |
|                             | BobOdell            |
|                             | Clements            |
|                             | Clements Boathouse  |
|                             | Musser              |
| <b>Cultural Site</b>        | Jackson's Green Run |
|                             | Graveyard           |

## Appendix G. Authorized motorized vehicles, mechanical transport and motorized equipment –Detailed

| Activity                                 | No. of times motorized vehicles used* |      | No. of times mechanical transport used |      | No. of times motorized equipment used |           |
|------------------------------------------|---------------------------------------|------|----------------------------------------|------|---------------------------------------|-----------|
|                                          | ASIS                                  | CNWR | ASIS                                   | CNWR | ASIS                                  | CNWR      |
| <b>Monitoring:</b>                       |                                       |      |                                        |      |                                       |           |
| Horses                                   | 40                                    |      |                                        |      |                                       |           |
| Plover                                   | 140                                   | 42   |                                        |      |                                       |           |
| Bald Eagle                               | 25                                    |      |                                        |      |                                       |           |
| Other breeding birds                     | 14                                    | 34   |                                        |      |                                       |           |
| Herpetology                              | 10                                    |      |                                        |      |                                       |           |
| Deer                                     | 75                                    | 3    |                                        |      |                                       |           |
| Goose                                    | 5                                     |      |                                        |      |                                       |           |
| General survey: rare or invasive plants  | 12                                    |      |                                        |      |                                       |           |
| General survey: rare of invasive animals | 12                                    |      |                                        |      |                                       |           |
| Amaranth                                 | 20                                    | 1    |                                        |      |                                       |           |
| Sea turtle                               | 20                                    |      |                                        |      |                                       |           |
| Mosquito                                 | 30                                    |      |                                        |      |                                       |           |
| Shoreline                                | 8                                     |      |                                        |      |                                       |           |
| Pond hydrology                           | 10                                    |      |                                        |      |                                       |           |
| SETs                                     | 4                                     | 3    |                                        |      |                                       |           |
| Nekton                                   | 20                                    | 3    |                                        |      |                                       |           |
| Marsh vegetation                         | 15                                    | 3    |                                        |      |                                       |           |
| Marsh birds                              | 12                                    |      |                                        |      |                                       |           |
| Tiger Beetle                             | 1                                     |      |                                        |      |                                       |           |
| Falcons                                  | 21                                    |      |                                        |      |                                       |           |
| Groundwater                              | 15                                    |      |                                        |      |                                       |           |
| Cross Island Elevation                   | 15                                    |      |                                        |      |                                       |           |
| Post marsh hydrology                     | 60                                    |      |                                        |      |                                       |           |
| Post marsh restoration                   | 10                                    |      |                                        |      |                                       |           |
| <b>Research:</b>                         |                                       |      |                                        |      |                                       |           |
| Mapping invasive plants                  | 20                                    |      |                                        |      |                                       |           |
| Assessment of cultural resources         | 12                                    |      |                                        |      |                                       |           |
| Assessment of storm/flood events         | 20                                    |      |                                        |      |                                       |           |
| Fox ecology                              | 60                                    |      |                                        |      |                                       |           |
| Soil Analysis                            | 30                                    |      |                                        |      |                                       |           |
| <b>Other Biological Actions</b>          |                                       |      |                                        |      |                                       |           |
| Horse Management                         | 25                                    |      |                                        |      |                                       |           |
| Treating Phragmites                      | 60                                    |      |                                        |      | 25                                    | (generato |

|                                  |                                     |                                             |                            |
|----------------------------------|-------------------------------------|---------------------------------------------|----------------------------|
|                                  |                                     |                                             | r)                         |
| <b>Mammal strandings</b>         | 10                                  |                                             |                            |
| <b>Marsh restoration</b>         | 100 (dump trucks, loaders, pick up) |                                             | 100 (generator, chainsaws) |
| <b>Survey Benchmark</b>          | 15                                  |                                             | 1 (jackhammer)             |
| <b>No hunting signs</b>          | 9                                   |                                             |                            |
| <b>OSV trail boundaries</b>      | 15                                  |                                             |                            |
| <b>Trapping</b>                  |                                     | 60                                          |                            |
| <b>Nest exclosures</b>           |                                     | 3                                           |                            |
| <b>Post signs</b>                |                                     | 1                                           |                            |
| <b>Patrolling</b>                |                                     |                                             |                            |
| <b>Hunting: waterfowl</b>        | 360                                 |                                             |                            |
| <b>Hunting: big game</b>         | 360                                 | 350                                         |                            |
| <b>Daily</b>                     | 485                                 | 450                                         |                            |
| <b>Assistance response</b>       | 14                                  |                                             |                            |
| <b>Fire report</b>               | 1                                   |                                             |                            |
| <b>Maintenance</b>               |                                     |                                             |                            |
| <b>Horse/marsh fencing</b>       | 4                                   |                                             |                            |
| <b>Deer/horse forest fencing</b> | 6                                   |                                             |                            |
| <b>Stateline fencing</b>         | 42 (wheel loader, tractor)          |                                             |                            |
| <b>Pony fence</b>                |                                     | 5                                           |                            |
| <b>Pony penning</b>              |                                     | 1                                           |                            |
| <b>Roadwork leveling</b>         |                                     | 60 (dump truck, loader, bobcat, fuel truck) | 15 (equipment trailer)     |
| <b>Post storm surveillance</b>   |                                     | 1                                           |                            |
| <b>Remove trees</b>              | 12                                  | 1                                           | 1 (chainsaw)               |
| <b>Check weather station</b>     |                                     | 1                                           |                            |
| <b>RomTech Service</b>           | 48                                  |                                             | 48 (pumper)                |
| <b>Maintain bridges</b>          | 1 (fill-in loader)                  |                                             |                            |
| <b>Maintain gates</b>            | 6                                   |                                             |                            |
| <b>Beach route</b>               | 12                                  |                                             |                            |
| <b>Cross island roads</b>        | 14 (mower)                          |                                             |                            |
| <b>Fill in potholes</b>          | 4 (loader)                          |                                             |                            |

|                            |      |                          |   |             |     |   |
|----------------------------|------|--------------------------|---|-------------|-----|---|
| <b>Service road mowing</b> |      | 10<br>(pickup,<br>mower) |   | 5 (trailer) |     |   |
| <b>Mow weather station</b> |      | 4 (pick up,<br>mower)    |   | 2(trailer)  |     |   |
| <b>Mow Jeep Trail</b>      |      | 2 (pick up,<br>mower)    |   | 1( trailer) |     |   |
| <b>TOTAL</b>               | 2338 | 1038                     | 0 | 23          | 174 | 1 |

**Appendix B**



USFWS

*Snowy Egret*

## **Other Federal Mandates and Relevant Plans and Initiatives**



This appendix provides full summary descriptions of the ESA Recovery Plans listed in Section 1.8.4 and of those plans and initiatives discussed in Section 1.10.

#### **1.8.4 Other Federal Mandates**

##### *Federal Endangered Species Act (ESA) Recovery Plans*

Four Federal ESA Recovery Plans are in effect to protect and enhance threatened and endangered species which are residents of Chincoteague and/or Wallops Island NWRs: Atlantic Coast Piping Plover (*Chadradius melodus*) Recovery Plan (USFWS 1995), Delmarva fox squirrel (*Sciurus niger cinereus*) Recovery Plan (USFWS 1993b), Recovery Plan for Seabeach amaranth (*Amarantus pumilus*) Rafinesque (USFWS 1996b), and Recovery Plan for U.S. Populations of Loggerhead Turtle (*Caretta caretta*) (NMFS and USFWS 1993). Current refuge management with respect to these federally-listed species has been guided by these Recovery Plans and numerous ESA Section 7/Biological Opinions for refuge projects. Habitat Management Plans (HMPs) for Chincoteague and Wallops Island NWRs will incorporate and build upon these recovery plans but each plan is summarized below.

##### **Atlantic Coast Piping Plover (*Chadradius melodus*) Recovery Plan (1996)**

The primary objective of this recovery program is to remove the Atlantic Coast piping plover population from the List of Endangered and Threatened Wildlife and Plants by: (1) achieving well-distributed increases in numbers and productivity of breeding pairs, and (2) providing for long-term protection of breeding and wintering plovers and their habitat. Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the species' decline. Disturbance by humans and pets often reduces the functional suitability of habitat and causes direct and indirect mortality of eggs and chicks. Predation has also been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites, and substantial evidence shows that human activities are affecting types, numbers, and activity patterns of predators, thereby exacerbating natural predation (USFWS 1995). This recovery plan follows the Atlantic Coast Recovery guidelines for managing and protecting piping plovers and describes specific policies concerning monitoring guidelines, protection efforts, disturbance issues, predator control, and reporting requirements. The refuge objectives are to maximize production of the piping plover (with mean productivity of 1.50 chicks fledged per nesting pair) and least tern on refuge lands. This will be accomplished through the reduction of predation and human disturbance, and through public educational efforts about the plight of the piping plover and least tern and the work conducted by the refuge to restore the bird populations.

##### **Delmarva Fox Squirrel (*Sciurus niger cinereus*) Recovery Plan (1993)**

The Delmarva Peninsula fox squirrel, generally called the Delmarva fox squirrel, was listed as federally endangered in 1967 because of concerns about a reduction in distribution to only 10 percent of its historical range. Three recovery plans have been written for this species, with the most recent completed in 1993 (USFWS 1993). This recovery plan focuses primarily on determining the current distribution and habitat requirements of the Delmarva fox squirrel and on implementing habitat protection within its remaining natural range. The plan also notes that successful establishment of translocated populations will be required for full recovery. The Delmarva fox squirrel's forested habitat is susceptible to continued loss and fragmentation through overcutting and land use changes, although this is balanced to some extent by regeneration of forest resources.

##### **2011 Delmarva Peninsula Fox Squirrel 5-Year Review**

This five-year status review (USFWS 2011) summarizes information obtained since the previous five-year review by the USFWS in 2007 and evaluates the status of the species' populations, habitat, and threats. It considers delisting criteria specified in the most current recovery plan and conducts an assessment of the five listing factors to determine the appropriate classification of this species under the ESA. USFWS will continue monitoring efforts on the refuge through the use of trapping and camera stations on the grounds.

**Recovery Plan for Seabeach amaranth (*Amarantus pumilus*) (1996)**

Seabeach amaranth is restricted to sandy ocean beaches, and its habitat consists of the sparsely vegetated zone between the high tide line and the toe of the primary dune. This plan seeks to establish the species in at least six of the coastal states within its historic range (Delaware, Massachusetts, Maryland, North Carolina, New Jersey, New York, Rhode Island, South Carolina, and Virginia). Recovery is defined as when a minimum of 75 percent of the sites with suitable habitat within each state are occupied by amaranth populations for 10 consecutive years. Habitat destruction and alteration, incompatible beach grooming practices, and recreational activities have all contributed to the decline of this species. Although some of the surviving populations are on public lands (national wildlife refuges, national seashores, and state parks), they are not completely protected from the threats that face almost all populations (Seabeach amaranth 1996b).

**Recovery Plan for U.S. Populations of Loggerhead Turtle (*Caretta caretta*) (1993)**

This plan reviews and discusses the species ecology, population status and trends, and identifies threats to the loggerhead turtle in the northwestern Atlantic. It lays out a recovery strategy to address the threats, based on the best available science, and includes recovery goals and criteria. In addition, the plan identifies actions needed to address the threats to the species and achieve recovery. This revised plan is significant in that it identifies five unique recovery units, which comprise the population of loggerhead turtles in the northwest Atlantic, and describes specific recovery criteria for each recovery unit (NMFS and USFWS 1993).

**1.10 Other Relevant Plans and Initiatives****1.10.1 International and National Conservation Plans and Initiatives**

The plans and initiatives listed below, in chronological order, provide guidance for the CCP/EIS development and development of refuge management policies, goals, and objectives in regard to the significance of the refuge's natural environment and considerations for its protection and management.

*North American Breeding Bird Survey (BBS; 1966 to present)*

The BBS is an ongoing cooperative effort between the U.S. Geological Survey's Patuxent Wildlife Research Center and Environment Canada's Canadian Wildlife Service to monitor the status and trends of North American bird populations. BBS data are collected by thousands of participants along thousands of randomly established roadside routes throughout the continent. Professional BBS coordinators and data managers work closely with researchers and statisticians to compile and deliver these population data and population trend analyses on more than 400 bird species.

In the mid-twentieth century, the success of DDT (dichlorodiphenyltrichloroethane) as a pesticide ushered in a new era of synthetic chemical pest control. As pesticide use grew, concerns, as epitomized by Rachel Carson in *Silent Spring*, regarding their effects on wildlife began to surface (Carson, 2002). Local studies had attributed some bird kills to pesticides, but it was unclear how, or if, bird populations were being affected at regional or national levels. Responding to this concern, Chandler Robbins and colleagues at the Patuxent Wildlife Research Center developed the BBS to monitor bird populations over large geographic areas.

Although most concerns over pesticide use in North America have subsided in recent decades, bird populations continue to be subjected to numerous widespread threats including habitat loss, habitat fragmentation, land-use changes, and other chemical contaminants. Today, the BBS continues to monitor bird populations across North America and informs researchers and wildlife managers of significant changes in bird population levels. If significant declines are detected, their causes can then be identified and appropriate actions taken to reverse them before populations reach critically low levels.

*North American Waterfowl Management Plan (NAWMP; 1986 and update 2004)*

Originally written in 1986, the NAWMP describes a 15 year strategy for the United States, Canada, and Mexico to restore and sustain waterfowl populations by protecting, restoring, and enhancing habitat. The plan committee, including representatives from Canada, the United States, and Mexico, has modified the 1986 plan twice to account for biological, sociological, and economic changes that influenced the status of waterfowl and the conduct of cooperative habitat conservation. The most recent modification in 2004 updates the latest needs, priorities, and strategies for the next 15 years, and guides partners in strengthening the biological foundation of North American waterfowl conservation and stakeholder confidence in the direction of the plan (NAWMP Committee 2004).

To convey goals, priorities, and strategies more effectively, that 2004 modification comprises two separate documents: a Strategic Guidance document and an Implementation Framework document. The former is for agency administrators and policy makers who set the direction and priorities for conservation and the latter includes supporting technical information for use by biologists and land managers (NAWMP Committee 2004).

The plans are implemented at the regional level in 14 habitat Joint Ventures and 3 species Joint Ventures: Arctic Goose, Black Duck, and Sea Duck. Chincoteague and Wallops Island NWRs lie in the Atlantic Coast Joint Venture, which includes all the Atlantic Flyway states from Maine to Florida and Puerto Rico.

*Partners in Flight Conservation Plans (PIF; 1990)*

In 1990, PIF began as a voluntary, international coalition of government agencies, conservation organizations, academic institutions, private industries, and citizens dedicated to reversing the population declines of bird species and “keeping common birds common.” The foundation of its long-term strategy is a series of scientifically-based bird conservation plans using physiographic areas as planning units.

The goal of each PIF plan is to ensure the long-term maintenance of healthy populations of native birds, primarily non-game birds. The plan for each physiographic area ranks bird species according to their conservation priority, describes their desired habitat conditions, develops biological objectives, and recommends conservation measures. The priority ranking factors in habitat loss, population trends, and the vulnerability of a species and its habitats to regional and local threats.

Chincoteague and Wallops Island NWRs are included in the Mid-Atlantic Coastal Plain (physiographic area 44) and its plan (Version 1.0, April 1999). The plan includes objectives for the following habitat types and associated species of conservation concern.

- Barrier and Bay Islands: American oystercatcher, black skimmer, least tern, Forester’s tern, gull-billed tern;
- Salt Marsh: black duck, clapper rail, willet and seaside sparrow;
- Pine Plantation: brown-headed nuthatch, eastern wood pewee, and eastern towhee;
- Early successional: field sparrow, northern bobwhite, and yellow-breasted chat; and
- Fresh/Brackish Emergent Wetland: American black duck.

The Mid-Atlantic Coastal Plain plan is available on line at [http://www.partnersinflight.org/bcps/pl\\_44sum.htm](http://www.partnersinflight.org/bcps/pl_44sum.htm) (Watts 1999).

*Regional Wetland Concept Plan, Northeast Region (1990)*

Congress enacted the Emergency Wetlands Resources Act in 1986 to promote the conservation of wetlands nationwide. Through this act, Congress directed the Department of the Interior to develop a national

wetlands priority conservation plan identifying the location and types of wetlands that should receive priority attention for acquisition by Federal and state agencies using Land and Water Conservation Fund appropriations. In 1990, the USFWS Region 5 completed a regional wetlands concept plan that complemented the national plan by providing more detailed information about the wetland resources of the northeastern states (USFWS 1990).

The regional wetlands concept plan identifies 850 wetland sites that warrant consideration for acquisition. It also describes wetland functions and values as well as identifies habitat loss and threats to wetlands remaining in the region. Of the 205 wetland sites identified in the Commonwealth of Virginia, 20 sites are located in Accomack County, including Cedar and Metompkin islands and Chincoteague Island. This information is important to consider for regional conservation efforts (USFWS 1990).

*North American Bird Conservation Initiative (NABCI, 1998)*

The NABCI is a coalition of government, private and academic organizations, and private industry leaders addressing bird conservation. The initiative's vision is to achieve regionally-based, biologically-driven, landscape-oriented partnerships that deliver the full spectrum of bird conservation across the North American continent and that support simultaneous, on-the-ground delivery of conservation for all birds. It evolved in 1998 out of recognition of the value of coordinating efforts of the NAWMP and PIF. Populations and habitats of North America's birds are protected, restored, and enhanced through coordinated efforts at international, national, regional, state, and local levels, guided by sound science and effective management. NABCI has designated 37 Bird Conservation Regions (BCR) that encompass landscapes having similar bird communities, habitats, and resource issues. NABCI defined BCRs as ecologically based units in a framework for planning, implementing, and evaluating bird conservation. Each BCR has its own implementation plan (NABCI n.d.a). Chincoteague and Wallops Island NWRs lie in the New England/Mid-Atlantic (NABCI n.d.b).

*U.S. Shorebird Conservation (2001) and North Atlantic Regional Shorebird Plans*

The U.S. Shorebird Plan Council is a partnership of state and federal agencies, non-governmental conservation organizations, academic institutions, and individuals that collaborated under a grant from USFWS in 2000 to develop the U.S. Shorebird Conservation Plan (USSCP), with a second addition published in May 2001. The plan develops conservation goals for each U.S. region, identifies important habitat conservation and research needs, and proposes education and outreach programs to increase public awareness of shorebirds and of threats to them. The USSCP is available online at <http://www.shorebirdplan.org/wp-content/uploads/2013/01/USShorebirdPlan2Ed.pdf> (Brown 2001).

In the Northeast, the North Atlantic Regional Shorebird Plan was drafted to step down the goals of the continental plan to smaller scales and identify priority species, habitats, and species goals, as well as prioritize implementation projects.

The North Atlantic Regional Shorebird Plan can be viewed online at <http://www.fws.gov/shorebirdplan/RegionalShorebird/downloads/NATLAN4.pdf> (Clark 2000).

*North American Waterbird Conservation Plan (NAWCP; Version 1, 2002)*

The NAWCP is the result of an independent partnership among individuals and institutions interested in or responsible for conserving water birds and their habitats. The plan is just one element of a multi-faceted conservation program. The primary goal of the plan is to ensure that the distribution, diversity, and abundance of populations and habitats of breeding, migratory, and non-breeding water birds are sustained or restored throughout the lands and waters of North America, Central America, and the Caribbean. It provides a framework for conserving and managing colonially-nesting water-dependent birds. In addition, it will facilitate continent-wide planning and monitoring; national, state, and provincial conservation; regional coordination; and local habitat protection and management.

A copy of the continental plan can be requested at <http://www.nawcp.org/pubs/ContinentalPlan.cfm> (Kushlan et al. 2002).

*Birds of Conservation Concern (BCC; 2002 and update 2008)*

USFWS developed the BCC report, Birds of Conservation Concern 2002, and its update, Birds of Conservation Concern 2008, in consultation with the leaders of ongoing bird conservation initiatives and partnerships such as PIF, NAWMP, NAWCP, and USSCP. The report fulfills the mandate of the 1988 amendment to the Fish and Wildlife Conservation Act requiring the Secretary of the Interior, through the USFWS, to “identify species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.”

The BCC report identifies the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities. The underlying philosophy behind BCC 2008 is that proactive bird conservation actions are necessary at a time when human impacts are at an all-time high to ensure the future of healthy avian populations and communities. BCC 2008 data and information serve as a barometer of the condition of the nation’s avifauna from a national landscape scale funneled down to regional details.

The 2008 report identifies species at three geographic scales: NABCI BCRs, USFWS regions, and national. The national BCC 2008 priority bird list provides an early warning for those bird species that have the potential to decline to levels requiring ESA protection; it is to be consulted before actions are taken on Federal lands, and for research, monitoring, and management funding in accordance with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (2002). The national list serves as an outreach tool for educating the public about the precarious status of selected bird species across the United States and as a general rule is not used to foster bird conservation at smaller geographic scales; that is the purpose of the BCR 30 and USFWS region lists (USFWS 2008c). The relevant BCR list for the refuge is discussed below.

*New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Implementation Plan (2008)*

The Atlantic Coast Joint Venture partnership created this plan in response to the NABCI challenge of building on existing partnerships to plan, implement, and evaluate cooperative bird conservation across North America. The plan outlines actions to restore and maintain healthy populations of birds native to the New England/Mid-Atlantic BCR (BCR 30).

Of the 134 bird species identified in the plan as priorities for conservation, 107 species occur on the refuge. Priority species include American black ducks, Atlantic brant, scoters, and bufflehead for waterfowl; piping plovers, American woodcock, red knots and American oystercatchers for shorebirds; least terns, gull-billed tern, glossy ibis and clapper rails for waterbirds; and northern bobwhite, field sparrow, eastern towhee, and prairie warblers for landbirds. We considered these species and priority habitats in developing management actions for this CCP.

The habitats of BCR 30 are a complex transition between the southern New England and the southern Atlantic coastal plains. Major threats to birds and habitats are invasive exotic species, climate change and sea level rise, and human disturbance from recreational uses and land development.

The implementation plan may be viewed online at [http://www.acjv.org/BCR\\_30/BCR30\\_June\\_23\\_2008\\_final.pdf](http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf) (Steinkamp 2008).

*A Blueprint for the Future of Migratory Birds: A Strategic Plan 2004-2014 (2004)*

In tandem with the BCC 2008 effort, USFWS also developed a 10-year national strategic migratory management plan to collaborate with its partners to recommit and set a successful course for migratory bird conservation over the next decade. The finalized plan describes the challenges facing migratory bird

conservation, with associated management strategies to meet these future challenges. We formulated a strong recommitment to migratory bird conservation with the following vision statement “*Through careful management built on solid science and diverse partnerships, the Service and its partners will restore and sustain the epic sweep of bird migration and the natural systems on which it depends --- fostering a world in which bird populations continue to fulfill their ecological roles while lifting the human spirit and enriching human lives in infinite ways, for generations to come*” (USFWS 2004a).

The plan points out that “birds enrich people’s lives and have intrinsic value as threads in the earth’s ecological tapestry, as pollinators, predators, and prey. Birds serve as excellent indicators of the health and quality of the environment as clean air, clean water and abundant, diverse natural habitats are essential for birds to survive and flourish” (USFWS 2004a). The plan also recognizes that birds are enjoyed by a large proportion of Americans, as more than 82 million residents of the U.S. (39 percent of adult population) participate in wildlife-related activities, and 64 million pursue bird-related recreation, contributing substantially to local economies throughout the nation by spending more than \$40 billion dollars annually on these pursuits.

The plan also identifies the major future challenges to conserve migratory birds. Declines in abundance of many landbird, shorebird, and waterbird populations are indicative of ecosystems that have been highly stressed and altered. The plan acknowledges that reductions in natural habitat quantity and quality are the primary causes of negative population trends in many bird species and are exacerbated by the direct loss of bird life from an array of environmental contaminants. Pesticides continue to poison birds and their food supplies. Invasive species and disease outbreaks also contribute to migratory bird mortality. Global climate change and demand for fresh water supplies pose current and future threats.

The plan explains that meeting these challenges will require consistent adherence to the principles of sound science. We will address many of these threats in this CCP/EIS and use the best available scientific information to mitigate environmental dangers to migratory birds. The refuge and its partners will focus on these challenges in the most cost-effective manner to perpetuate avian populations (USFWS 2004a).

#### *Conserving the Future: Wildlife Refuges and the Next Generation (USFWS 2011)*

USFWS created this report, *Conserving the Future*, using the previous Refuge System strategic plan, the 1999 report *Fulfilling the Promise* (USFWS 2009), as a foundation. It provides an updated vision for the future of America’s national wildlife refuges. The report recognizes that since the 2009 report, much of America has changed from a conservation standpoint, with an increasing focus on such topics as invasive species and changing climate. USFWS worked with the National Wildlife Refuge Association, a non-profit focused on policy, landscape-scale conservation efforts, grassroots development and public education, to develop this report, as well as over 100 USFWS staff members and input from over 10,000 public comments.

This report outlines a vision that states:

“The Service will enhance its close relationship with the state fish and wildlife agencies. We will coordinate with them on management of fish and wildlife within the Refuge System and on establishing population objectives. We will strive to increase hunting and fishing opportunities to a diverse constituency. We will also be a catalyst to find common ground with other refuge supporters with the goal of expanding the conservation constituency for the benefit of healthy wildlife and habitats for future generations” (USFWS 2011c).

Specifically, this document is split into three chapters that highlight the main ideas for conservation:

- “Conserving the Future: Wildlife and Wildlands,” which outlines how the USFWS will embrace a scientific, landscape-level approach to conserving, managing and restoring refuge lands and waters, and work to facilitate conservation benefits beyond our boundaries;

- “A Connected Conservation Constituency,” which explains how the USFWS will engage the American people to better understand their expectations and increase their awareness of the Refuge System and its role in conservation; and
- “Leading Conservation into the Future,” which speaks to developing a diverse workforce that embodies the Guiding Principles of the USFWS and demonstrates those principles in our daily activities and interactions.

USFWS recognizes the challenges that refuges face in coming years, and the report focuses on gaining conservation strength through partnerships with other agencies and individuals (USFWS 2011c). We have incorporated the importance of partnerships in the changing world into this CCP/EIS throughout, and specifically in Goal 5.

#### *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines (2012)*

The USFWS developed these guidelines developed in conjunction with the Wind Turbine Guidelines Advisory Committee to acknowledge the growing concern of potential wildlife disturbance due to wind energy sources. We recognize that as the U.S. shifts to renewable energy production to supplant the need for carbon-based fuel, wind energy will be an important source of power. As wind energy production increases, both developers and wildlife agencies have also recognized the need for a system to evaluate and address the potential negative impacts of wind energy projects on species of concern. These voluntary guidelines provide a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development. They also promote effective communication among wind energy developers and federal, state, and local conservation agencies and tribes. When used in concert with appropriate regulatory tools, the guidelines form the best practical approach for conserving species of concern (USFWS 2012b).

#### **1.10.2 National Public Use Plans and Initiatives**

##### *America's Great Outdoors: A Promise to Future Generations (AGO; 2011)*

On April 16, 2010, President Obama launched the America's Great Outdoors (AGO) initiative and charged the Secretaries of the Departments of the Interior and Agriculture, the Administrator of the Environmental Protection Agency (EPA), and the Chair of the White House Council on Environmental Quality to develop a 21st-century conservation and recreation agenda. Multiagency teams conducted more than 50 listening sessions in communities throughout the U.S., engaging a full range of interested groups, including tribal leaders, farmers and ranchers, sports enthusiasts, foresters, motorized recreationists, youth groups, businesspeople, educators, historic preservationists, state and local governments, and land trusts. Many thousands of Americans provided feedback and comments through e-mail and the AGO website. In all, more than 105,000 comments contributed to the conversation. These comments and recommendations provide the basis for the AGO report to the President, and a starting point for a continuing conversation on conservation in the 21st-century. The report was created in consultation with the American people; it reflects their ideas on how to reconnect people with America's lands, waters, and natural and cultural treasures and builds on the conservation successes in communities across the nation (Department of the Interior, et. al. 2012).

##### *Let's Move! And Let's Move Outside*

Let's Move is an initiative launched by First Lady Michelle Obama, with the goal of solving the problem of obesity within a generation. The program is focused on children, and helping them and their parents focus on healthy eating and physical activity. At the launch of the initiative, President Barack Obama signed a Presidential Memorandum creating the first-ever Task Force on Childhood Obesity to conduct a review of every single program and policy relating to child nutrition and physical activity and develop a national action plan to maximize federal resources and set concrete benchmarks toward the First Lady's national goal. The five pillars of the initiatives are: creating a healthy start for children, empowering their parents

and caregivers, providing healthy food in schools, improving access to healthy, affordable foods, and increasing physical activity.

Let's Move has an outgrowth initiative, Let's Move Outside, administered by the DOI in partnership with the U.S. Forest Service and U.S. Army Corps of Engineers with the goal of connecting children to nature through active, outdoor recreation. The initiative's website has several ways to search by type of activity or type of location for nearby recreational opportunities. Let's Move Outdoors is an initiative of the AGO.

#### *Youth in the Great Outdoors*

Youth in the Great Outdoors is a U.S. Department of Interior initiative to employ, educate, and engage young people from all backgrounds in exploring, connecting with and preserving America's natural and cultural heritage. This initiative aims to promote outdoor and educational programs as well as employment opportunities for youth throughout the Department and reach out to audiences who have never visited their public lands. The hope for this initiative is to help tackle some of the many challenges facing youth today, from high unemployment rates to declining health, by reconnecting youth with the outdoors and building pathways to careers in resource stewardship.

#### *Connecting People with Nature*

Connecting People with Nature is a USFWS initiative that recognizes the need to connect children, their families and communities to nature through innovative ideas, evidence-based resources and tools, broad-based collaboration, and the support of grassroots leadership. Through this initiative, we partner with companies and educators across the country as well as other initiatives to develop programs that inspire people to get outside and become more connected with nature.

### **1.10.3 Climate Change and Sea Level Rise Studies**

USFWS is concerned with the potential effects of climate change on Assateague Island and the Virginia Eastern Shore, and the potential impact on refuge facilities, infrastructure, and access. We therefore consider climate change to be a key consideration for this CCP/EIS. These concerns are further described in section 1.14.

The two most relevant climate change plans are the following:

- *Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change.* Our climate change strategic plan identifies key goals and objectives for the agency centered around three areas: adaptation, mitigation, and engagement. Key adaptation goals and objectives include the creation of regional Climate Science Centers and Landscape Conservation Cooperatives, development of a National Fish and Wildlife Adaptation Strategy over a 5 year period (see below), conduct species and habitat vulnerability assessments, and incorporate climate change into agency activities and decisions (USFWS 2010b). A draft supplemental, "Appendix: 5-Year Action Plan for Implementing the Climate Change Strategic Plan," details the specific actions the USFWS will take through 2013 to achieve each of the goals and objectives (USFWS 2009).
- *The National Fish, Wildlife and Plants Climate Adaptation Strategy* (2012) was called for by Congress in 2010. USFWS, the National Oceanic and Atmospheric Administration, the Council on Environmental Quality, state wildlife agencies, and Tribes co-led the development of this Strategy using the best available science. Working with a broad range of conservation interests, including local governments, states, tribes, conservation organizations, federal agencies, industry and private landowners, the strategy provides "a unified approach—reflecting shared principles and science-based practices—for reducing the negative impacts of climate change on fish, wildlife, plants, and the natural systems upon which they depend." The strategy is a blueprint for action, and includes scientific support, policy and legal frameworks, best management practices, processes for integration and communication, and a framework for implementation.

The relevant work on climate change for the refuge includes the following studies and plans, presented in chronological order:

- *A Case Study on Chesapeake Bay and Assateague Island*, part of the 2001 Climate Change, Wildlife, and Wildlands Toolkit by the U.S. EPA in partnership with the National Park Service (NPS) and USFWS, recognizes the constant change in the shape and geographical position of Assateague Island and predicts that the island is likely to continue to move landward, as sand is pushed across the island to the bay side. It finds that similar habitats will probably not suffer serious net losses, but that infrastructure such as the Wildlife Loop Road may be destroyed (EPA, NPS, USFWS 2009)
- *Refuges at Risk: the Threat of Global Warming*, a 2006 report by the Defenders of Wildlife, warns of the threat of global warming to National Wildlife Refuges and details its potential effects on ten national wildlife refuges that it considers the most endangered. Chincoteague NWR is included in those ten. The report states that scientists predict that Assateague Island will narrow due to sea level rise leading to a loss in wildlife habitat and impacts to roads and visitor facilities (Schlyer 2006).
- *The Virginia Climate Change Action Plan*, published in 2008 by the Governor's Commission on Climate Change, identifies sea level rise as a major concern for coastal Virginia. The Plan projects that sea levels in the Chesapeake Bay region will be 0.7 to 1.6 meters (2.3 to 5.2 feet) higher by 2100, with great local variability as a result of subsidence. The Plan recommends that local governments in coastal Virginia and the Secretary of Transportation include projected climate change impacts, especially sea level rise and storm surge, in all planning efforts, including transportation planning, project design, and prioritization of projects for funding as well as transportation systems management, operations, and maintenance (Governor's Commission on Climate Change 2008).
- *Sea Level Rise and Coastal Habitats in the Chesapeake Bay Region*, published by the National Wildlife Federation, used the Sea Level Affecting Marshes Model (SLAMM)<sup>1</sup> to predict coastal changes, including impacts on coastal wildlife habitats, in the Chesapeake Bay region over the 21<sup>st</sup> century. The report notes that because of its expansive coastline, low-lying topography, and growing coastal population, the Chesapeake Bay region is one of the most vulnerable places in the nation to the impacts of sea level rise. Many places along the Chesapeake Bay have seen a one-foot increase in relative sea level rise over the 20th century, including six inches due to global warming and six inches due to naturally subsiding coastal lands. In looking at the Chesapeake Bay area, the report concluded that there would be significant inundation of dry-land and conversion to marshes by 2100 (Glick 2008).
- *Application of the SLAMM 5.0.2 in the Lower Delmarva Peninsula* was commissioned by Chincoteague NWR to project the effects of sea level rise on barrier islands extending from Ocean City Inlet, Maryland to Fisherman Island, Virginia in the Delmarva Peninsula with a main focus on Chincoteague NWR and Assateague Island National Seashore. The study used three scenarios, which reflect the projections adopted by the Virginia Climate Change Action Plan, including:

<sup>1</sup> SLAMM is one of the models used to study the impact of coastal processes, such as sea-level rise, on an area and simulate the dominant processes and forecast long-term effects. SLAMM takes into account five processes that determine the impact of sea level rise impact on wetlands: inundation (the rise of water levels and the salt boundary); erosion; overwash (beach migration and transport of sediments); saturation (migration of coastal swamps and fresh marshes onto adjacent uplands due to the water table responding to rising sea level); and accretion (vertical rise due to buildup of organic and inorganic matter).

- Intergovernmental Panel on Climate Change (IPCC) A1B scenario: 0.7 meter global sea level rise by 2100
- 1.0 meter global sea level rise by 2100
- 1.5 meter global sea level rise by 2100

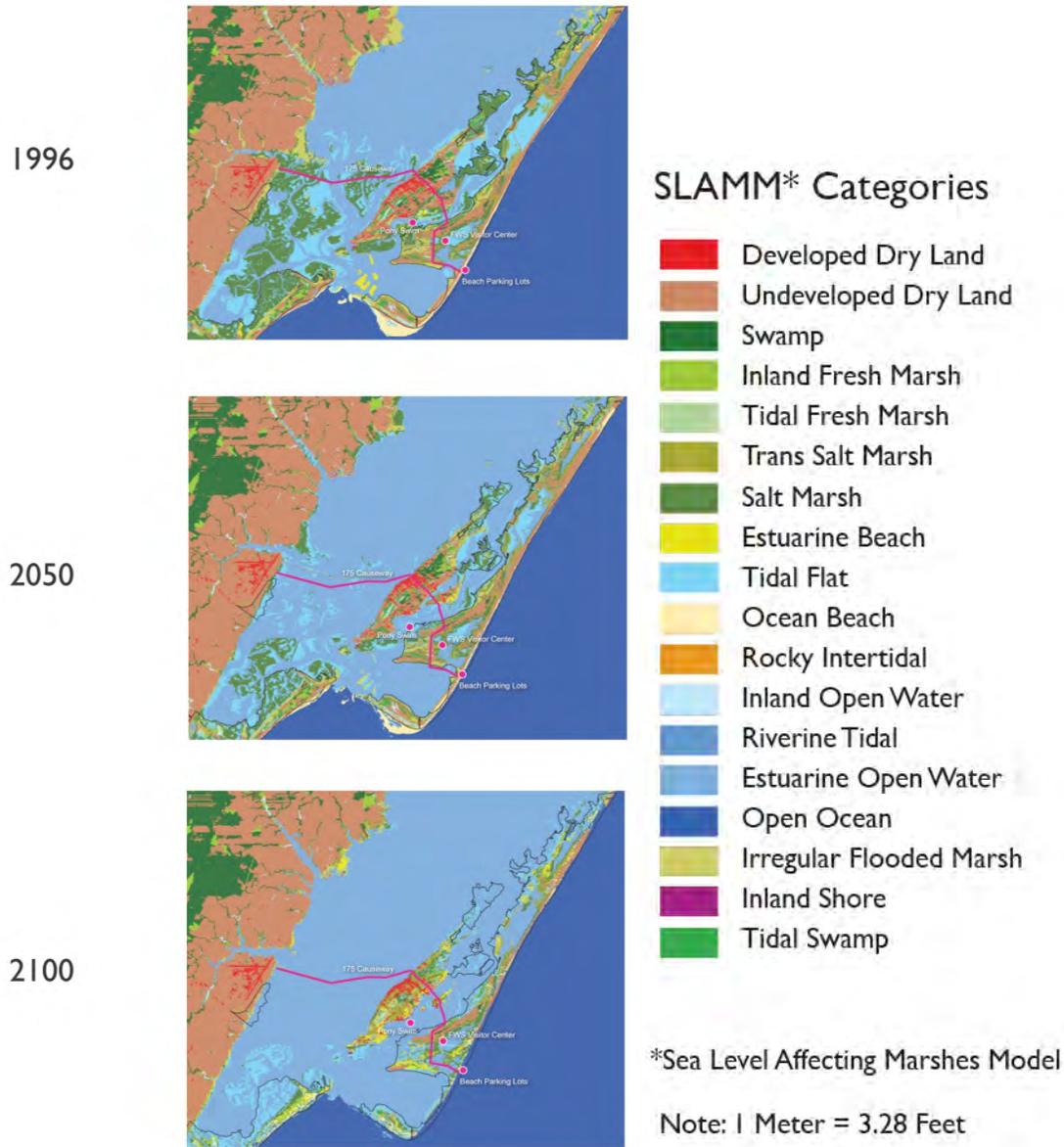
These three scenarios and the resulting habitat changes are shown in Figure 1-3. The study executed simulations in 25 year increments from the date of available existing conditions (1988-2003) until 2100 and found that the most significant changes would occur on the eastern shore beaches and marshes. Breaching is expected along areas near Toms Cove and significant loss of coastal habitats is anticipated for Assateague Island and other barrier islands within Chincoteague NWR by 2075 or 2100 in the 1.0 and 1.5 meter rise scenarios, respectively. Assuming a 0.69 m to 1.5 m sea-level rise, Brackish Water marshes would decline 68% to 91% and saltmarsh would decline 37% to 49% by 2100. Under the same sea-level rise scenarios, transitional salt marsh (scrub shrub) may gain 88% to 156% habitat. Furthermore, Ocean beach habitat would decline by 80 percent by the year 2100 in the 1.0 meter sea level rise scenario. Estuarine beaches, on the other hand, are projected to gain habitat. As with all ecological models, SLAMM does not currently account for all of the feedback and functions of coastal ecosystems.

The study indicates that critical transportation infrastructure is under threat of overwash and inundation in the future, including the Route 175 Causeway, the bridge and causeway between Chincoteague and Assateague Islands, and low-lying stretches of Beach Road. As noted in the Chincoteague NWR Master Plan (1993), the land now beneath current beach parking areas will eventually be reduced due to the natural movement of the barrier island, a movement that would most likely be exacerbated and added to by effects of climate change (Nieves 2009).

- *National Parks in Peril: The Threats of Climate Change Disruption*, published by The Rocky Mountain Climate Organization and the Natural Resources Defense Council, identifies 25 national parks, including Assateague Island National Seashore, as most at risk to climate change impacts. The report recommends that parks focus on reducing emissions of NPS operations and visitor activities, in particular due to transportation, through demonstrating model programs and becoming climate-neutral<sup>2</sup> (Saunders 2009).

<sup>2</sup> The term climate neutral, which is often used interchangeably with carbon-neutral, reflects the fact that it is not just carbon dioxide (CO<sub>2</sub>), that is driving climate change, but also encompasses other greenhouse gases regulated by the Kyoto Protocol, such as: methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF<sub>6</sub>).

Figure 1-1. SLAMM Analysis Results for Chincoteague and Wallops Island NWRs (Nieves 2009).



#### **1.10.4 State, Regional, and Local Plans**

##### *Virginia's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plan*

In 2002, Congress created the State Wildlife Grant Program (SWG), and appropriated \$80 million in state grants. The purpose of the program is to help state and tribal fish and wildlife agencies conserve fish and wildlife species of greatest conservation need. The funds appropriated under the program are allocated to states according to a formula that takes into account their size and population.

To be eligible for additional Federal grants and satisfy the requirements for participating in the SWG program, each state and U.S. territory developed a statewide “Comprehensive Wildlife Conservation Strategy” and submitted it to the National Advisory Acceptance Team by October 1, 2005. Each plan addressed eight required elements and identified and focused on “species of greatest conservation need,” while still addressing other wildlife and wildlife-related issues.

The Virginia Department of Game and Inland Fisheries developed the Virginia Wildlife Action Plan as to meet that charge. The goal of the plan is to create a vision for conserving wildlife and stimulate other states, Federal agencies, and conservation partners to think strategically about their individual and coordinated roles in prioritizing conservation. The eight elements addressed in the Virginia Wildlife Action Plan supplement and validate the information on species and habitat and their distribution on Chincoteague and Wallops Island NWRs – which helps identify conservation threats and management strategies for species and habitats of conservation concern on the refuge. The plan identifies 925 species in need of greatest conservation concern in Virginia and groups them into four tiers of relative risk of imperilment. The plan also identifies the “top 10” threats faced by terrestrial wildlife; seven are related to habitat destruction or fragmentation (Virginia Department of Game and Inland Fisheries 2005).

##### *State Comprehensive Outdoor Recreation Plan (2007)*

The 2007 *Virginia Outdoors Plan (VOP)* is the ninth VOP created since 1965, and provides guidance and direction in meeting the state’s needs for outdoor recreation and for the conservation of natural, cultural, and scenic resources important to Virginians’ quality of life. The document recognizes that with the growing population, decrease in undeveloped natural landscape, and increase in anthropogenic stimuli, the preservation of natural lands and the provision of outdoor recreation opportunities are high public demands. The 2007 VOP offers specific statewide recommendations for program areas, land management agencies responsible for outdoor recreation, and land conservation. It also includes numerous recommendations for each planning region throughout the Commonwealth; the refuge is located within the Accomack-Northampton Planning District. Region-specific recommendations include working with USFWS on optimizing compatible recreation activities while still protecting sensitive beach habitats and working with partners on wildlife corridor protection and migratory bird habitat. It highlights several issues and trends that Virginia faces in the coming years, with the most critical being funding and economics, outdoor recreation, and land conservation and key infrastructure planning (Virginia Department of Conservation & Recreation 2007).

##### *Accomack County Comprehensive Plan (2008)*

The Accomack County Comprehensive Plan provides an inventory of existing conditions, list of issues and concerns, future land use plan, and goals, objectives, and recommendations. The plan identifies natural resource preservation as an important issue and goal for the future. The plan recognizes that the County’s natural resources base, including forests, fields, marsh, creeks, bays, and barrier islands, has economic, aesthetic, and recreational value, as well as being valuable habitat for a variety of wildlife. The plan states that the County will enact a variety of policy, regulatory, and program tools to preserve farmland, shorelines, water resources, and other natural resources (County of Accomack 2008).

*Town of Chincoteague Comprehensive Plan (2010)*

The Town of Chincoteague Comprehensive Plan provides a community profile, with information on the history, socioeconomic characteristics, natural features, and land use of the Town of Chincoteague, and goals, objectives, and implementation strategies for land use, economic development, community facilities, transportation, and housing. The plan focuses on balancing growth and economic development with economic and environmental sustainability. The plan identifies tourism and aquaculture as two primary areas of concern for economic development and establishes a resource conservation planning area to complement the purpose and objectives established by the NPS and the USFWS for Assateague Island National Seashore and Chincoteague NWR. This includes maintaining the protections afforded by barrier islands from storm events and protecting the diverse and unique ecology that serves as the basis for the Town's economy and visitation to the area (Town of Chincoteague 2010).

**Appendix C**



USFWS

*Ruddy Turnstone*

## **Laws and Executive Orders Applicable to Chincoteague NWR and Wallops Island CCP**



Legal mandates and policies of the U.S. Fish and Wildlife Service (USFWS) govern our planning and management of the National Wildlife Refuge System (Refuge System). A list and brief description of these legal mandates can be found at the “Division of Congressional and Legislative Affairs, USFWS” Web site (<http://www.fws.gov/laws/Lawsdigest.html>). In addition, USFWS has developed policies to guide NWRs planning and management. These policies can be found at the “NWRs Policies Web site” (<http://www.fws.gov/refuges/policiesandbudget/refugepolicies.html>).

All projects and step-down plans described in a CCP will be required to comply with the National Wildlife Refuge System Improvement Act of 1997 and the National Environmental Policy Act (described in Chapter 1 of the CCP), as well as a variety of other Federal regulations, EOs, and legislative acts. A brief description of the laws and EOs applicable to Chincoteague and Wallops Island NWR CCP, as well as a statement indicating how each relates to the CCP, is provided in Table 1.

**Table 1. Applicable Laws and Executive Orders**

| Law, Regulation, or Guideline                                                                                                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Relation to the CCP                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Enabling Legislation</b>                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                          |
| Public Law 89-195 (16 U.S.C. 459f) (1965)                                                                                                                  | Created the Assateague Island National Seashore and authorized the Secretary of the Department of Interior to acquire all of the right, title, or interest of the Chincoteague-Assateague Bridge and Beach Authority, in the bridge constructed by such Authority across the Assateague Channel, together with all lands or interests therein, roads, parking lots, buildings, or other real or personal property of such Authority, and such right, title, and interest have been acquired by the National Park Service. | The CCP references this law in determining ownership of the Chincoteague-Assateague Bridge and in continuing the recreational beach as referenced above. |
| 16 U.S.C. § 667b, Public Law 80-537, An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other Purposes; and,                        | Authority under which Wallops Island NWR was established.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | The CCP relies on this authority for defining the purpose of the CCP.                                                                                    |
| 16 U.S.C 715-715r, The Migratory Bird Conservation Act, as amended and Established under the authority of the Migratory Bird Conservation Act, as amended. | Authority under which Chincoteague and Wallops Island NWRs were established.                                                                                                                                                                                                                                                                                                                                                                                                                                              | The CCP relies on this authority for defining the purpose of the CCP.                                                                                    |

| Law, Regulation, or Guideline                                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Relation to the CCP                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Climate Change</b>                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                          |
| Department of the Interior Secretarial Order 3226                   | States that there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision-making in the U.S. This Order requires Departmental planning and decision-making to take climate change impacts into account. Additionally, it calls for the incorporation of climate change considerations into long-term planning documents, such as Comprehensive Conservation Plans (CCP). | The CCP identifies addressing climate change as part of its purpose and establishes objectives and strategies that aim to meet this order.                                                                                                                                                               |
| <b>Agency Coordination</b>                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                          |
| Executive Order 12372, Intergovernmental Review of Federal Programs | Requires that Federal agencies afford other agencies review of documents associated with Federal programs.                                                                                                                                                                                                                                                                                                                                                      | Availability of the EIS will be advertised in the Federal Register and copies of the draft CCP/EIS will be sent to Federal, State (including the State Clearinghouse), and local agencies and Tribal governments.                                                                                        |
| <b>Human Rights</b>                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                          |
| Executive Order 12898, Environmental Justice                        | Mandates Federal agencies to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.                                                                                                                                                                                                | Implementing the CCP will not have a disproportionately high and adverse human health or environmental effect on minority or low-income populations. The CCP promotes compatible uses of the land that protect the natural resources and provide opportunities for wildlife-dependent recreational uses. |

| Law, Regulation, or Guideline                                                                                  | Description                                                                                                                                                                                                                                                                                                                                                                             | Relation to the CCP                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Architectural Barriers Act of 1968, as amended (42 U.S.C. §§ 4151 et seq.)                                     | Requires that all new federal buildings and facilities constructed or altered with federal funds since 1968 be accessible to and usable by individuals with disabilities. Also requires that modifications be made to existing buildings and facilities to ensure that individuals with disabilities have equal access to any program or opportunity provided to employees or visitors. | New buildings on the refuge will comply with these requirements. Where appropriate, new trails and outdoor facilities will be designed per the draft accessibility guidelines for outdoor developed areas.                                                                 |
| <b>Cultural Resources</b>                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                            |
| Antiquities Act of 1906                                                                                        | This act authorizes the scientific investigation of antiquities on Federal land. It prohibits and provides penalties for unauthorized search for or collection of artifacts or other objects of scientific interest. The Act also authorizes the President to establish national monuments and cultural areas on Federal lands.                                                         | USFWS will continue to comply with this Act under the CCP.                                                                                                                                                                                                                 |
| Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 25 USC 3001 et seq.)(NAGPRA)       | Regulations for the treatment of Native American graves, human remains, funeral objects, sacred objects, and other objects of cultural patrimony. Requires consultation with Native American Tribes during Federal project planning.                                                                                                                                                    |                                                                                                                                                                                                                                                                            |
| Executive Order 11593, Protection and Enhancement of the Cultural Environment                                  | States that if the USFWS proposes any development activities that may affect archaeological or historical sites, the USFWS will consult with Federal and State Historic Preservation Officers to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.                                                                                                 | Cultural resources that have been identified will be protected, and steps to avoid any inadvertent impacts to subsurface deposits that have yet to be identified will be taken as required by this Order. The USFWS will continue to comply with this Order under the CCP. |
| Archaeological Resources Protection Act of 1979 (PL 96-95; 93 STAT 722; 16 USC 470aa-47011), as amended (ARPA) | Protects materials of archeological interest from unauthorized removal or destruction and requires Federal managers to develop plans to locate archaeological resources.                                                                                                                                                                                                                | Cultural resources that have been identified will be protected, and steps to avoid any inadvertent impacts to subsurface deposits that have yet to be identified will be taken. The USFWS will continue to comply with this Act under the CCP.                             |

| Law, Regulation, or Guideline                                                                                          | Description                                                                                                                                                                                                                                                                                                                                                                                     | Relation to the CCP                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| American Indian Religious Freedom Act 1978 (PL 95-341; 92 STAT 469; 42 USC 1996)                                       | Provides for freedom of Native Americans to believe, express, and exercise their traditional religion, including access to important sites.                                                                                                                                                                                                                                                     | The Tribes will be contacted regarding the CCP and will be invited to provide information necessary to protect sacred sites and other resources.                                                                                                                 |
| National Historic Preservation Act of 1966 (PL 89-665; 50 STAT 915; 16 USC 470 et seq.; 36 CFR 800), as amended (NHPA) | Requires Federal agencies to consider the effects of any actions or programs on historical properties.                                                                                                                                                                                                                                                                                          | The EIS prepared to accompany the draft CCP addresses the potential effects of the actions proposed in the CCP and includes measure to ensure that no adverse effects to historical properties will occur.                                                       |
| Archaeological and Historic Preservation Act of 1974 (PL 93-291; 88 STAT 174; 16 USC 469)                              | Provides for the preservation of historical buildings, sites, and objects of national significance.                                                                                                                                                                                                                                                                                             | Potential historical resources have been identified in the CCP and those of national significance will be preserved. The USFWS will continue to comply with this Act under the CCP.                                                                              |
| <b>Tribal Coordination</b>                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                  |
| Executive Order 13175, Consultation and Coordination with Indian Tribal Governments                                    | Requires Federal agencies to implement an accountable process to ensure meaningful and timely input by tribal officials as policies are developed that have tribal implications.                                                                                                                                                                                                                | Tribal governments in Virginia were initially consulted prior to publication of the Notice of Intent and have continued to be updated on the progress of the CCP.                                                                                                |
| <b>Paleontological Resources</b>                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                  |
| Paleontological Resources Preservation Act of 2009 (P.L. 111-11, Title VI, Subtitle D)                                 | Requires the management and protection of paleontological resources on federal lands using scientific principals and expertise; requires the development of plans for the inventory, monitoring, and scientific and educational use of paleontological resources; addresses the collection and curation of resources; identifies prohibited acts, and establishes criminal and civil penalties. | The potential effects of refuge actions on paleontological resources have been evaluated and there is a low potential for these resources to be present on the refuge. The USFWS will however comply with the provision of this Act as applicable under the CCP. |
| <b>Biological Resources</b>                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                  |

| Law, Regulation, or Guideline                                                          | Description                                                                                                                                                                                                                                                                                                                                                                            | Relation to the CCP                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Endangered Species Act of 1973 (16 USC 1531 et seq.), as amended (ESA)                 | Provides for protection of plants, fish, and wildlife that have a designation as threatened or endangered.                                                                                                                                                                                                                                                                             | An Intra-Service Section 7 has been completed that evaluates the effects of the proposed actions on the refuge's endangered and threatened species.                                                           |
| National Environmental Policy Act of 1969 (42 USC 4321 et seq.) (NEPA)                 | Requires analysis, public comment, and reporting for environmental impacts of Federal actions.                                                                                                                                                                                                                                                                                         | The public will be notified of the availability of the draft EIS and will be provided with a 60-day period to provide comments.                                                                               |
| Fish and Wildlife Act of 1956 (16 USC 742a-743j, not including 742d-742l)              | Provides Secretary of Interior with authority to protect and manage fish and wildlife resources.                                                                                                                                                                                                                                                                                       | USFWS will continue to comply with this Act under the CCP.                                                                                                                                                    |
| Fish and Wildlife Conservation Act of 1980 (16 USC 661-667e), as amended               | Requires the USFWS to monitor non-game bird species, identify species of management concern, and implement conservation measures to preclude the need for listing under ESA.                                                                                                                                                                                                           | The CCP will continue to comply with this Act under the CCP.                                                                                                                                                  |
| Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds | Instructs Federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation Plans, the North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents. | The USFWS has incorporated the strategies and recommendations of the listed management plans into the CCP to conserve migratory birds. The USFWS will continue to comply with this Order under the CCP.       |
| Executive Order 13112, Invasive Species                                                | Federal agencies are required to use relevant programs and authorities to prevent, control, monitor, and research invasive species and coordinate complementary, cost-efficient, and effective activities concerning invasive species by relying on existing organizations already in place that address invasive species issues.                                                      | The CCP addresses the need to work with others to address invasive species issues on the refuge. In addition, an Integrated Pest Management Plan will be prepared for the refuge in association with the HMP. |
| Bald and Golden Eagle Protection Act of 1940 (16 USC 668 et seq.)                      | Provides protection for bald and golden eagles.                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                               |

| Law, Regulation, or Guideline                                                                                            | Description                                                                                                                                                                                                                                                                   | Relation to the CCP                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Migratory Bird Treaty Act of 1918, as amended (MBTA)                                                                     | Provides protection for bird species that migrate across state and international boundaries.                                                                                                                                                                                  | The USFWS will continue to comply with this Act under the CCP.                                                                                                                                                                                |
| Fish and Wildlife Coordination Act of 1958                                                                               | Requires equal consideration and coordination of wildlife conservation with other water resource development programs.                                                                                                                                                        | The CCP acknowledges the need to coordinate refuge actions with the agencies that maintain reservoirs downstream of the refuge.                                                                                                               |
| Federal Noxious Weed Act of 1990                                                                                         | Requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other Federal and State agencies.                                                                                |                                                                                                                                                                                                                                               |
| Emergency Wetlands Resources Act of 1986                                                                                 | Promotes the conservation of migratory waterfowl and offsets or prevent the serious loss of wetlands by the acquisition of wetlands and other essential habitats.                                                                                                             | The CCP includes strategies to protect, restore, and enhance the wetlands that occur on the refuge.                                                                                                                                           |
| <b>Hazardous Materials</b>                                                                                               |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                               |
| Oil Pollution Act of 1990 (PL 101-380; 33 USC 2701, et seq.)                                                             | Provides oil pollution policies and protections.                                                                                                                                                                                                                              | The USFWS will continue to comply with this Act under the CCP.                                                                                                                                                                                |
| Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (PL 96-510; 42 USC 9601, et seq.) (CERCLA) | Provides mechanism for hazardous waste cleanup.                                                                                                                                                                                                                               |                                                                                                                                                                                                                                               |
| <b>Water Quality</b>                                                                                                     |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                               |
| Clean Water Act of 1972, Section 404 (33 USC 1344 et seq.), as amended                                                   | Establishes a program to regulate the discharge of dredged or fill material into waters of the United States (U.S.), including wetlands and requires a permit from the U.S. Army Corps of Engineers before dredged or fill material may be discharged into waters of the U.S. | The CCP requires the implementation of best management practices during ground-disturbing activities to minimize siltation and run-off into adjacent wetlands, as well as during the application of pesticides, all to protect water quality. |

| Law, Regulation, or Guideline                                                                                                                        | Description                                                                                                                                                                                                                                                       | Relation to the CCP                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clean Water Act, Section 401                                                                                                                         | Requires that an applicant for a federal license or permit provide a certification that any discharges will comply with the Act, including water quality standard requirements.                                                                                   |                                                                                                                                                                                                                                                                                                  |
| <b>Land and Water Use</b>                                                                                                                            |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                  |
| National Wildlife Refuge System Administration Act of 1966 (16 USC 668dd-668ee), National Wildlife Refuge System Improvement Act of 1997 (PL 105-57) | Administration, management, and planning for National Wildlife Refuges, Amends the National Wildlife Refuge System Administration Act of 1966. Requires development of CCPs for all refuges outside of Alaska.                                                    | The USFWS determined that hunting, wildlife observation, photography, environmental education, interpretation, research, and recreational trails are compatible with the purposes for which the refuge was established. Implementation of the CCP will therefore satisfy the intent of this Act. |
| Executive Order 11990, Protection of Wetlands                                                                                                        | Provides for the conservation of the natural and beneficial values of wetlands and their associated habitats.                                                                                                                                                     | The CCP includes strategies to protect, restore, and enhance the wetlands that occur on the refuge.                                                                                                                                                                                              |
| Executive Order 11988, Floodplain Management                                                                                                         | Provides for the support, preservation, and enhancement of the natural and beneficial values of floodplains.                                                                                                                                                      | Structures, such as trail bridges, that have the potential to influence the movement of floodwater will be designed to take into consideration the hydrology of the site, thus the proposed action is consistent with this Order.                                                                |
| Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System                                                      | Directs the Secretary of the Interior to recognize compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education/interpretation as priority general public uses on refuges. | The CCP addresses the compatibility of these uses on the refuges.                                                                                                                                                                                                                                |

| Law, Regulation, or Guideline                                                                                                    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Relation to the CCP                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Refuge Recreation Act of 1962, as amended                                                                                        | Provides for recreation use that is compatible with the primary purpose of a refuge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The USFWS determined that hunting, wildlife observation, photography, environmental education, interpretation, and recreational trails are compatible with the purposes for which the refuge was established.                       |
| Fish and Wildlife Improvement Act of 1978                                                                                        | Improves administration of fish and wildlife programs and amends earlier laws including Refuge Recreation Act, NWRS Administration Act, and Fish and Wildlife Act of 1956. Authorizes the Secretary to accept gifts or real and personal property on behalf of the U.S. Also authorizes use of volunteers on Service projects and appropriations to carry out a volunteer program.                                                                                                                                                                                                                                                                                                                      | The CCP acknowledges the continued acquisition of lands within the approved refuge boundary and that some parcels may come into the refuge as a gift or donation. Volunteers will also be an important aspect of refuge management. |
| Coastal Zone Management Act of 1972 (Pub.L. 92-583, 86 Stat. 1280, enacted October 27, 1972, 16 U.S.C. §§ 1451-1464, Chapter 33) | Designates certain undeveloped coastal barrier islands for inclusion in the Coastal Barrier Resources System (System). Areas so designated are ineligible for direct or indirect Federal financial assistance that might support development, including flood insurance, except for emergency life-saving activities. Exceptions for certain activities, such as fish and wildlife research, are provided, and National Wildlife Refuges and other, otherwise protected areas are excluded from the System. The law encourages the conservation of hurricane prone, biologically rich coastal barriers by restricting Federal expenditures that encourage development, such as Federal flood insurance. | The CCP acknowledges the Act and commits to considering climate change when planning or constructing infrastructure, but relevance of the Act's regulations are limited.                                                            |
| Wilderness Act of 1964 (Pub.L. 88-577)                                                                                           | Established the National Wilderness Preservation System and a process for Federal agencies to recommend wilderness areas to Congress.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The CCP commits to maintaining the wilderness character of the proposed wilderness within Chincoteague NWR.                                                                                                                         |
| Other                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                     |
| Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation                                                | Directs Federal agencies, including USFWS, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The CCP supports continued opportunities for hunting on the refuge.                                                                                                                                                                 |

| Law, Regulation, or Guideline                                                                                                                                                           | Description                                                                                                                                                                                                                                                                                                                                            | Relation to the CCP                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Data Quality Act (DQA) passed through the United States Congress in Section 515 of the Consolidated Appropriations Act, 2001 (Pub.L. 106-554). (Also known as Information Quality Act). | Requires Federal agencies to adhere to guidance and regulation issued by the Office of Management and Budget (OMB) that "provide policy and procedural guidance to Federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies". | The CCP commits the refuge to supporting efforts to improve and share data, consistent with USFWS guidance issued in response to this Act. |

**APPENDIX C – ATTACHMENT 1**

*Memorandum for Mosquito Management on National Wildlife Refuges*



# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Washington, D.C. 20240



In Reply Refer To:  
FWS/ANRS-NRCP/057103

MAY 27 2014

Memorandum

To: Regional Directors 1-8

From: Deputy Director

*Rowan W. Gould*

Subject: Mosquito Management on National Wildlife Refuges

This Memorandum sets forth the U.S. Fish and Wildlife Service's (Service) interpretation of existing regulations and policies that allow for mosquito management activities on lands and waters within the National Wildlife Refuge System (Refuges). By issuance of this Memorandum, the Director's Memorandum dated April 8, 2005, *Subject: Interim Guidance for Mosquito Management on National Wildlife Refuges*, is hereby rescinded. Mosquito management activities may occur on Refuges to protect public health when local, current mosquito monitoring data collected by a public health authority or their authorized, designated representative (health authority) indicate that mosquitoes on a Refuge are contributing to a public health threat. Mosquito management activities must be consistent with authorities set forth in this document and with all applicable Federal laws and regulations. A Technical Handbook to guide Service employees is in preparation for interpreting regulations and policies as they pertain to mosquito management activities and understanding mosquitoes and management alternatives.

## Refuge Administration Act

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Administration Act) (16 U.S.C. §§ 668dd-668ee) authorizes the Service to establish regulations and policies for managing Refuges and to govern Refuge uses. The Administration Act also prohibits uses that are not compatible with the purpose(s) of an individual Refuge and the mission of Refuges. As authorized by the Administration Act, the Service will use existing regulations and policies to guide mosquito management decisions and actions on Refuges. Title 50 Code of Federal Regulations (CFR) Subchapter C, Part 25 -28 are the primary enabling regulations of the National Wildlife Refuge System. Guiding policies are: Comprehensive Conservation Planning Process (602 FW 3), Step-Down Management Planning Policy (602 FW 4), Biological Integrity, Diversity, and Environmental Health (601 FW3), Integrated Pest Management (569 FW 1), Appropriate Refuge Uses (603 FW 1), and Compatible Uses (603 FW 2).

The Refuge Administration Act, 668dd (k) emergency power, states that the Secretary of the Department of the Interior may temporarily suspend, allow, or initiate any activity in a Refuge to protect the health and safety of the public or a fish or wildlife population. Authority to make these decisions is delegated to the Refuge manager, but decision-making may include coordination with Regional and National Service personnel. We may expedite preparation of

special use permits, pesticide use proposals, and other compliance documentation for situations that require emergency response to protect the health and safety of the public.

### **Regulations of the National Wildlife Refuge System**

Title 50 CFR Subchapter C, §25-38, Administrative Provisions, are the enabling regulations of the National Wildlife Refuges System as authorized by the Refuge Administration Act. 50 CFR §25.21 (a), (b), and (c) set forth the regulations that allow a Refuge manager to open or close a Refuge or take an action or temporarily allow a use to protect health and safety of the public. 50 CFR §25.31 sets forth the general provisions for public notification of changes in use. 50 CFR §25.41-43 establish responsibility and requirements for issuance or revocation of Refuge permits and the appeals procedures. 50 CFR §26.41 establishes regulations regarding determination of compatible Refuge uses. 50 CFR §27.51 establishes that disturbing, injuring, spearing, poisoning, destroying, collecting or attempting to disturb, injure, spear, poison, destroy or collect any plant or animal on a Refuge is prohibited except by special permit.

### **Comprehensive Conservation Planning Policy and Step-Down Management Planning**

The Service's Comprehensive Conservation Planning (CCP) policy (602 FW 3) describes the process we use to establish long-range guidance and management direction to achieve Refuge purposes and fulfill the Refuge mission. Comprehensive Conservation Plans may include, but are not limited to, Refuge-specific Integrated Pest Management Plans, Invasive Species Management Plans, or Mosquito Management Plans, as appropriate. The Service's Step-Down Management Planning Policy 602 FW 4 allows for Step-Down Management Plans, such as Integrated Pest Management Plans and/or Mosquito Management Plans that may be prepared when necessary to provide strategies and implementation for meeting goals and objectives identified in a CCP; all are subject to National Environmental Policy Act of 1969 (42 U.S.C. 4321 - 4347) compliance documentation.

### **Biological Integrity, Diversity and Environmental Health Policy**

The Service's Biological Integrity, Diversity and Environmental Health Policy (BIDEH) policy (601 FW 3) sets forth a process and directs Refuge managers to maintain and restore the biological integrity, diversity and environmental health of a Refuge. The underlying principle of BIDEH is to ensure wildlife conservation; biological integrity, diversity, and environmental health are critical components of wildlife conservation. If a public health authority has advised a Refuge manager of a public health risk or threat due to mosquitoes on a Refuge, BIDEH guides Refuge manager's review of the public health authority's proposed alternatives for mosquito management. A Refuge manager considers the Refuge mission and the biological integrity, diversity and environmental health of the Refuge, and works with the public health authority to select a mosquito management alternative that achieves the necessary reduction of public health threat while maintaining the Refuge purpose and minimizing adverse effects to biological integrity, diversity and environmental health.

## **Integrated Pest Management Policies**

Department of the Interior 517 DM 1 Integrated Pest Management policy 517 DM 1.3 C allows for management of pests, defined as any living organism that may interfere with the site-specific purposes, operations, or management objectives or that jeopardizes human health and safety. Further, 517 DM 1.4 and 1.5 direct that the departmental bureaus will manage pests using integrated pest management (IPM) principles such that risks from both the pests and the associated pest management activities are reduced; that pest management be accomplished through cost-effective means that pose the least risk to humans, natural and cultural resources and the environment, and that all applicable Federal authorities are incorporated when addressing pest issues.

The Service's IPM policy, 569 FW 1, follows the Department policy. Under 569 FW 1.3 and 1.6 we manage pests that interfere with site management goals and objectives, when public health or safety is jeopardized, when there is a threat to wildlife health; and when action thresholds for the pest are exceeded. The Service receives no appropriated funds for mosquito management activities. Unless mosquito populations interfere with site management goals and objectives, or jeopardize human health or safety, the Department and Service policies authorize Refuge managers to allow native mosquito populations to exist unimpeded. When a public health authority identifies to the Service that there is a threat to public health from mosquitoes on a Refuge, Refuge managers are authorized to allow mosquito management actions on the Refuge as long as the activities are in full accordance with Service regulations, policies and permitting procedures. Public health authorities may work with Refuges to use IPM principles that include surveillance/monitoring and thresholds that will support actions to respond to public health threats and emergencies, to avoid and avert public health threats and to reduce the risk of public health threats due to mosquitoes on Refuges. Under the IPM policy, the National IPM Coordinator works with the Regional IPM Coordinators and other technical advisors to inform employees about mosquito management techniques and products.

Section 569 FW 1.4 directs managers to use the most effective IPM method or combination of methods that pose the lowest risk to fish, wildlife, and their habitats. Section 569 FW 1.7 also directs managers to choose pest management methods by considering human health, environmental integrity, effectiveness, and cost. Refuge managers evaluate the mosquito treatment options using this policy.

## **Appropriate and Compatible Use Policies**

The Service's Appropriate Refuge Uses (603 FW 1) policy provides evaluation procedures (603 FW 1.11A (3)) for Refuge managers to ensure that a new or existing mosquito management action or control method is an appropriate Refuge use. There are five types of Refuge uses, mosquito management to protect human health and safety would be covered under 603 FW 1.10 D Specialized Uses.

The Service's Compatible Use (603 FW 2) policy and the associated regulations (50 CFR §26.41) provide guidelines and direct Refuge managers to ensure that a new or existing mosquito management method or activity will not interfere with or detract from the fulfillment of Refuge purpose(s) and the mission of the Refuge System, and that any use considered compatible is

periodically reviewed, and complies with all applicable laws, policies, and regulations. 603 FW 2.10C further describes the emergency power authorization provided in the Administration Act, as follows: “Authority to make decisions under this emergency power is delegated to the refuge manager. Temporary actions should not exceed 30 days and will usually be of shorter duration. The refuge manager will create a written record (memorandum to the file) of the decision, the reasons supporting it, and why it was necessary to protect the health and safety of the public or any fish or wildlife population.”

### **Summary**

As authorized by the Administration Act, the Service will use the existing regulations and policies summarized above when considering and authorizing mosquito management actions on Refuges. Although mosquitoes are generally considered part of the natural ecosystem in most Refuge habitats in which they occur, the Service recognizes that Federal, State or local public health authorities (or their authorized, designated representative) may document and identify that there is a threat to public health from mosquitoes on a Refuge. Public health authorities may work with Refuges to plan surveillance and monitoring programs that provide information to respond to public health threats and emergencies, to implement actions to avoid public health threats and reduce the risk of public health threats due to mosquitoes on Refuges. When a public health authority advises the Service of a threat to health and safety of the public from mosquitoes arising from a Refuge, we will work with the public health authority to allow them to reduce the public health risk on the Refuge, as long as the activities are in full accordance with our regulations, policies and permitting procedures.

**Appendix D**

John White and Steve Hillebrand



*Chincoteague Ponies*

# **Interim Chincoteague Pony Management Plan**



# 2013 INTERIM CHINCOTEAGUE PONY MANAGEMENT PLAN



07-26-10 Patrick J. Hendrickson / Highcamera.com

Draft by:

Emily Grey – Writer Editor  
Chincoteague National Wildlife Refuge

*Emily Grey*

Reviewed by:

Harry S. Thornton – Pony Committee Chairman  
Chincoteague Volunteer Fire Company

*Harry S. Thornton*

Edit & Submitted by:

Louis Hinds – Refuge Manager  
Chincoteague National Wildlife Refuge

*Louis S. Hinds* 02/06/2013

## Table of Contents

|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| <b>PURPOSE .....</b>                                                | <b>4</b>  |
| <b>BACKGROUND AND HISTORY .....</b>                                 | <b>4</b>  |
| The Refuge: .....                                                   | 4         |
| The Ponies and the CVFC: .....                                      | 6         |
| Ash Wednesday Storm:.....                                           | 7         |
| Pony Roundup and Auction: .....                                     | 8         |
| <b>CLIMATE CHANGE AND ASSOCIATED SEA LEVEL RISE.....</b>            | <b>9</b>  |
| <b>ECONOMIC IMPORTANCE OF PONIES .....</b>                          | <b>10</b> |
| Regional and Local Economy: .....                                   | 10        |
| Fireman’s Carnival and Pony Swim:.....                              | 11        |
| <b>MANAGEMENT AND OPERATIONS.....</b>                               | <b>11</b> |
| 2012 Pony Population Estimates: .....                               | 11        |
| Grazing Units.....                                                  | 12        |
| Southern Grazing Unit (Black Duck Marsh).....                       | 12        |
| Northern Grazing Unit (Pony Grate to MD/VA Line) .....              | 12        |
| Wayward Ponies and Volunteer Call Out: .....                        | 13        |
| Fence Line Repairs and Replacement: .....                           | 13        |
| Entrance to Refuge by CVFC Pony Committee (Official Business):..... | 14        |
| Severe Weather Operations: .....                                    | 15        |
| Pre-storm .....                                                     | 15        |
| Post-storm Operations.....                                          | 16        |
| Supplemental Feeding and Watering .....                             | 16        |
| Stock Replacement: .....                                            | 17        |
| Disease and Injury:.....                                            | 18        |

Fees: ..... 18

Use of Ponies in Impoundment Vegetation Management: ..... 19

Exclosures and Photo-documentation points:..... 19

**COORDINATION WITH THE NATIONAL PARK SERVICE.....20**

Horse Management by ASIS in Maryland: ..... 20

Fence Line at the VA/MD State Line: ..... 20

**CONSIDERATIONS FOR THE CVFC.....20**

Hired Staff/Range-Hand:..... 20

Annual Special Use Permit ..... 21

**BIBLIOGRAPHY.....22**

**APPENDICES: .....25**

Appendix I - Veterinary Care and Procedures as explained by Dr. Charles Cameron DVM:..... 25

Appendix II - HISTORY of SEA LEVEL RISE and ASSATEAGUE ISLAND..... 26

Appendix III – Pony Management Areas Map ..... 29

Appendix IV - List for Emergency Calling ..... 30

Appendix V - Special Use Permit: 81312 - FY 2013 ..... 31

Appendix VI - Intra-Service Section 7 Biological Evaluation for Chincoteague Pony Penning and Piping Plover/Sea Turtle Management..... 41

## **2013 INTERIM CHINCOTEAGUE PONY MANAGEMENT PLAN**

### **PURPOSE**

The purpose of the Interim Chincoteague Pony Management Plan (Plan) is to provide a written framework for the management of the semi-wild population of horses, known as Chincoteague ponies (ponies) on the Virginia portion of Assateague Island for a 5 – 10 year period. This plan builds upon the Chincoteague Pony Management Plan which was signed in 1990 and revised in 1995.

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a refuge and provide long-range guidance and management direction to achieve refuge purposes. This Plan will provide provisional guidance for the management of the ponies during the development of the CCP and until such time that a more robust management plan can be developed. This Plan will be incorporated into the CCP, and corresponding Environmental Impact Statement, as an attachment.

The Refuge Administration Act sets forth a mandate to ensure that all “uses” be managed in a manner compatible with the Refuge’s primary purposes. The Refuge is working to balance increasing demands for recreation and economic opportunities with the need to protect and enhance wildlife populations that depend on the Refuge.

Careful observation, research, and cooperation of the Chincoteague Volunteer Fire Company (CVFC), the National Park Service (NPS), the Fish and Wildlife Service and the community will continue to ensure that the hardy ponies remain healthy and do not detract from Assateague Island’s diverse natural resources.

### **BACKGROUND AND HISTORY**

The Refuge:

Under the auspices of the Fish and Wildlife Service (Service), an agency within the Department of the Interior (DOI), the Chincoteague National Wildlife Refuge (Refuge) was established on May 13, 1943 through acquisition of 8,808 acres under authority of the Migratory Bird Conservation Act. The Assistant Secretary of the Interior determined that FWS ownership of this land was necessary for protection during nesting and migration seasons of all those species of wildlife determined as being of great value as a source of food, or in destroying of injurious insects, or nevertheless in danger of extermination through lack of adequate protection (U.S. District Court 1943). The Migratory Bird Conservation Commission (MBCC) initially approved

the Refuge at a meeting on March 25, 1941, acknowledging the importance of Assateague Island as wintering habitat for migrating greater snow geese, and nesting habitat for black ducks, shorebirds, and migratory birds (MBCC 1941). At that time they also approved acquisition of Jerico and Hebron Islands, two small marshes adjacent to Assateague Island, just north of the Virginia boundary in Maryland.

Since 1943, numerous tracts of land have been added to the Refuge. All lands have been purchased under the authority of either the Migratory Bird Conservation Act {16 U.S.C. 715d}, Refuge Recreation Act {16 U.S.C. 460 K-1}, and the Emergency Wetlands Resources Act of 1986. Federal title of these lands is acquired to the mean low water line. In 1990, Assawoman and portions of Metompkin Island (1,608.5 acres total) were purchased with Land and Water Conservation Funds.

Refuge purposes are taken from enabling legislation and acquisition authorities for a particular refuge and from Congressional legislation affecting the refuge system as a whole. CNWR “purposes” include:

- 1) “ ... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- 2) "... suitable for— (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." 16 U.S.C. § 460k-1 "... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ..." 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).
- 3) "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. § 3901(b) (Emergency Wetlands Resources Act of 1986)
- 4) "... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. § 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956)
- 5) "... for conservation purposes ..." 7 U.S.C. § 2002 (Consolidated Farm and Rural Development Act)

In 1997, Congress passed the landmark National Wildlife Refuge System Improvement Act (NWRISA) establishing a unifying mission and a wildlife-first mandate for the Refuge System. The NWRISA affirmed that: refuges are anchors for biodiversity and ecosystem-level conservation; lands and waters of the System are biologically healthy; and refuge lands reflect national and international leadership in habitat management and wildlife conservation.

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

The NWRISA also declares that all existing and proposed public uses must be compatible with each refuge's purposes, and highlights six priority public uses that each Refuge should evaluate for compatibility. These are; wildlife observation, photography, interpretation, environmental education, hunting and fishing. Recreational activities allowed on CNWR are also influenced by the Assateague Island National Seashore (ASIS) within which the Assateague Island portion of the Refuge lies.

Now, almost 70 years later, the Refuge is managed to support a number of migratory bird species, federal threatened and endangered species, and a number of federal or state species of conservation concern. As one of the most visited refuges in the country, Chincoteague also provides a range of recreational opportunities and supports a critical part of the local economy.

### The Ponies and the CVFC:

The legacy of the ponies is rich and enigmatic. Historical documents refer to domestic and wild livestock, including horses, on Assateague Island since the late 1600s. There is no recorded evidence on how the earliest horses arrived on Assateague Island, though legends romanticize the ways.

There are some that believe Native Americans released them on the islands. Others firmly believe the ponies are descendents from horses that swam ashore from the wreck of a Spanish galleon on the shoals of Assateague Island. However, the most realistic explanation is that the ponies originated from domestic stock of early Eastern Shore settlers. The pasturing of livestock on Assateague Island was done to evade taxes and fencing laws enacted to protect crops.

No matter what the origins of the ponies, early accounts describe grazing horses and cattle on Assateague and other barrier islands along the entire Atlantic Coast. These animals were semi-wild and roamed freely on the island(s). Existing on a barrier island subjected them to a wide variety of environmental extremes. Excessive heat and cold, strong northeasters, hurricanes,

tidal surges, snowstorms, droughts, biting insects, etc. made their existence difficult and their management problematic.

Archival research conducted by John Amrhein, Jr., author of *The Hidden Galleon*, suggests that a very powerful hurricane in 1749 eradicated all livestock on Assateague Island. Former governor of Virginia, Henry A. Wise, is credited as providing the earliest eyewitness testimony to the size of horses inhabiting Assateague Island. Attributed to him is the following statement reported in the 1840s:

“There has been, since long before the American Revolution, on the islands along the sea-board of Maryland-Virginia, a race of very small, compact, hardy horses, usually called beach horses .... They are very diminutive, but many of them are of perfect symmetry and extraordinary powers of action and endurance...and [one] was yet so small that a tall man might straddle one and his toes touch the ground on each side.”

Wise, an Accomack County resident, lived about 50 miles from Assateague. His knowledge of the ponies is believed to have come from his grandfather, John Cropper, whose grandfather Coventon Corbin lived across the bay from Assateague (See *The Hidden Galleon*, pp. 343-344).

Despite the hardships of managing livestock on barrier islands, periodic roundups and “pennings” were held regularly to determine ownership of animals and to account for and sell excess stock. The year 1925 marked the first pony roundup and swim conducted by the CVFC. Fire company members, later dubbed “Saltwater Cowboys,” herded the ponies to the Assateague Channel and swam them to nearby Chincoteague Island for auction.

With the creation of the Refuge in 1943, the Service granted a permit to livestock owner, Wyle Maddox, to graze cattle and horses on designated portions of the island (Narrative Report (NR) 1943). In 1946, the Service issued the CVFC a Special Use Permit (SUP) for grazing no more than 150 head of horses (NR 1946). Since the early 1950s, the CVFC remains the only permittee with livestock on the Refuge.

In 1947, the ponies reaped national and international attention with Marguerite Henry’s children’s classic, *Misty of Chincoteague*. The later movie version in 1961 further heightened the popularity of the authentic island pony and its lineage. To children and adults, “Misty of Chincoteague” is an iconic symbol of the spirited, pretty ponies frolicking on Assateague Island.

### Ash Wednesday Storm:

A very powerful and long lived northeaster devastated Chincoteague and Assateague Islands from March 6-8, 1962. Because it fell during the first day of Lent, it is historically known as the Ash Wednesday Storm of 1962.

Unusually high tides during a new moon, winds up to 60 and 70 miles per hour, and crashing breakers caused flooding on 95 % of Chincoteague Island. Water rose six feet deep on Main Street as individuals sought safety at the second-story level. Electricity and telephone lines as well as the causeway to the mainland were cut off. On Assateague Island, the dunes and other habitats were flattened or otherwise damaged. Countless animals perished including a majority of the famous ponies. (Mariner, K., 1996, *Once Upon an Island*, pp. 140-142).

For over four months, outsiders and islanders helped the Town of Chincoteague and Assateague Island heal. Ponies penned that summer came from “Yankee” stock, imported to replenish the “storm-wasted” Assateague herd (See *Virginian-Pilot*, Feb. 1964, p.1).

### Pony Roundup and Auction:

The ponies are a registered breed owned by the Chincoteague Volunteer Fire Company (CVFC) a 501c3 nonprofit organization. Annually three pony roundups take place; spring, summer and fall. The roundups are conducted by the fire company members and volunteers, riding horses. The presence of a veterinarian is required during all Pony Penning activities.

Both the spring and fall roundups take two days to complete. The spring pony roundup is done during the month of April to assess individual pony health after the winter season. Ponies are inoculated, blood is drawn for certain tests, and females are checked for pregnancy (See Appendix 1, “Veterinary Care and Procedures as explained by Dr. Charles Cameron DVM.”) The fall pony roundup is conducted in October to assess individual pony health before the onset of winter. Additionally, any foals that were sold during the auction but were too young to be weaned from the mare will be separated from the herd and given to their new owners.

The summer event takes place in the last week of July in which the Wednesday and Thursday fall within the month of July. This provides consistency in long range planning efforts for the CVFC, the Refuge, Town of Chincoteague, Chamber of Commerce, and tourism related agencies. The summer event is conducted in several specific phases:

1. Round-up and penning: On Saturday the south herd is rounded up and placed in the south corral. Following the round-up the veterinarian begins his/her health checks and identifies those individuals too old or young to make the swim to Chincoteague Island. The next day (Sunday) the process is repeated for the north herd. These animals are placed in the north corral and the veterinarian repeats the process of health checks and identification of those too old or young to make the swim.
2. Sunrise walk: On Monday morning at daybreak, the north herd is moved south down along the Atlantic Ocean beach to the south corral. This “Pony Walk” has become a major tourist attraction bringing approximately 1,500 to 3,000 people to the beach to witness this sunrise experience. This is currently a major public event requiring the

establishment of a small Incident Command System team and the entire Refuge staff to manage the crowds present that day.

Disturbance and/or harm to Federal threatened piping plovers, nests, and broods along the Pony Walk route is a concern. **The Pony Walk route is determined annually by the refuge manager.** If piping plover chicks are present within the Pony Walk route, CVFC will herd the ponies along an alternate route to avoid contact with plover broods (see Appendix 6 – Intra-Service Section 7 Biological Evaluation). On Tuesday, the ponies rest in the south corral.

3. Pony Swim: On Wednesday morning, the “Saltwater Cowboys” move the entire herd across the south pasture to Assateague Channel where at slack tide (high or low tide) the ponies are driven into the water for the swim over to Chincoteague Island. Thousands of exhilarated tourists watch the swim trying to get that once in a lifetime picture. After a brief rest at the shoreline the ponies are then paraded to the CVFC carnival grounds.
4. Pony Auction: On Thursday, the foals are auctioned by CVFC to the highest bidder. Money collected from the sale of the foals allows the CVFC to purchase new fire and rescue vehicles as well as maintaining the current fleet. This funding source is viewed by the community as critically important to safeguard the community, the Refuge and its visitors.
5. Return of Ponies to Refuge: On Friday, guided by the “Saltwater Cowboys,” the southern herd stallions and mares swim back to Assateague Island. The north herd is transported by truck to the north pasture. The few foals, too young to be separated from their mothers, are kept at the carnival grounds until they are old enough to be transferred to their new owners.

## CLIMATE CHANGE AND ASSOCIATED SEA LEVEL RISE

For the last million years, the earth’s climate has changed from a cold ice age to a warm interglacial period back to an ice age roughly every 100,000 years. These changes have had enormous impacts on plant and animal life, human societies, and sea level with lowest levels during cold periods and highest levels during warm periods. Hence, changing sea level is not a recent phenomenon (Pew Center on Global Climate Change 2007).

Research now indicates that the Mid-Atlantic coastline is experiencing a rate of sea-level rise that is second only to that of the Louisiana and Texas wetlands/coastline along the Gulf of Mexico. Delissa Padilla Nieves, (2009), conducted a Sea Level Affecting Marsh Model (SLAMM) analysis for the lower Delmarva Peninsula. The results of that modeling revealed an

overall loss of approximately 57% of the salt marsh by the year 2100 under a 1 meter sea level rise scenario. This is alarming since most of the grazing area within the southern compartment (547 acres) consist primarily of salt marsh. In the northern compartment (3,399 acres) much of this unit is also salt marsh but it does have a more upland shrub/scrub and pine forest component.

Continued grazing by Chincoteague ponies in the salt marshes of the two grazing compartments is expected to reduce and/or eliminate the accumulation of detritus (decaying vegetation.) This build up of decaying vegetation is thought to be vital if salt marsh root systems are to keep pace with rising sea-levels. Reducing grazing pressure on the salt marsh is consistent with CVFC's goal of maintaining a viable healthy population of Chincoteague ponies on the Refuge.

Assateague Island is continually changing shape and geographic location. Refuge managers, park superintendents, wildlife biologists, and the CVFC will all need to work together to maintain pony grazing units that are robust so as to provide for a healthy pony herd that is self-sustaining, without human intervention, in light of a warming climate and corresponding sea-level rise. This issue will need to be revisited (at a minimum every 10 years) as new information becomes available from the scientific community. (See Appendix II - HISTORY of SEA LEVEL RISE and ASSATEAGUE ISLAND for more information on this topic.)

## **ECONOMIC IMPORTANCE OF PONIES**

### **Regional and Local Economy:**

The Assateague Island recreational beach, the ponies, and the Refuge are the Town of Chincoteague and Accomack County's major tourist attractions. Every year the Refuge experiences between 1.2 and 1.5 million visits. This makes the Refuge one of the top five most visited National Wildlife Refuges in America. Peak visitation to the area occurs Memorial Day weekend through Labor Day.

Eighty to 90 % of over 160,000 visitors stopping at the Eastern Shore Visitor Center located at the Chesapeake Bay Bridge-Tunnel plan to visit Chincoteague. This translates into over \$100 million dollars spent in the regional economy for lodging, meals, gasoline, souvenirs, recreation, and other items. The Town of Chincoteague accounts for approximately 60% of the county's total collected Lodging Excise Tax.

In 2010, the town completed a visitor survey. Eighty percent of Chincoteague visitors selected Assateague Beach as their top destination. Viewing the wild ponies consistently ranked among the top three activities most important to visitors.

## Fireman's Carnival and Pony Swim:

By far, the Fireman's annual carnival, along with the annual Pony Swim and Auction, is the largest single event that draws tourists to the town. Beginning around the Fourth of July and continuing until the first weekend in August, the carnival is held every weekend and then every night of Pony Penning week except Sunday. Money collected from this much anticipated celebration allows the CVFC to purchase new fire and rescue vehicles and to maintain its current fleet which is vitally necessary to safeguard the community, the Refuge and its visitors.

In 2012, 67 foals were sold at auction for a total of \$96,625. The average price was \$1,442/foal. The veterinarian costs for the year were \$18,000, and hay and grain cost for supplemental feeding \$12,500 (Letter dated 9/25/2012, from Harry Thornton).

## MANAGEMENT AND OPERATIONS

### 2012 Pony Population Estimates:

During the spring roundup of 2012, the CVFC estimated the adult pony population was approximately 125 animals. However as of 8/31/2012, that estimate was revised to 134 ponies on the refuge; 22 stallions and 112 mares. Twenty One (21) ponies roam within the southern compartment of the Refuge and 113 ponies graze within the northern compartment. (Letter dated 9/25/2012, from Harry Thornton).

The current SUP grants the CVFC, "...the grazing of not more than 150 head of wild ponies," on the Refuge. In managing for wildlife diversity, quality habitats, and overall environmental health, the Refuge supports a well managed pony herd.

With our current scientific understanding of Climate Change and its potential effects to local weather (i.e. intense rainfall events, stronger coastal storms, frequent coastal flooding, increase in the number of hot days, and sea level rise) the FWS recommends, **but does not demand**, that the current population of 134 adult ponies remain constant (or lower) until the year 2023 (year for the next CD review for this use.) At that time, additional scientific information (10 years of additional Climate Change data) will be available to the CVFC and the Refuge concerning Climate Change. This additional information will allow for better decisions concerning grazing management and population size.

## Grazing Units

The grazing program allows up to 150 adult Chincoteague ponies, a registered breed and owned by the Chincoteague Volunteer Fire Company (CVFC), a 501c3 nonprofit organization, to graze within two separate compartments on the refuge. Foals of the year are annually sold at auction and are not included in count of adult horses.

The present grazing management units include the Southern Management Unit (Black Duck Marsh), totaling approximately 547 acres, and the Northern Management Unit (Pony Grate to MD/VA Line), with over 3,300 acres. These grazing units include four of the 14 waterfowl impoundment management areas. Combined, the two units comprise over 40 % of the Assateague Island portion of the Refuge. (See Appendix III, Map of Chincoteague National Wildlife Refuge Pony Management Areas)

### **Southern Grazing Unit (Black Duck Marsh)**

This 547-acre unit encompasses the entire southern portion of the Refuge west of Beach Road, the road to the boat dock, and areas adjacent to Assateague Channel. This smallest unit used for grazing ponies includes Black Duck Creek and all of Black Duck Marsh. It is comprised of 70% saltmarsh cordgrass, saltmarsh meadow hay, salt grass, and upland grassland (bent grass and Panicum species) with the remaining 30 % in loblolly pine and oak/sweetgum hardwood forest. Tidal flooding occurs during spring and fall lunar tides and severe coastal storm events. Within the higher marsh and forested areas are several natural freshwater pools which usually provide adequate fresh drinking water. However, during times of severe drought conditions, water may be scarce, and animals may be forced to rely on brackish water or supplemental watering by CVFC to sustain them. The Fire Company usually keeps from 30 to 50 ponies in this unit throughout the year.

### **Northern Grazing Unit (Pony Grate to MD/VA Line)**

This 3,399-acre expanse is the largest unit assigned for grazing ponies. Within this designated area are the freshwater impoundments of South Wash Flats, Old Fields, Ragged Point, and a portion of North Wash Flats. These impoundments occupy about 805 acres or 24 % of the total available grazing area. The remaining 2,594 acres consist mostly of saltmarsh cordgrass and saltmarsh meadow hay areas, adjacent to Assateague Channel. Also, on the interior of the island is a maritime forest of primarily loblolly pines and shrub communities with an understory of wax myrtle/greenbrier and upland grass species (Panicum species and bent grass). Most impoundment perimeters have significant areas of forage such as three-square bulrush, red-root nutsedge, and dwarf spikerush.

Located within Northern Grazing Unit is the North Wash Flats Impoundment. From March 15 – September 1, the ponies are excluded from this 704-acre area to provide for a safe haven for Piping Plovers and other migrant shorebirds and waterfowl (Refuge 2008 Intra-Service, Section 7 & Biological Opinion, pp. 5 & 6). This brackish water impoundment located between Chincoteague Bay and the ocean is intensively managed to create Piping Plover nesting and feeding habitat to mitigate impacts from public recreational beach use. It is also managed to mimic natural processes, which occurred before the artificial dunes were constructed (Habitat Management Plan, 2011, p. 55).

### Wayward Ponies and Volunteer Call Out:

The Pony Committee will provide a list of people that will respond to roundup ponies that are found roaming outside of the assigned grazing units. These designated people will act on this matter no later than the first weekend after the horses are detected (see Appendix IV, List for Emergency Calling).

### Fence Line Repairs and Replacement:

Repair and replacement of the approximately 13 miles of fences is an ongoing maintenance issue at the Refuge. Inclement weather, storm tides, sea level rise, fallen tree limbs or blow downs, ponies, people, and ordinary wear and tear continually damage the fence lines that delineate the pony enclosures. In the past the CVFC was responsible for all fence line maintenance. However, a federal court ruling concerning property rights called into question the advisability of continuing this course of action. Therefore, starting in 2008, the Refuge began purchasing materials such as post, wire, and gates and in consultation with CVFC to conduct repair and replacement of fence lines.

Key in fence line maintenance is the cooperation of all parties. Refuge staff working beside CVFC members creates a highly efficient team. The CVFC Pony Committee and the Refuge staff will meet minimally once annually to plan fence line maintenance for that year. It would be beneficial for planning and budgeting purposes for the CVFC and the Refuge to develop a long range fence line replacement schedule.

Mending fence lines in support of the Chincoteague pony management is an appealing volunteer project. Refuge staff and the CVFC should work together to provide opportunities for the public to volunteer and assist in fence line repair. It is imperative that all volunteers be provided with personnel protective equipment and given training on the standards and proper techniques of fence line repairs. In addition, it will be required that all volunteers working for the Refuge sign specified volunteer agreements before commencing work.

Current estimates for ¼ mile barbed wire fence installation including site preparation, materials and labor are shown below.

- Site Preparation:
  - Demolition of existing fence, brush clearing, and other operations. \$1,000 est.
- Materials:
  - Approximate material cost for ¼ mile = \$864
- Labor:
  - ¼ mile constructed by 4 “experienced” workers 96 hrs x \$21.36 = \$2,050

**Total estimated cost for the replacement of ¼ mile of pony fence is:..... \$3,914**

**Total estimated cost for 1 mile of fence is:.....\$15,656**

The 2013 - 2015 fence and gate replacement plan is:

2013.....2.2 miles x \$15,656/mile = \$34,443

2014-15.....4.2 miles x \$15,656/mile = \$65,755

Without considering inflation, the total estimated expenditure for fence replacement from 2013 through 2015 is \$100,198. Fences scheduled for replacement may require additional years to complete contingent on available funds and labor. Volunteers are important in this ongoing project because labor is the predominate cost.

Obtaining access to perform fence maintenance is necessary for the CVFC and the Refuge. To become more proficient at fence maintenance and/or installation, Refuge maintenance and biological staff have developed a GIS map, which shows a fence repair and replacement schedule. This map will be updated annually in consultation with the CVFC Pony Committee and will show what has been accomplished and what remains to be done in future years.

**Entrance to Refuge by CVFC Pony Committee (Official Business):**

Pony Committee members are required to apprise the Pony Committee Chairman and the Refuge Manager of their presence on the Refuge. All Pony Committee members must have a government or CVFC provided photo identification on their person when conducting official Pony Committee activities.

Fire Company members typically drive the official Pony Committee pick-up. Magnetic CVFC signs will be attached to their private transports.

Refuge LE will approach individuals they do not know, who appear to officially represent the CVFC, and ask to see proper identification. If the suspect or suspects are not authorized to be on the Refuge, they will be instructed to leave or be escorted off Assateague Island. This level of security is appropriate due to stolen watering troughs, vandalism, and other potential crimes against CVFC property and ponies.

## Severe Weather Operations:

### Pre-storm

The reoccurrence of severe weather events impacting Assateague Island are well documented in historical records. Northeasters, tropical storms, and hurricanes are a continuous threat to coastal communities and preparedness is everyone's responsibility. To do otherwise is irresponsible.

Annually, the Refuge staff prepares and/or updates the Hurricane Action Plan. This plan along with the Continuity of Operations Plan provides guidance for Refuge operations and staff actions during weather related or other emergencies. Contained within the documents are time frames for actions to be taken by Refuge staff. One of these actions is the closure of the Refuge when a direct impact from a severe coastal storm is predicted. Therefore, the integration of a CVFC action plan that addresses the care of the ponies before and after a major weather event is recommended.

Currently, if a severe weather event is predicted for Assateague Island, the CVFC has several options:

- 1) Do nothing and allow the ponies to weather the storm within the corrals.
- 2) The entrance/exit gates of the North and South grazing compartments will be open by a designated member of the CVFC or Refuge staff **at the request by CVFC**. This will be done so as to allow the ponies to seek the safety of higher ground. If the storm misses the area, the CVFC will promptly roundup the ponies and redistribute them to their respective grazing compartments.
- 3) Roundup the ponies in the South and/or the North compartments prior to the storm and relocate them to a safer location off the island.

At the request of the Refuge Manager, the CVFC developed a one-page emergency action plan in 2008 to describe the actions it would take in the event of a hurricane. However, the 2009 November northeaster identified deficiencies in this plan and in the execution of its strategies. It is recommended that CVFC develop a more detailed emergency action plan that addresses subjects such as, but not limited to:

- evacuation of the pony herd from the South and/or the North grazing compartments

- supplemental feeding and watering
- health and well-being evaluations following a severe storm
- updated emergency call list (See Appendix IV, List for Emergency Calling)

### **Post-storm Operations**

Following a major weather event, the Refuge will be closed to all public entry until qualified staff (either the NPS or the Service) can conduct a Rapid Assessment (RA) of the impacts and/or damages to bridges, roads, buildings, habitat, and wildlife on CNWR. This RA is needed to ensure the safety of Refuge staff and visiting public to Assateague Island.

If possible, the RA will include a visual assessment of the overall well-being of the ponies and their foraging areas. The Refuge Manager or his/her designated representative will contact the CVFC Pony Committee Chairman and provide a verbal assessment of the pony herd.

If necessary, and when conditions are safe for CVFC members to enter the Refuge, the CVFC may move the ponies to suitable areas on the Refuge where they can be confined and provided supplemental food and fresh water.

If there is severe habitat damage, the CVFC should consider removing the horses off the island until the animals and natural environment recover. The CVFC will ask its veterinarian to come to the island and perform a visual assessment for injured ponies and treat them if necessary.

### **Supplemental Feeding and Watering**

Supplemental feeding and watering of the ponies can be necessary when weather extremes (i.e. heat and drought, strong coastal storms and tidal flooding, snow and ice storms, etc.) dry up watering holes and/or make quality forage unavailable for ponies to feed upon. Williams C. A. and Ralston S. (2011), (See Rutgers - New Jersey Agriculture Experimental Station - 2011, Winter Feeding of Horses, Cooperative Extension - Fact Sheet FS1143) state that;

“Winter conditions vary dramatically between the various regions, as do the tolerances of individual horses to cold weather stressors, so it is impossible to give exact recommendations regarding nutritional needs that would be applicable to all horses and regions. However, there are general nutritional concerns that always need to be addressed as the weather gets colder. These are insuring adequate caloric (energy) and water intake, and recognizing situations where supplemental nutrients may be necessary to maintain a horse’s optimal health and well-being. ...” Additionally, “The major nutritional concerns during the winter months include adequate calories to maintain good body condition and adequate water intake to prevent impaction colic...”

Supplemental feeding and watering is fundamental to the continued health and well-being of the ponies. Since feeding and watering will be conducted at numerous locations within the grazing units the following conditions apply:

- 1) In order to reduce the importation of “weed seeds” into Refuge habitats, the use of certified **weed free hay/forage** is a requirement. Prior to beginning any supplemental feeding, CVFC will provide the Refuge Manager with documentation that the hay/forage to be dispersed is from a certified weed free hay/forage source.
- 2) Tanker trucks used to fill watering troughs must be filled at a location off the refuge water system/grid. All fire hydrants located east of Piney Island and the Assateague Channel Bridge fall within the refuge water system/grid system and therefore the Refuge is billed by the Town of Chincoteague for that water usage.

### Stock Replacement:

As mentioned in earlier sections, it had been a past practice to supplement the Chincoteague pony herd with stock brought in from other sources. A wide variety of breeds such as Morgan, Welsh, Shetland, Arabian, and Mustangs were placed in the Chincoteague pony herd to increase genetic diversity and vigor among the present stock. Most Mustangs were brought to the island shortly after the 1978 EIA eradication program to help build-up the herd. Few survived the rigorous barrier island environmental conditions (Refuge Pony Management Plan, 1990).

On occasion, CVFC also replenished the herd with “problem” ponies from ASIS. These feral horses had been involved with visitor/pony conflicts in the campground areas. Only their offspring were sold. It has been the policy of CVFC to no longer supplement their herd with NPS northern herd animals. These animals proved to be problematic for the Fire Company and the Refuge. However, these animals may have a more direct genetic link to the current Chincoteague ponies than past genetic introductions.

To preserve the integrity of the registered Chincoteague pony breed, the CVFC will no longer introduce foreign stock into the Refuge population. If deemed necessary by CVFC in consultation with a geneticist and the Refuge Manager one “healthy” foreign mare may be introduced to mate with a stallion and give birth. Shortly thereafter, the foreign mare will be transported off the Refuge. The same mare’s progeny will remain behind to continue the lineage of this new genetic input.

The refuge encourages the active “Buy Back” program. This activity allows citizens within the community to buy foals and yearlings at auction and then to donate these animals back to the CVFC for release back into the pony population on the Refuge. This effort supports the sustainability of the herd on the Refuge without introducing foreign stock. CVFC will continue to pit tags ponies for identification of individual animals.

Following pony penning activities, the Pony Committee Chairman will provide the Refuge Manager with written records of all pit tags recorded during pony penning activities and the number placed in each grazing unit.

### Disease and Injury:

The CVFC is responsible for the care and health of the ponies inhabiting the Refuge. Animals that become severely sick or injured are usually removed from the Refuge for treatment or, if conditions dictate, are euthanized and disposed of on the site where found. Pit tags should be recovered and that animals records closed.

Veterinarian services must be available for call out for injured or sick animals and for semiannual health checks when the entire herd is de-wormed, inoculated against EEE and rabies (confirmed on the Refuge in December 2012), and checked for equine infectious anemia (EIA) and other diseases the veterinarian deems necessary.

Animals testing positive for EIA are promptly removed from the Refuge for treatment or disposed of by the Fire Company or a qualified veterinarian. {See 1990 Pony Management Plan, pp. 2-3 & 10-11 for a thorough account of equine infectious anemia (EIA) and eastern equine encephalitis (EEE)}.

Injured ponies are routinely removed from the herd and transported to facilities on Chincoteague Island. When a pony is incapacitated by severe injuries, it is usually put down either by a refuge staff person at the request of the CVFC or its contracted veterinarian. It is the Refuge Manager's discretion to determine the fate of a clearly suffering animal when a member of the CVFC or a veterinarian cannot be reached, despite due diligence to reach these parties. (See Appendix I, "Veterinary Care and Procedures as explained by Dr. Charles Cameron DVM.")

### Fees:

The current Federal grazing fee for 2012 is \$1.35/AUM for those public lands administered by the Bureau of Land Management (BLM). The acronym "AUM" stands for "animal unit month." It is "the amount of forage needed to sustain one cow and her calf, one horse, or five sheep or goats for a month."

The CVFC pays the Service \$1,500 per year for grazing rights on the Refuge. Currently the Service does not follow the BLM pricing guidelines.

The movement and placement of ponies within assigned grazing units is the responsibility of the CVFC's Pony Committee. During the summer months, about one-third of the present herd is placed within the South Unit (Black Duck Marsh), which affords viewing opportunities for the visiting public. The remainder is placed in the North Unit, accessible to the public by foot and

the Chincoteague Natural History Association tour bus. No requirement specifies that a given number of animals be assigned to any particular compartment.

### Use of Ponies in Impoundment Vegetation Management:

Past studies by the USFWS (Service) confirm that controlled livestock grazing can be beneficial to some vegetative communities by increasing vigor of perennial grasses, speeding recycling of nutrients, increasing production of vegetation, preventing the decline and death of plants due to lodging and build-up of old plant material, and accomplishing the effect of burning without leaving soil severely exposed (Service 1987).

Annually the Refuge, on a rotational basis, undertakes mowing, disking and at times prescribed burning of impoundments to set back succession and maintain a healthy vigorous plant community. Refuge staff propose introducing a specified number of ponies (to be determined) into the impoundments (Pools A, B North, C, D, and E) for a specified period of time. This will provide rotational disturbance to the plant communities without the use of fossil fuels.

A recent *Rangelands* article entitled, “Livestock Grazing, Wildlife Habitat, and Rangeland Values,” supports rotational grazing as more likely to help managers achieve wildlife habitat objectives than continuous grazing. Through grazing treatments, key wildlife habitat components can be assured on the landscape each year. Carefully planned grazing rotations can ensure maintaining native habitats that are also functional for an abundance and diversity of wildlife. The authors propose that these grazing areas be appropriately stocked and managed to provide blocks of undisturbed cover at times that allow for plant reproduction and energy storage and wildlife reproduction and survival (Krausman, et. al., 2009, pp. 15-19).

Precautions should be implemented to thwart unnatural dissemination of exotic biota resulting from horse movement and feces. Direct effects include dispersal of undesirable alien seeds, fungi, arthropods, and other organisms, as well as the potential build up of pathogenic life forms. (ASIS, Berlin, MD – Wild Horse PHVA Workshop, March 28-31, 2006).

Overall, regulated grazing on impoundment and saltmarsh vegetation may stimulate growth, help control undesirable flora, and sustain the palatability of species which, upon maturing, become less desirable to wildlife (Pony Management Plan, 1995, p. 31).

### Exclosures and Photo-documentation points:

In an effort to better understand the affect of grazing by herbivores on salt marsh and upland habitats of the Refuge we will establish exclosures and photo-documentation points within and outside the grazing compartments. This will be beneficial baseline information for future management planning.

## **COORDINATION WITH THE NATIONAL PARK SERVICE**

### Horse Management by ASIS in Maryland:

On the northern portion of Assateague Island in Maryland, the NPS owns the wild horses roaming within its boundary. In 2009, the NPS Northeast Regional Director approved the Finding of No Significant Impact for the Environmental Assessment of Alternatives for Managing the Feral Horses of ASIS (See FONSI – found at <http://parkplanning.nps.gov>).

The Selected Alternative (SA) (modified Alt D), will reduce the NPS-owned horse population to a more sustainable 80 - 100 head. This reduction will be accomplished over five to eight years through intensive use of contraceptives for mares as well as through natural mortality. No NPS-owned horses will be removed from the island.

The SA is a compromise between “reducing the adverse effects of the horses while protecting the long-term health of the population.” It includes long-term monitoring, public outreach and education, and mitigation to protect the horse population from potential inbreeding.

Service-owned land, located in Maryland and lying adjacent to ASIS, will be managed as part of ASIS. Any horses roaming within the Service’s land in Maryland will fall under the management guidelines of the NPS horse management plan.

### Fence Line at the VA/MD State Line:

It is the responsibility of the NPS to maintain the .75 mile fence line at the Maryland and Virginia State line. This fence is necessary to keep the NPS horse herd separate from the ponies privately owned by the CVFC. However, it is in the best interest of all parties (the Service, the NPS, and the CVFC) to work cooperatively to maintain the boundary fence. The NPS received funding in 2011 to replace the entire dune to beach border fence. This project has been completed (pers. comm. Carl Zimmerman).

## **CONSIDERATIONS FOR THE CVFC**

### Hired Staff/Range-Hand:

The CNWR would like the CVFC to consider hiring a part time employee to work as a range hand. Duties could include checking the herd health, mending breaks in fence lines, coordinating Refuge and CVFC cooperative events, and when necessary rounding up wayward ponies. During winter months and/or strong storm events it would be crucial for this individual to carefully observe the ponies’ overall health, noting any aberrant behavior or poor habitat conditions.

## Annual Special Use Permit

A Special Use Permit (SUP) for grazing is annually issued to the CVFC at the start of the new fiscal year. Prior to the signing of the new SUP the Refuge Manager will meet with the Pony Committee Chairman for the CVFC and discuss changes or updates to the proposed SUP. Once agreement has been reached as to the content of the SUP the Pony Committee Chairman will submit the proposed SUP to the CVFC Pony Committee and then the full CVFC membership. Once approved, the SUP will be signed by the Refuge Manager and the Pony Committee Chairman and/or the President of the CVFC. Additional meeting(s) with the CVFC Pony Committee are held to organize volunteer work details and/or round-up events.

As part of the SUP a section annually updated is “Special Terms and Conditions.” This section stipulates the terms and conditions under which the SUP will be administered for the year. However, it is an opportunity for the CVFC Pony Committee and the Refuge to jointly plan for that current year’s activities and agree to those activities in writing. Preplanning by the Pony Committee and the Refuge is essential for a health pony herd and a well run program. (See Appendix V – 2012 Special Use Permit - Special Terms and Conditions)

## BIBLIOGRAPHY

Amrhein, J., Jr. 2007. The hidden galleon. New Maritima Press, Kitty Hawk, North Carolina, USA.

Assateague Island National Seashore. Back to the wild: The wild horses of Assateague. Berlin, Maryland, USA.

Assateague Island National Seashore. 28-31 March, 2006. Wild Horse PHVA Workshop, Berlin, Maryland, USA. <http://parkplanning.nps.gov>.

Assateague Island National Seashore. 2007. Assessment of the effects of feral horses, sika deer and white-tailed deer on Assateague Island forest and shrub habitats, Final Report, Berlin, Maryland, USA.

Chincoteague National Wildlife Refuge. 1993. Master Plan, Chincoteague, Virginia, USA.

Chincoteague National Wildlife Refuge. 2011. Habitat Management Plan, Chincoteague, Virginia, USA.

Chincoteague National Wildlife Refuge. 2008. Intra-Service, Section 7 and Biological Opinion, Chincoteague, Virginia, USA.

Chincoteague National Wildlife Refuge. 2011. Inventory and Monitoring Plan, Phase II, Chincoteague, Virginia, USA.

Chincoteague National Wildlife Refuge. 1995. Pony Management Plan, Chincoteague, Virginia, USA.

Chincoteague National Wildlife Refuge. 1990. Pony Management Plan, Chincoteague, Virginia, USA.

Chincoteague National Wildlife Refuge. 2010. Special Use Permit, Chincoteague, Virginia, USA.

Church and White. 2006.

Davis. 2006.

Furbish, C.E. and M. Albano. 1994. Selective herbivory and plant community structure in a mid-Atlantic saltmarsh. *Ecology* 75 (4): 1015-1022.

Godfrey, P.J. 1976. Barrier beaches of the east coast. *Oceanus* 19 (5): 27-40.

Hansen. 2007.

Harington, 2008.

International Panel on Climate Change. 2007.

Keiper, R.R. 1981. Ecological impact and carrying capacity of ponies. Research report, U.S. Fish and Wildlife Service, Chincoteague National Wildlife Refuge, Chincoteague, Virginia, USA.

Keiper, R.R. 1985. The Assateague Ponies, Tidewater Publications, Centreville, Maryland, USA.

Krausman, P.R., et. al. 2009. Livestock Grazing, Wildlife Habitat, and Rangeland Values, Rangelands.

Lear, K. 1969. Analysis of Grazing Impact on Salt Water Marsh Grasses. Report to the National Park Service, Assateague Island National Seashore, Berlin, Maryland, USA.

Mariner, K. 1996. Once Upon an Island, Minona Publications, New Church, Virginia, USA.

Morton, M. M., et. al. 1989. Habitat use and movements of American black ducks in winter, Journal of Wildlife Management 53 (2): 390-400.

National Park Service, Back to the Wild: The Wild Horses of Assateague.

Pew Center on Global Climate Change. 2007.

Rahmstorf. 2007.

Rutgers, New Jersey Agriculture Experimental Station - 2011, Winter Feeding of Horses, Cooperative Extension - Fact Sheet FS1143, Carey A. Williams, Ph.D., Associate Extension Specialist, Department of Animal Sciences Sarah Ralston, VMD, Ph.D., DACVN, Associate Professor, Department of Animal Sciences

Titus, et. al. 2009.

Town of Chincoteague Island. 2010 Visitor Survey.

Thornton, H.S., 2012. Informational letter, Permit #81271.

Turner, M.M.G., 1986. Effects of feral horse grazing, clipping, trampling and late winter burn on a saltmarsh. Technical Report 23, University of Georgia, Athens, Georgia, USA.

U.S. Department of the Interior. 2009. Finding of No Significant Impact (FONSI) for the Environmental Assessment of Alternatives for Managing the Feral Horses of Assateague Island National Seashore, Berlin, Maryland, USA.

U.S. Department of the Interior. 2007. Technical Guide, Washington, D.C., USA.

U.S. Fish and Wildlife Service. 1987.

Virginian-Pilot. 1 February 1994.

Virginia Tourism Corporation. 2009 Report of the Economic Impact of Travel.

Wild Horse Workshop PHVA Workshop (March 28-31, 2006). Assateague Island National Seashore, Berlin, MD.

Zervanos, S.M. 1978. National Park Service Report.

**APPENDICES:****Appendix I - Veterinary Care and Procedures as explained by Dr. Charles Cameron DVM:**

In the spring of 1990, Eastern Shore Animal Hospital, located in Melfa, Accomack County, Virginia, became involved with the care of the Chincoteague pony herd.

“We are in charge of the preventative maintenance program, which includes vaccinating the herd annually for Eastern and Western Encephalitis, Tetanus and West Nile Virus (EWTWN) and Rabies,” explained Dr. Charles Cameron DVM. “We deworm the herd with a drench dewormer (Eqvalan) in the spring and fall.

Also in spring, we draw blood samples from all the Ponies and submit the samples to Ivor State Diagnostic Lab for Coggins Tests (the test for Equine Infectious Anemia (EIA)).

“During Pony Penning Week in July, we are available for any emergency that might occur with the herd or the riders’ horses,” he continued. “On Tuesday of that week (the day before the swim), we cull out the ponies that are too young or too old and otherwise not fit to make the swim. On the day of the sale (Thursday), we estimate the age of the foals before they go on the auction block and fill out and sign health certificates for the foals that have been sold.”

Dr. “Charlie” Cameron and his veterinary staff are also available to answer new owners’ questions regarding the care of their foals.

“Some foals will be going to states which require a negative Coggins Test on the foal regardless of its age,” Dr. Charlie explained. “We will advise the owners of this and draw the blood sample for the test.”

Over the course of the year, the veterinarians are occasionally called out for emergencies such as foaling issues and lacerations.

“A medical issue, which has occurred during Pony Penning Week, has been hypocalcaemia in some of the lactating mares,” said Dr. Charlie. “This is a medical emergency which can be reversed by administering calcium intravenously. So we are well prepared for this with stocks of Cal-Dex Fluids, IV catheters and dri sets.”

## Appendix II - HISTORY of SEA LEVEL RISE and ASSATEAGUE ISLAND

For the last million years, the earth's climate has changed from a cold ice age to a warm interglacial period back to an ice age roughly every 100,000 years. These changes have had enormous impacts on plant and animal life, human societies, and sea level with lowest levels during cold periods and highest levels during warm periods. Hence, changing sea level is not a recent phenomenon. During the warmest interglacial period about 130,000 years ago, the Earth's temperature was 2-3° F (35.6 - 37.4° C) warmer than today's temperatures and ocean levels were 13-20 feet (4.0 - 6.1 m) higher than today (Pew Center on Global Climate Change 2007).

The most recent cycle started over 100,000 years ago, when a 39-42°F (4-10° C) drop in global temperatures over thousands of years caused a major change in climate. Approximately 25,000 years ago, the Laurentide ice sheet moved out of Canada. About 18,000 years ago, it extended as far south as northern New Jersey and northeastern Pennsylvania on the East Coast, and nearly half of North America was covered by a continental glacier over one mile thick in places.

A significant amount of the Earth's fresh water was locked in glacial ice. Consequently, much fresh water was not returned to the oceans, leading to a significant drop in sea level. The Mid-Atlantic coast was roughly 40 to 50 miles (64 - 80 km) offshore from its present day location. This area was exposed for about 10,000 years and was occupied by tundra and boreal forest similar to what is found in Canada today. Elk, moose, and grizzly bears were dominant mammals. (Davis 2006). The waters were cold like Arctic waters and supported species like walrus, sea lions, and bearded seals (Harington 2008).

About 15,000 years ago, climate began to change again, and the warmer temperatures caused the Laurentide glacier to begin melting. The melt-water ran off the land and into the ocean causing sea levels to rise. The rise was not a steady one; it was marked by a rapid increase from 15,000 to 8,000 years ago at rates as high as 0.5m (1.6 ft.) per decade (Hansen 2007).

Around 6,000 years ago, the rate of sea level slowed to 0.5mm (.25 in.) per year due to a reduction in the rate of ice melting. This allowed shorelines to stabilize, and the Mid-Atlantic shoreline may have looked much like it does today (minus the human-induced alterations). These more stable conditions promoted the formation of barrier islands and spits, which facilitated the establishment of coastal marshes in sheltered lagoons behind the protective barriers and along the low-lying shores of tidally influenced rivers.

From 3000 years ago to the late 1800s (the beginning of the "Industrial Revolution"), the rate of sea level rise was very low: 0.1-0.2mm (.0625 in. - .125 in.) per year. (Titus et al. 2009). During the last century, the average global rise in sea level was 1.7mm (0.5 in.) per year (Church and White 2006).

From 1993-2003, the rate of sea level rise rose an average of 3.1mm (.75 in.) per year. (IPCC 2007). It is unclear whether this increase is simply a decadal response or an indicator of a longer-term trend. It is, however, likely that the losses of polar ice sheets during this decade significantly contributed to the increase (Titus et al. 2009).

The 2007 International Panel on Climate Change (IPCC) lowered predictions from their 1995 report. Most recently, they predicted a 0.6-1.9-foot (7-23-inch or 18-59 cm) increase in sea level over the next 100 years. Earlier, the Panel had predicted a 0.3-2.9-foot (nearly 9 cm – nearly 1 m) rise by 2100. This new estimate excludes any increase in melt-water from the Greenland and Antarctica ice sheets.

The IPCC admits that this is a very conservative estimate. Moreover, recent observations of accelerated ice flow and melting from Greenland and western Antarctica glaciers could contribute substantially to present increasing sea levels. (Titus et al. 2009). If the Greenland ice sheet disappeared, it would add 23 feet (7m) to sea level (IPCC 2007).

During the last interglacial period of 125,000 years ago, reductions of polar ice led to a 13-20-foot (4-6m) rise in sea level. It is interesting to note that the projected rise may not be a simple steady increase in sea levels. Instead, it may be rapid due to a quick collapse of large portions of the polar ice sheets (Pew Center on Global Climate Change 2007).

A 2007 study that accounted for continued increases in greenhouse gas emissions predicted that sea level could rise 1.6-4.5 feet (0.5-1.4m) by the end of the 21<sup>st</sup> century. (Rahmstorf 2007). This work and the view of other climatologists suggest that global sea level could rise by 3.3 feet or more (one meter or more) by 2100 and that it may rise additional meters over the next several centuries.

#### Impacts on the Mid-Atlantic Region

In the Mid-Atlantic region (New Jersey through Virginia), sea level is rising due to global changes and to land subsidence. During the past century, sea level rise rates were higher than global rates, ranging from 2.4-4.4 mm (about .75 in. – about 1 in.) per year. This translated to an approximate one-foot rise (0.3m) by 2000. These are the highest rates of sea level rise in the United States, excluding Louisiana and Texas where human-induced coastal subsidence is a significant contributing factor (Titus et al. 2009).

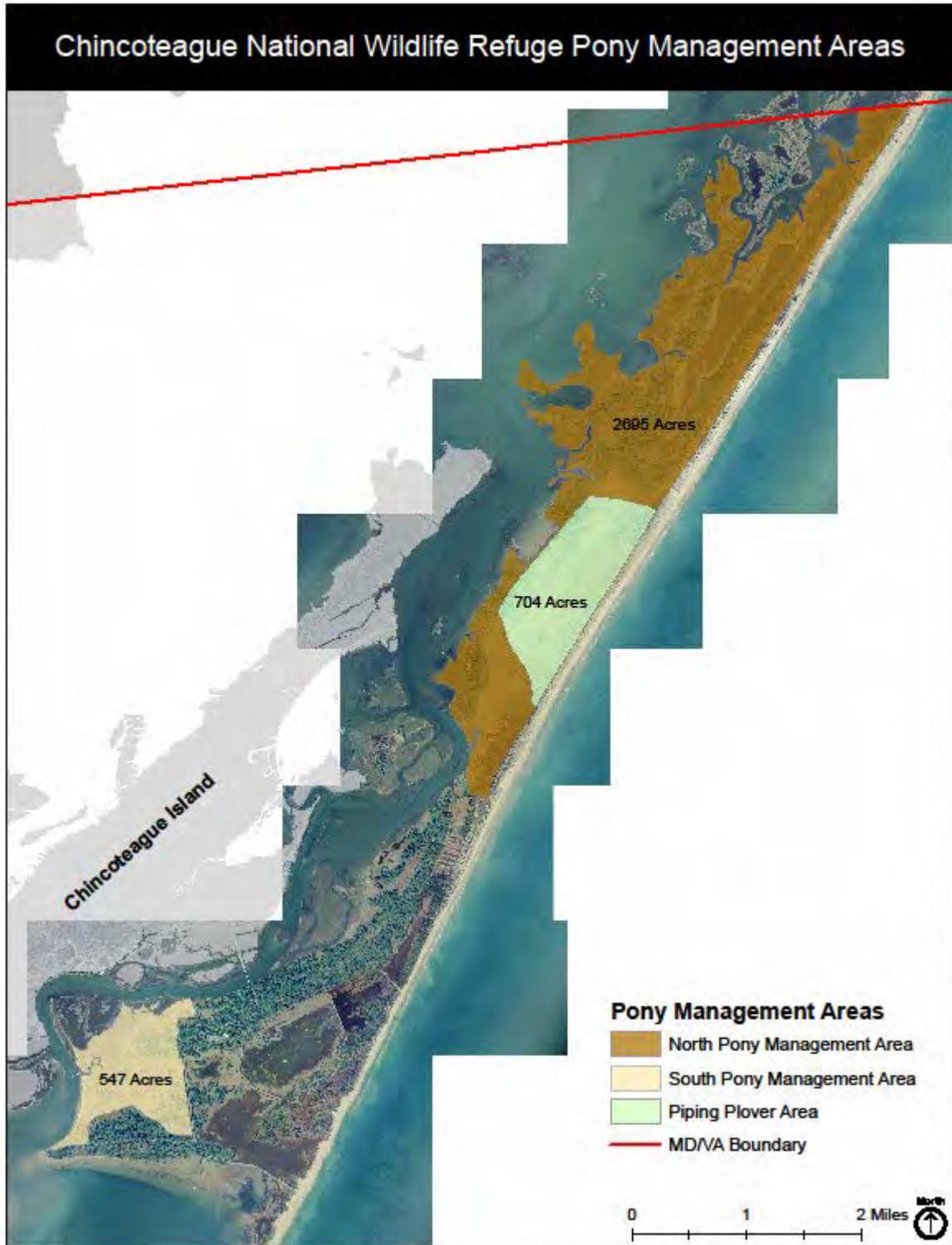
Rising seas are already changing the coast, submerging the lowest tidal wetlands, eroding coastal beaches, increasing flooding of lowlands, and altering salinity regimes in coastal waters. Low salt marshes are being converted to tidal flats, while existing tidal flats are becoming permanently inundated shallow water habitats.

The shoreline of Assateague Island, already threatened by erosion from the current sea-level rise rate, is even more vulnerable with predicted increases of 2mm (nearly 0.5 in.) per year. If the

rate increases by 2mm per year, the island may begin migrating landward and may break up into smaller sections (segmentation). The impacts of a 7mm (around 1.5 in.) per year rise would be devastating.

Assateague Island is continually changing shape and geographic location. Refuge managers, park superintendents, wildlife biologists, and the CVFC will all need to work together to maintain pony grazing units that are robust so as to provide for a healthy pony herd that is self-sustaining, without human intervention, in light of a warming climate and corresponding sea-level rise. This issue will need to be revisited (at a minimum every 5 years) as new information becomes available from the scientific community.

Appendix III – Pony Management Areas Map



## Appendix IV - List for Emergency Calling

2010-2011 CVFC, Pony Committee members responsible for herd management.

SUP #51570-81233

## LIST FOR EMERGENCY CALLING

|                              |          |          |
|------------------------------|----------|----------|
| Harry S. Thornton (Chairman) | 336-5560 | 894-0440 |
| Nathan (Skeebo) Clark        | 336-5996 | 894-8771 |
| David Savage                 | 336-5610 | 894-3574 |
| Wesley Bloxom                | 336-3213 | 894-4751 |
| Rick Raymond                 | 336-2657 | 894-0618 |
| Bobby Lapin                  | 336-0619 | 894-3586 |
| John Bloxom                  | 336-1709 | 894-3381 |
| Randy Thornton               | 336-6670 | 894-4136 |
| Edwin Taylor                 |          | 894-3384 |
| Roe Terry                    | 336-5758 | 894-0330 |
| Denise Bowden                |          |          |

## EASTERN SHORE ANIMAL HOSPITAL

|                     |                                       |
|---------------------|---------------------------------------|
| Dr. Charlie Cameron | 757-442-3150 (24-hour service number) |
|---------------------|---------------------------------------|

Appendix V - Special Use Permit: 81312 - FY 2013

**See following page**

Appendix VI - Intra-Service Section 7 Biological Evaluation for Chincoteague  
Pony Penning and Piping Plover/Sea Turtle Management

**See page 41**

**National Wildlife Refuge System  
General Special Use  
Application and Permit**

Name of Refuge Chincoteague NWR  
Address PO Box 62, Chincoteague, VA 23336  
Attn: (Refuge Official) Louis S. Hinds III  
Phone # 757-336-6122 E-mail louis\_hinds@fws.gov

**Application**

(To be filled out by applicant. Note: Not all information is required for each use. See instructions at the end of the notice.)

1)  New  Renewal  Modification  Other \_\_\_\_\_

**Applicant Information**

2) Full Name: Chincoteague Volunteer Fire Company Pony Committee 6) Phone #: 757-894-0440  
3) Organization: Chincoteague Volunteer Fire Company 7) Fax #: 757-336-1340  
4) Address: PO Box 691 8) E-mail: \_\_\_\_\_  
5) City/State/Zip: Chincoteague, VA 23336

9) Assistants/Subcontractors/Subpermittees: (List full names, addresses and phone #'s and specifically describe services provided if subcontractors are used.)

See Attached List

**Activity Information**

10) Activity type:  Event  Wood Cutting  Group Visit  Cabin/Subsistence Cabin  Educational Activity  
 Other To permit the grazing of not more than 150 head of wild ponies.

11) Describe Activity: (Specifically identify timing, frequency, and how the event is expected to proceed.)

Grazing is permitted on those parts of Tract 4, 4a, 4b, 41, and 31 where ponies are not excluded by fences; the fenced enclosures where grazing will not be permitted are primarily the waterfowl development areas and sand dunes.

12) Activity/site occupancy timeline: (Specifically identify beginning and ending dates, site occupation timeline, hours, clean-up and other major events.)



**Appendix D**

(Depending on the activity for which you are requesting a permit, we may ask you for the following activity information. Please contact the specific refuge where the activity is being conducted to determine what activity information is required.)

13) Expected number of participants:  
Children \_\_\_\_\_ Adults \_\_\_\_\_ Total \_\_\_\_\_

14) Grade level of educational group:  
Grade \_\_\_\_\_  N/A

15) Will staff time/assistance be required?  
 Yes  No  N/A

16a) Plan of Operation required?  Yes  No  N/A

16b) Plan of Operation attached?  Yes  No

17) Location: (Specifically identify location; GPS location preferred.)

18a) Is map of location(s) required?  
 Yes  No  N/A

18b) Is map of location(s) attached?  
 Yes  No

**Insurance Coverage/Certifications/Permits**

19a) Is insurance required?  
 Yes  No  N/A

19b) Insurance: (Provided carrier, type and policy number)

20) Other licenses/certifications/permits required: (Specifically identify licenses, certifications, and permits.)

**Logistics and Transportation**

21) Does activity require personnel to stay overnight onsite?  Yes  No

22) Personnel involved:  
See Attached Conditions

23) Specifically describe all equipment/gear and materials used:

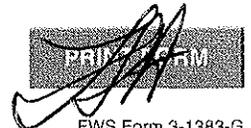
24) Transportation description(s) and license number(s) to access refuge(s): [Provide description of and specific auto license/boat/plane registration number(s).]  
See Attached List

25) Specifically describe onsite work and/or living accommodations:  
N/A

26) Specifically describe onsite hazardous material storage or other onsite material storage space:  
N/A

27) Signature of Applicant James Russell Date of Application: 2-4-2013

Sign, date, and print this form and return it to the refuge for processing. Do not fill out information below this page.



**For Official Use Only** (This section to be filled out by refuge personnel only.)

**Special Use Permit**

81312

Permit #: \_\_\_\_\_

1) Date: 1/11/2013

2)  Permit Approved  Permit Denied

3) Station #: 51570

4) Additional special conditions required: (Special conditions may include activity reports, before and after photographs, and other conditions.)  
 Yes  No  N/A

Additional sheets attached:  
 Yes  No

5) Other licenses/permits required:  
 Yes  No  N/A

Verification of other licenses/permits, type: \_\_\_\_\_

6) Insurance/certifications required:  
 Yes  No  N/A

Verification of insurance/certification, type: \_\_\_\_\_

7) Record of Payments:  Exempt  Partial  Full

Amount of payment: \$1500.00 *PAID*

Record of partial payment: \_\_\_\_\_

8) Bond posted:  Yes  No

This permit is issued by the U.S. Fish and Wildlife Service and accepted by the applicant signed below, subject to the terms, covenants, obligations, and reservations, expressed or implied herein, and to the notice, conditions, and requirements included or attached. A copy of this permit should be kept on hand so that it may be shown at any time to any refuge staff.

Permit approved and issued by (Signature and title):

*James L. Birds*

Date: 2/6/2013

Permit accepted by (Signature of applicant):

*James J. Russell*

Date: 2-4-2013

*AA*

**Notice**

In accordance with the Privacy Act (5 U.S. C. 552a) and the Paperwork Reduction Act (44 U.S. C. 3501), please note the following information:

1. The issuance of a permit and collection of fees on lands of the National Wildlife Refuge System are authorized by the National Wildlife Refuge System Administration Act (16 U.S. C. 668dd-ee) as amended, and the Refuge Recreation Act (16 U.S. C. 460k-460k-4).
2. The information that you provide is voluntary; however submission of requested information is required to evaluate the qualifications, determine eligibility, and document permit applicants under the above Acts. It is our policy not to use your name for any other purpose. The information is maintained in accordance with the Privacy Act. All information you provide will be considered in reviewing this application. False, fictitious, or fraudulent statements or representations made in the application may be grounds for revocation of the Special Use Permit and may be punishable by fine or imprisonment (18 U.S.C. 1001). Failure to provide all required information is sufficient cause for the U.S. Fish and Wildlife Service to deny a permit.
3. No Members of Congress or Resident Commissioner shall participate in any part of this contract or to any benefit that may arise from it, but this provision shall not pertain to this contract if made with a corporation for its general benefit.
4. The Permittee agrees to be bound by the equal opportunity "nondiscrimination in employment" clause of Executive Order 11246.
5. Routine use disclosures may also be made: (a) to the U.S. Department of Justice when related to litigation or anticipated litigation; (b) of information indicating a violation or potential violation of a statute, rule, order, or license to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting the violation or for enforcing or implementing the statute, rule, regulations, order, or license; (c) from the record of the individual in response to an inquiry from a Congressional office made at the request of the individual (42 FR 19083; April 11, 1977); and (d) to provide addresses obtained from the Internal Revenue Service to debt collection agencies for purposes of locating a debtor to collect or compromise a Federal Claim against the debtor, or to consumer reporting agencies to prepare a commercial credit report for use by the Department (48 FR 54716; December 6, 1983).
6. An agency may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. This information collection has been approved by OMB and assigned control number 1018-0102. The public reporting burden for this information collection varies based on the specific refuge use being requested. The relevant public reporting burden for the General Use Special Use Permit Application form is estimated to average 30 minutes per response, including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Comments on this form should be mailed to the Information Collection Clearance Officer, U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, MS 2042-PDM, Arlington, Virginia, 22203.

**General Conditions and Requirements**

1. **Responsibility of Permittee:** The permittee, by operating on the premises, shall be considered to have accepted these premises with all facilities, fixtures, or improvements in their existing condition as of the date of this permit. At the end of the period specified or upon earlier termination, the permittee shall give up the premises in as good order and condition as when received except for reasonable wear, tear, or damage occurring without fault or negligence. The permittee will fully repay the Service for any and all damage directly or indirectly resulting from negligence or failure on his/her part, and/or the part of anyone of his/her associates, to use reasonable care.
2. **Operating Rules and Laws:** The permittee shall keep the premises in a neat and orderly condition at all times, and shall comply with all municipal, county, and State laws applicable to the operations under the permit as well as all Federal laws, rules, and regulations governing national wildlife refuges and the area described in this permit. The permittee shall comply with all instructions applicable to this permit issued by the refuge official in charge. The permittee shall take all reasonable precautions to prevent the escape of fires and to suppress fires and shall render all reasonable assistance in the suppression of refuge fires.
3. **Use Limitations:** The permittee's use of the described premises is limited to the purposes herein specified and does not, unless provided for in this permit, allow him/her to restrict other authorized entry onto his/her area; and permits the Service to carry on whatever activities are necessary for: (1) protection and maintenance of the premises and adjacent lands administered by the Service; and (2) the management of wildlife and fish using the premises and other Service lands.
4. **Transfer of Privileges:** This permit is not transferable, and no privileges herein mentioned may be sublet or made available to any person or interest not mentioned in this permit. No interest hereunder may accrue through lien or be transferred to a third party without the approval of the Regional Director of the Service and the permit shall not be used for speculative purposes.
5. **Compliance:** The Service's failure to require strict compliance with any of this permit's terms, conditions, and requirements shall not constitute a waiver or be considered as a giving up of the Service's right to thereafter enforce any of the permit's terms or conditions.
6. **Conditions of Permit not Fulfilled:** If the permittee fails to fulfill any of the conditions and requirements set forth herein, all money paid under this permit shall be retained by the Government to be used to satisfy as much of the permittee's obligation as possible.
7. **Payments:** All payment shall be made on or before the due date to the local representative of the Service by a postal money order or check made payable to the U.S. Fish and Wildlife Service.
8. **Termination Policy:** At the termination of this permit the permittee shall immediately give up possession to the Service representative, reserving, however, the rights specified in paragraph 11. If he/she fails to do so, he/she will pay the government, as liquidated damages, an amount double the rate specified in this permit for the entire time possession is withheld. Upon yielding possession, the permittee will still be allowed to reenter as needed to remove his/her property as stated in paragraph 11. The acceptance of any fee for the liquidated damages or any other act of administration relating to the continued tenancy is not to be considered as an affirmation of the permittee's action nor shall it operate as a waiver of the Government's right to terminate or cancel the permit for the breach of any specified condition or requirement.
9. **Revocation Policy:** This permit may be revoked by the Regional Director of the Service without notice for noncompliance with the terms hereof or for violation of general and/or specific laws or regulations governing national wildlife refuges or for nonuse. It is at all times subject to discretionary revocation by the Director of the Service. Upon such revocation the Service, by and through any authorized representative, may take possession of the said premises for its own and sole use, and/or may enter and possess the premises as the agent of the permittee and for his/her account.

10. Damages: The United States shall not be responsible for any loss or damage to property including, but not limited to, growing crops, animals, and machinery or injury to the permittee or his/her relatives, or to the officers, agents, employees, or any other who are on the premises from instructions or by the sufferance of wildlife or employees or representatives of the Government carrying out their official responsibilities. The permittee agrees to save the United States or any of its agencies harmless from any and all claims for damages or losses that may arise to be incident to the flooding of the premises resulting from any associated Government river and harbor, flood control, reclamation, or Tennessee Valley Authority activity.

11. Removal of Permittee's Property: Upon the expiration or termination of this permit, if all rental charges and/or damage claims due to the Government have been paid, the permittee may, within a reasonable period as stated in the permit or as determined by the refuge official in charge, but not to exceed 60 days, remove all structures, machinery, and/or equipment, etc. from the premises for which he/she is responsible. Within this period the permittee must also remove any other of his/her property including his/her acknowledged share of products or crops grown, cut, harvested, stored, or stacked on the premises. Upon failure to remove any of the above items within the aforesaid period, they shall become the property of the United States.

### Instructions for Completing Application

You may complete the application portion verbally, in person or electronically and submit to the refuge for review. Note: Please read instructions carefully as not all information is required for each activity. Contact the specific refuge headquarters office where the activity is going to be conducted if you have questions regarding the applicability of a particular item.

1. Identify if permit application is for new, renewal or modification of an existing permit. Permit renewals may not need all information requested. Contact the specific refuge headquarters office where the activity is going to be conducted if you have questions regarding the applicability of a particular item.

2-8. Provide full name, organization (if applicable), address, phone, fax, and e-mail.

9. Provide names and addresses of assistants, subcontractors or subpermittees. Names and address are only required if the assistants, subcontractors or subpermittees will be operating on the refuge without the permittee being present. Volunteers, assistants, subcontractors or subpermittees that are accompanied by the permittee need not be identified.

10. Activity type: check one of the following categories:

- a. Event;
- b. Wood cutting;
- c. Group visit;
- d. Cabin/Subsistence cabin;
- e. Educational activity; or
- f. Other—any other activity(s) not mentioned above. Please describe "other" activity.

11. Describe Activity: provide detailed information on the activity, including times, frequency and how the activity is expected to proceed, etc. Permit renewals may not need activity description, if the activity is unchanged from previous permit. Most repetitive activities, such as group visits, do not require an activity description for each visit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if an activity description is required.

12. Activity/site occupancy timeline: Identify beginning and ending dates, site occupation timeline, hours, clean-up and other major events. Permit renewals may not need an activity/site occupancy timeline, if the activity is unchanged from previous permit. Most repetitive activities, such as group visits, do not require an activity/site occupancy timeline for each visit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if an activity/site occupancy timeline is required.

13-14 Expected number of participants: Provide an estimate of the number of adults, and children and grade level of group, if applicable.

15. Identify if onsite refuge staff will be required for group activities and anticipated time frame, if applicable.

16a-16b. Identify and attach Plan of Operation, if required. Most repetitive activities, such as group visits, do not require Plans of Operations for each visit. In addition, permit renewals may not require Plans of Operations if the activity is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a Plan of Operations is required.

17. Location: identify specific location (GPS coordinates preferred), if not a named facility. Most repetitive activities, such as group visits, do not require a location. In addition, permit renewals may not require a location if the activity is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a location is required.

18a-18b. Attach a map of location, if required and not conducted at a named facility. Most repetitive activities, such as group visits, do not require a map. In addition, permit renewals may not require a map if the activity is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a map is required.

19a-19b. Provide name, type and carrier of insurance, if required. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if insurance and type of insurance are required.

20. Specifically identify types and numbers of other licenses, certifications or permits, if required. Contact the specific refuge headquarters office where the activity is going to be conducted to determine the types of licenses, certifications or permits required, and to coordinate the simultaneous application of several types of licenses, certifications or permits. This Special Use Permit (SUP) may be processed while other certifications are being obtained.

21-22. Provide name(s) of any personnel required to stay overnight, if applicable.

23. Identify all equipment and materials, which will be used, if required. Most repetitive events, such as group visits, do not require a list of equipment. In addition, permit renewals may not require a list of equipment if the event is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a list of equipment is required.
24. Describe and provide vehicle descriptions and license plate or identification numbers of all vehicles, including boats and airplanes, if required. Motor vehicle descriptions are only required for permittee vehicle, and/or if the vehicle will be operated on the refuge without the permittee being present. Motor vehicles that are accompanied by the permittee as part of a group (convoy) activity need not be identified if cleared in advance by refuge supervisor. Specifically describe ship-to-shore, intersite (between islands, camps, or other sites) and onsite transportation mechanisms, and license plate or identification numbers, if required.
25. Specifically describe onsite work and/or living accommodations, if applicable.
26. Specifically describe onsite hazardous material storage, or other onsite material storage space (including on and offsite fuel caches).
27. Sign, date, and print the application. Click on the Print button to print the application (if using the fillable version). The refuge official will review and, if approved, fill out the remaining information, sign, and return a copy to you for signature and acceptance.

**The form is not valid as a permit unless it includes refuge approval, a station number, a refuge-assigned permit number, and is signed by a refuge official.**

Special Use Permit: 81312  
FY 2013

PERMITTEE: Chincoteague Volunteer Fire Company  
South Main Street  
Chincoteague Island, VA 23336

### SPECIAL TERMS AND CONDITIONS

1. This permit authorizes the use of the Chincoteague National Wildlife Refuge (Refuge) for the grazing of Chincoteague Ponies (ponies) only. Ponies are authorized only within the permitted pasture/habitat units (i.e. North and South Pony Management Areas, see attached map.) The herd numbers will not exceed that allotted for such grazing, unless permission is granted by Refuge Manager for extenuating circumstances (i.e. weather, tidal flooding, etc.) Permittee is solely responsible for ensuring the ponies are not in violation of these conditions. Failure to comply may result in cancellation of grazing privileges, the imposition of administrative fees and/or legal charges.
  - a. Permittee has one week to return ponies to permitted compartments once notified by the Refuge Manager; an additional week may be granted based on adequate justification. Ponies that habitually get out of permitted compartments will be removed from the refuge until the fence is repaired or escape is blocked.
  - b. Ponies will be promptly returned to their assigned grazing units after the annual July round-up and auction.
2. The permittee is responsible for the maintenance of all assigned fences, including repair of damage caused by tidal flooding and other acts of nature. The U.S. Fish and Wildlife Service will purchase all post and fencing materials necessary for scheduled maintenance and repairs of fence lines. The permittee in concert with the Refuge Manager will develop a fence replacement and repair schedule/plan that stipulates the replacement of fence lines for a period of 15 years. The permittee will work in concert with the Refuge Manager for the scheduling of joint fence maintenance activities.
3. The permittee will designate individuals authorized to assist in management activities for the Chincoteague pony herd and will supply a list to the Refuge Manager within 30 days after issuance of the Special Use Permit. The top four names will be authorized to take action in the event of an emergency, if the Pony Committee Chairman is not available. Additionally, the permittee will provide the Refuge Manager a list of volunteers and helpers assigned to Pony Committee activities (round-ups, feeding and watering, etc.)
4. The permittee will provide the name and phone number of a contact veterinarian in case of emergency. CNWR will contact the permittee in case of an emergency, but should the permittee fail to respond within 12 hours, CNWR will initiate veterinarian services and the permittee will be responsible for all charges. Permittee will comply with all Commonwealth of Virginia and US Department of Agriculture livestock health laws.



5. During the July pony penning:
  - a. Permittee will provide a minimum of three responsible CVFD staff from 0700 to 2200 hours to respond to public inquiries concerning the ponies and ensure safety. Those individuals will wear standardized, visible and clearly marked CVFD shirts that distinguish them to the public. All personnel inside the corral, with the exception of the veterinarian, will wear the CVFD shirt.
  - b. Permittee will provide at least two individuals to monitor the ponies overnight from 2200 to 0700 hours. The permittee will erect a small tent, approximately ten feet square, clearly marked CVFD Pony Committee, to provide shelter from inclement weather and to distribute public information packets. No products may be sold. Tent location will be agreed upon by CNWR and the permittee.
  - c. Permittee will provide water to ponies at least every five hours beginning at 0700 hrs and ending at 2200 (0700, 1200, 1700, and 2200 hours). The Permittee is encouraged to maintain the water supply line to the watering troughs, in the South corral that would automatically fill the troughs when they become low.
  - d. Permittee will provide a licensed veterinarian for all pony penning activities who will remain within a one hour response time following the activity. The name and phone number of the veterinarian present will be provided to the Refuge Manager prior to any pony penning activities.
  - e. Prior to all swims the veterinarian will inspect the pony herd to determine which animals shall swim and those needing to be transported.
  - f. Permittee will erect a fence or barrier at least three feet from the corral fence to prevent physical contact between the public and the ponies. Fences will be clearly marked to keep the public off.
  - g. No smoking is permitted within the corral.
6. The permittee is responsible for conduct of members of work parties while on the refuge. Consumption of alcoholic beverages is not allowed on the refuge.
7. When the refuge is closed to normal visitation (after hours, inclement weather, etc...), the CVFC Pony committee chairman must receive authorization from the Refuge Manager or his designee to gain access to the refuge. Access will be granted on a case by case basis to authorize individuals to ensure for the welfare of the ponies. All other activities are prohibited. When the refuge is closed due to emergency conditions, all third party requests for information regarding the status of the refuge shall be deferred to the refuge manager or his designee. No photographs may be taken.
8. The permittee after each round-up (spring, summer and fall) will provide the Refuge Manager a written report stating the number of ponies present on the refuge. The report at a minimum will



**INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM**

**Originating Person:** Louis Hinds, Refuge Manager

**Station Name:** Chincoteague National Wildlife Refuge

**Prepared By:** Amanda A. Daisey, Wildlife Biologist

**Telephone and Facsimile Numbers:** (Phone) 757/336-6122; (Fax) 757/336-5273

**Date:** April 22, 2011

**Project Title:** Chincoteague Pony Penning and Piping Plover/Sea Turtle Management,

**I. Service Program:** National Wildlife Refuge System

**II. Geographic Area Including Name of County/City and State and Specific Project Location:**

Chincoteague National Wildlife Refuge  
Assateague Island  
Accomack County  
Chincoteague, Virginia

**III. Background Information:**

Two herds of feral horses known as the “Chincoteague Ponies” reside on Chincoteague National Wildlife Refuge. Crop damage caused by free roaming animals in 17<sup>th</sup> century Eastern Shore led colonial legislatures to enact laws requiring fencing and taxes on livestock. The Chincoteague Ponies are believed descendants of colonial horses brought to Assateague Island by farmers to avoid fencing expenses and taxation. Prior to the refuge's establishment in 1943, the Chincoteague Volunteer Fire Company (CVFC) purchased the Virginia portion of Assateague Islands' ponies and retains ownership.

CNWR annually issues a Special Use Permit to CVFC allowing 150 adult ponies to graze on Assateague Island, Virginia. Ponies graze within two barbed wire sections referred to as the north (3,354 ac) and south (542 ac) compartments (Fig. 1). The North Wash Flats impoundment is closed to pony grazing during the piping plover breeding season. The grazing compartments were created in part to prevent ponies from grazing in important refuge habitats, including shorebird breeding areas, and to reduce visitor-pony contact for safety. The CNWR maintenance staff and CVFC maintain, replace, and repair sections of the fencing year round.

The Annual Chincoteague Pony Swim and Auction is held the last consecutive Wednesday and Thursday in July. The CVFC rounds up all ponies from both the north and south compartments and places them into holding corrals. Horseback riders swim the

ponies across Assateague Channel from Assateague Island to neighboring Chincoteague Island. Foals and yearlings are sold at auction to benefit the Town of Chincoteague's ambulance and fire services. Following the auction, the remaining ponies are returned to their respective compartments on CNWR.

#### **Proposed Activity: CVFC Beach Pony Walk**

The Monday prior to the Pony Penning Swim, approximately 110 ponies and their foals from the North compartment are herded to the south holding corral on Beach Road. The "Pony Walk" is a popular event with visitors and begins at 0600 hrs. The CVFC traditionally moves the ponies via horseback from the South Wash Flats along the beach intertidal zone through the beach parking lots and Beach Road to the south corral (Fig. 2). Over 1,700 visitors attended the Pony Walk in 2010. Spectators congregate on the beach berm between the beach parking lots and Swan Cove Trail to view the Chincoteague ponies. Because of the number of parking spaces available and the number of visitors anticipated to try to view the event, visitors are expected to park at the beach parking lot and walk north along the beach to where they would like to view the ponies. In 2010, two piping plover pairs nested and hatched chicks along a portion of the Pony Walk route. Disturbance and/or harm to piping plovers, nests, and broods is a concern. CNWR proposes continuing the Pony Walk using piping plover nest protection measures and alternative Pony Walk routes when necessary.

#### **IV. Pertinent Species and Habitat Within Action Area**

- A. Action area:** Assateague Island, Virginia beach habitat, from South Wash Flats (north pony corral) to the current public beach parking lots (Beach Road).
- B. List of listed species/critical habitat, proposed species/critical habitat, and candidate species known to occur or potentially occurring within the action area. Include species/habitat occurrence.**

Piping Plover (*Charadrius melodus*) - 2 breeding pairs with chicks in the area in 2010  
 Loggerhead sea turtle (*Caretta caretta*) – 1 sea turtle nest in the area in 2010  
 Green sea turtle (*Chelonia mydas*) – very low potential for a nest in the area  
 Leatherback sea turtle (*Dermochelys coriacea*) – very low potential for a nest  
 Seabeach amaranth (*Amaranthus pumilus*) – low potential for occurrence  
 Red Knot (*Calidris canutus rufa*) – migrant, not present in late July

#### **V. Determination of Effects**

- A. Explanation of the adverse and beneficial effects of the action on species and/or critical habitat listed above.**

Herding ponies down the beach and the large number of spectators on the beach to view the ponies may result in trampling of plover nests or young and sea turtle nests that occur on the beach along the pony route. The ponies, the cowboys, spectators, and Refuge personnel all increase the chance of trampling. The pony penning event is also expected to result in human disturbance to piping plover nests and young that is greater than what would occur without the event. This includes the presence of large numbers of people for several hours; and mass movements of people up the beach in the early morning, and then down the beach after the ponies have passed. This may result in interference with normal breeding, feeding, and sheltering activities for plovers, and may result in plovers moving into areas they would not otherwise use as a result of either being precluded from normal use areas by people, and flushing. Any sea turtle hatchlings that emerge from nests at the time of the event may also be subject to trampling, disorientation, and disturbance as a result of the presence of large numbers of people and the ponies. Most of the activities are expected to occur within the intertidal zone, and consequently, the potential effects to seabeach amaranth are limited to those already addressed within the 2008 biological opinion.

**B. Explanation of actions to be implemented to reduce adverse effects:**

CNWR staff will meet annually with a CVFC representative prior to the Pony Walk to discuss event logistics and the pony route. If piping plover nests and/or chicks are present on the beach between South Wash Flats and the beach parking lot #1, staff and the CVFC will follow one or more of the following measures:

**Piping Plover Nest Protection (Fig. 3).**

Staff will construct a temporary fence north of the any piping plover nests located within the established pony penning route. The fence will direct the ponies, firemen, and spectators to the intertidal zone and around the plover nests. A staff member, intern or trained volunteer will be stationed near the plover nests during the Pony Walk to monitor incubating adults and eggs. Staff will remove the temporary fence after the ponies pass the nest. CNWR staff currently employs this method with sea turtles nests and found the method effective.

**Sea Turtle Nest Protection**

Staff will construct a temporary fence north of any sea turtle nest within the pony penning route to divert the ponies and people away from the nest. The nest site will also be marked with signs and flagging to aid in preventing trampling.

### **Alternate Pony Walk Routes**

If piping plover chicks are present within the Pony Walk route, CVFC will herd the ponies along an alternate route to avoid contact with plover broods:

#### Alternate Route #1: Piping plover chicks between South Wash Flats and C-Dike (Fig. 4).

CVFC will herd ponies from the North Pony Corral along the Service Road to C-Dike. The ponies will cross the dike to the beach and continue along the traditional route to the South Pony Corral.

#### Alternate Route #2: Piping plover chicks between C-Dike and Swan Cove Trail (Fig. 5).

CVFC will herd ponies from the North Pony Corral along the Service Road to the Wildlife Loop. Ponies will follow the Wildlife Loop to Swan Cove Trail and cross to the beach. Once on the beach, the ponies will continue along the traditional route to the South Pony Corral.

#### Alternate Routes #3A & 3B: Piping plover chicks between Swan Cove Trail and Parking Lots.

*Option A (Fig. 6):* CVFC will herd ponies from the North Pony Corral and cross to the beach adjacent to South Wash Flats. Ponies will walk south along the beach intertidal zone and cross to the Wildlife Loop via Swan Cove Trail. The ponies will continue along the Wildlife Loop to Black Duck Trail. Ponies will continue on Beach Road to the South Pony Corral.

*Option B (Fig. 7):* CVFC will herd ponies from the North Pony Corral and cross to the beach adjacent to South Wash Flats. Ponies will walk south along the beach intertidal zone and into F-Pool. The ponies will continue through F-Pool, west of the beach parking lot #1 to Beach Road. Ponies will continue on Beach Road to the South Pony Corral. Staff will erect temporary buffer fencing on the beach around the plover brood. The fencing will keep visitors away from the plover brood during the event. Staff members, interns or trained volunteers will be stationed along the fencing during the Pony Walk. Staff will remove the temporary fence after the ponies pass the nest.

#### Alternate Route #4: Piping plover chicks in multiple locations between South Wash Flats and Parking Lots (Fig. 8).

CVFC will herd ponies from the North Pony Corral south along the Service Road. Ponies will cross to Beach Road through the Office Complex or Wildlife Loop parking lots. Ponies will continue on Beach Road to the South Pony Corral.

### Visitor/Spectator Management

Refuge personnel will be briefed prior to the event to allow them to provide information to the public about avoiding plover and sea turtle nests that will reduce potential adverse effects. If alternate pony routes are used, Refuge staff will notify visitors of the selected route through outreach, signage, and visitor contacts. While most visitors are expected to closely follow the pony route, some visitors may travel up the beach to reach portions of the pony route that are along the beach, and in doing so, may walk past plover nests or unfledged young plovers that the pony re-routing was intended to protect. If spectators are expected to travel on the beach near plover nests or young, Refuge staff will provide direction, signage, and other appropriate aids to help direct people away from areas where young plovers or plover nests occur. If young plovers may be in the intertidal zone, a Refuge monitor will be stationed at the nest to determine the location of young and help Refuge staff direct spectators to avoid and minimize disturbance to plover nests and young.

With the implementation of these measures to avoid and minimize potential effects of the pony penning event on piping plovers and sea turtles, the risk to these species is significantly reduced. The likelihood of trampling of a plover nest or chick or sea turtle nest or hatchling is almost eliminated, and would only be expected to occur if the CVFC loses control of one or more ponies, or if spectators or visitors fail to heed Refuge personnel instructions or signage. Disturbance to plovers may still occur as a result of the large numbers of people on the beach in the vicinity of nesting areas, and disturbance may result in temporary changes in plover behavior and habitat use, but these effects are expected to be limited to a few hours of the morning of the event, and are not expected to be significant enough that they would result in injury, death, or reproductive failure of any plovers. Consequently, with the implementation of the action to reduce adverse effects, the remaining effects are expected to be insignificant or discountable.

## **VI. Effect Determination and ES Response Requested**

### **A. Listed species/designated critical habitat:**

| Field Station Determination       | Species Name(s)                                                                                           | Ecological Services Response Requested (check one) |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| No effect                         |                                                                                                           | <input type="checkbox"/> None Needed               |
| Is not likely to adversely affect | Piping Plover<br>Loggerhead sea turtle<br>Green sea turtle<br>Leatherback sea turtle<br>Seabeach amaranth | <input checked="" type="checkbox"/> Concurrence    |
| Is likely to adversely affect     |                                                                                                           | <input type="checkbox"/> Formal Consultation       |

| Field Station Determination                  | Critical Habitat For (list species) | Ecological Services Response Requested (check one) |
|----------------------------------------------|-------------------------------------|----------------------------------------------------|
| No effect                                    |                                     | _____ None Needed                                  |
| Is not likely to destroy or adversely modify |                                     | _____ Concurrence                                  |
| Is likely to destroy or adversely modify     |                                     | _____ Formal Consultation                          |

**B. Proposed species/proposed critical habitat/candidate species:**

| Field Station Determination       | Species Name(s) | Ecological Services Response Requested (check one) |
|-----------------------------------|-----------------|----------------------------------------------------|
| No effect                         | Red knot        | <u>  X  </u> None Needed                           |
| Is not likely to adversely affect |                 | _____ Concurrence                                  |
| Is likely to jeopardize           |                 | _____ Conference                                   |

| Field Station Determination              | Critical Habitat For (list species) | Ecological Services Response Requested (initial/check one) |
|------------------------------------------|-------------------------------------|------------------------------------------------------------|
| No effect                                |                                     | _____ None Needed                                          |
| Is not likely to adversely affect        |                                     | _____ Concurrence                                          |
| Is likely to destroy or adversely modify |                                     | _____ Conference                                           |

*Louis S. Vindas* <sup>III</sup> 7/15/11  
 signature date  
 Refuge Manager, Chincoteague NWR

VII. Reviewing Ecological Services Field Office Evaluation

- A. Concurrence   X   Nonconcurrence \_\_\_\_\_
- B. Formal consultation required \_\_\_\_\_
- C. Conference required \_\_\_\_\_
- D. Informal conference required \_\_\_\_\_
- E. Remarks:

*John R. ...* 7-21-11  
 Supervisor, Virginia Field Office Date

Fig 1. Pony grazing compartments on Chincoteague NWR, Assateague Island, VA.

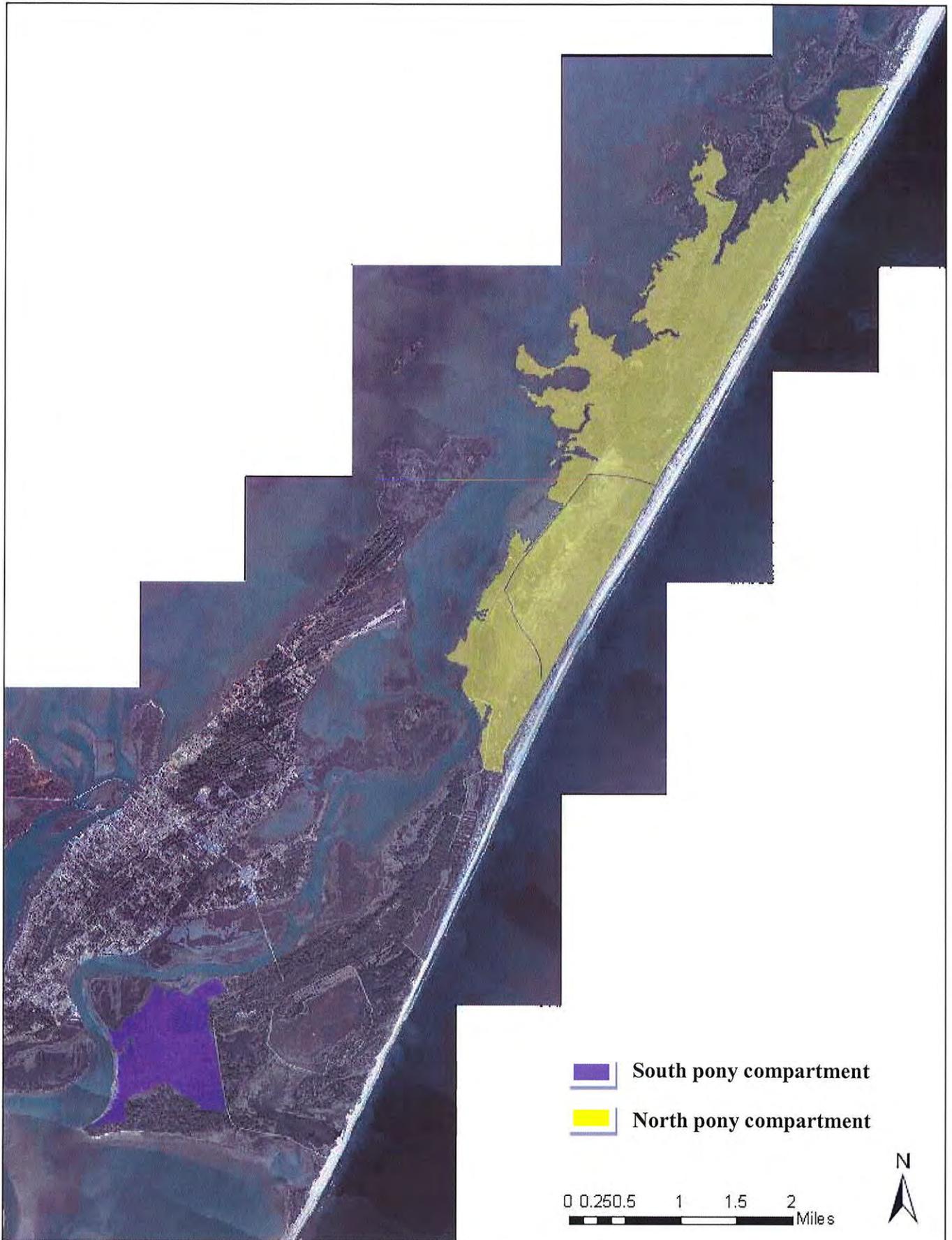
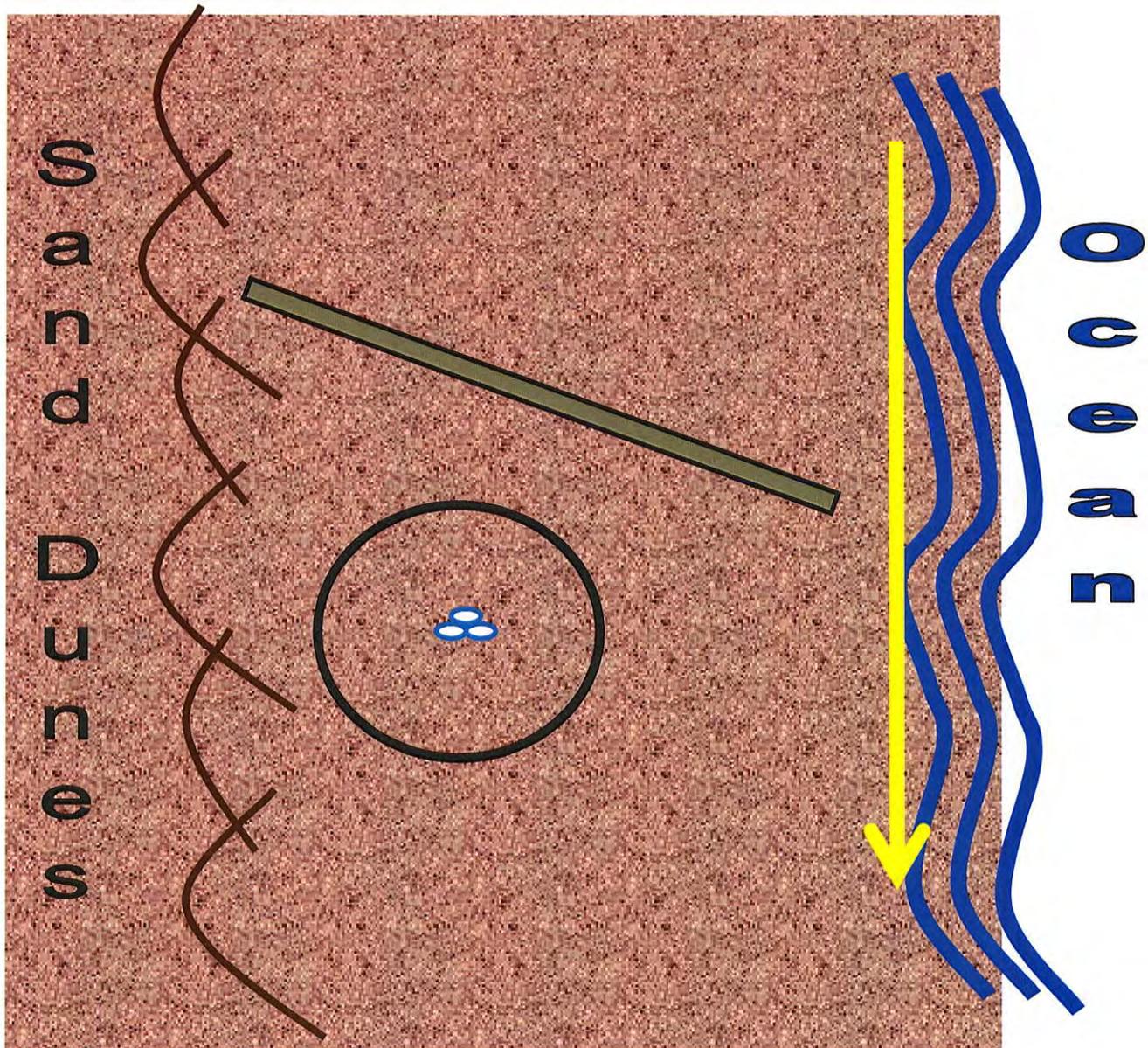


Fig 2. Traditional Chincoteague Volunteer Fire Department “Pony Walk” route from South Wash Flats Impoundment to the South Pony Corral.



Fig 3. Protection measures for piping plover nest located within Pony Walk route.



-  Piping plover nest
-  Nest enclosure
-  Temporary fence
-  Pony walk route



Fig 5. Alternate Route #2: Option used if piping plover chicks are between C-Dike and Swan Cove Trail.



**Fig 6. Alternative Route #3A: Option used if piping plover chicks are between Swan Cove Trail and Parking Lots.**



Fig 7. Alternate Route #3B: Option used if piping plover chicks are between Swan Cove Trail and Parking Lots.



**Fig 8. Alternate Route #4B: Option used if piping plover chicks are in multiple locations between South Wash Flats and Parking Lots.**



Appendix E

Bill Thompson/ USFWS



*Green-winged Teal*

**Memorandum of Understanding  
between the National Park  
Service and U.S. Fish and  
Wildlife Service for  
Interagency Cooperation at  
Assateague Island National  
Seashore and Chincoteague  
National Wildlife Refuge**



**MEMORANDUM OF UNDERSTANDING**

Agreement Number G4190120001  
FWS Agreement Number FF05R00000-12-K002  
Page 1 of 15

**Memorandum of Understanding  
between the  
National Park Service and U.S. Fish and Wildlife Service  
for Interagency Cooperation at  
Assateague Island National Seashore and Chincoteague National Wildlife Refuge**

This Memorandum of Understanding (hereinafter “Agreement”) is entered into by and between the National Park Service (hereinafter “NPS”), U.S. Department of the Interior, acting through the Superintendent of Assateague Island National Seashore, and the U.S. Fish and Wildlife Service (hereinafter “FWS”), U.S. Department of the Interior, acting through the Refuge Manager of Chincoteague National Wildlife Refuge.

**ARTICLE I – BACKGROUND**

Chincoteague National Wildlife Refuge (CNWR) was established on Assateague Island in 1943 to be administered by the FWS under the authority of the Migratory Bird Conservation Act. In 1959, under the authority of Public Law 85-57, the Secretary of the Interior granted to the Chincoteague-Assateague Bridge and Beach Authority (Beach Authority) an easement to build a bridge to and roadway across CNWR to the Toms Cove Hook area. Coincident to the easement, the FWS entered into an agreement with the Beach Authority allowing the development and operation of a public beach and recreational facilities. These actions were taken in recognition of the need for public recreational facilities on the Virginia portion of Assateague Island and under the assumption that regulated public use of the Toms Cove area could be permitted without preventing accomplishment of the purposes for which CNWR was established.

Assateague Island National Seashore (ASIS) was established in 1965 under Public Law 89-195 and its boundary drawn to encompass CNWR. Section 2(c) of P.L. 89-195 authorized the Secretary of the Interior to acquire all of the rights, title, or interests of the Beach Authority, including its real and personal property. When the acquisition was accomplished with NPS appropriations in 1966, the former Beach Authority easements merged with the United States' ownership interests.

Section 6(a) of Public Law 89-195 directs the Secretary of the Interior to administer ASIS for the general purposes of outdoor public recreation. This has been interpreted by the Secretary as also directing the NPS to aid the FWS in providing public recreation within the boundaries of CWNR. Public Law 89-195 stipulates, however, that the "land and waters in CNWR, which are a part of the seashore, shall be administered for refuge purposes under laws and regulations applicable to national wildlife refuges, including administration for public recreation uses in accordance with the provisions of the Refuge Recreation act of September 28, 1962 (P.L. 87-714)." The act authorizes the Secretary to administer refuges for recreational use, when such uses do not interfere with the area's primary purposes.

Amendments to the National Wildlife Refuge System Administration Act in 1976 (P.L. 94-223) direct that all areas in the system "shall be administered by the Secretary through the United States Fish and Wildlife Service", and that the FWS has ultimate decision-making authority within refuges. Subsequent opinions by Department of the Interior solicitors affirmed the authority of the FWS to cooperate with other Federal agencies in carrying out their responsibilities, and the NPS role in administering public recreation in the Toms Cove area as approved by the FWS.

The National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57) provides guidance to the Secretary for the overall management of the Refuge System. Key components of the Act include a strong wildlife conservation mission for the Refuge System; a process for determining compatible uses of refuges; a recognition that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible, are appropriate public uses of refuges; and

that compatible wildlife-dependent recreational uses are the priority public uses of the Refuge System.

Although beach recreation is not one of the priority public uses of refuges, legislative directives related to the management of Assateague Island by the FWS and NPS have made clear that beach recreation is an appropriate activity within CNWR so long as it remains compatible with the overall purposes of the Refuge. The continued appropriateness of beach recreation at CNRW was affirmed in an approved 2004 Compatibility Determination.

## **ARTICLE II – PURPOSE AND OBJECTIVES**

The cooperative relationship between the NPS and FWS on Assateague Island has been defined in a series of agreements dating back to 1966; all of which have assigned certain management responsibilities to each of the two agencies. The agreements have evolved over time, reflecting changes in management goals as well as legislative changes to agency authority and administrative requirements.

The purpose of this Agreement is to provide an updated and contemporary framework for effective and efficient interagency cooperation on Assateague Island. This Agreement, unless otherwise specified, applies to the management of that portion of Assateague Island in the general vicinity of Toms Cove referred to as the “Assigned Area”, depicted on a map attached to and made a part of this Agreement. Should the Assigned Area change, this Agreement will be amended to address any associated changes in management responsibilities or administrative requirements.

The specific objectives of both the FWS and NPS with respect to management of the Assigned Area on Assateague Island are:

- A. To protect and enhance refuge and park resources, as well as the appropriate enjoyment and appreciation of same by the public;

- B. To provide high quality recreational, interpretive, and educational opportunities for the visiting public;
- C. To reduce confusion regarding each agencies' roles and responsibilities
- D. To eliminate unnecessary duplication of services, permitting, paperwork, and reviews.
- E. To effectively utilize the experience, skills, and expertise of the two agencies' personnel.

This Agreement supersedes and replaces the General Agreement dated October 18, 2001 between the FWS and NPS pertaining to the administration, development, and use of the Assigned Area on Assateague Island. Cooperative operational activities covered by this Agreement include visitor services, interpretive services, visitor and resource protection, facility management, land and resource management, and interagency communications. Cooperative law enforcement activities are further defined under a separate agreement.

### **ARTICLE III – AUTHORITY**

Pursuant to 16 U.S.C. §1a-2(l), the NPS is authorized to cooperate with Federal, State and local park agencies for the more effective and efficient management of adjacent park areas, so long as the administrative responsibilities for any unit of the National Park System are not transferred.

### **ARTICLE IV – STATEMENT OF AGREEMENT FOR OPERATIONAL ACTIVITIES**

#### **A. Visitor Services**

- 1. The NPS will:
  - a. Plan, facilitate, support, and manage appropriate recreational activities within the Assigned Area and other areas of NPS jurisdiction. Activities include swimming,

- fishing, motorized and non-motorized boating, clamming and crabbing, bird watching, beach combing, sightseeing, and other similar visitor uses compatible with the FWS and NPS missions.
- b. Consult with FWS prior to initiating or allowing any new or non-traditional recreational activities within the Assigned Area.
  - c. Assist in the day to day management of over-sand vehicle (OSV) use within the designated OSV zone by issuing permits, educating permit holders on OSV use regulations, and assisting the FWS with enforcing OSV use regulations, limits, and closures. Vehicle and equipment standards will be as defined by 36 CFR, 7.65(b).
  - d. Operate and manage a lifeguarded beach during the peak visitor use season in accordance with NPS policies and practices. The NPS will:
    - i. Have sole supervisory responsibility for lifeguards and lifeguard operations, including closure of the lifeguard protected beach for public safety. All beach closures require the approval of the Chief Lifeguard or his delegated supervisor.
    - ii. Use all-terrain vehicles (ATVs) in conducting lifeguard operations (including emergency medical response) within the Assigned Area.
    - iii. Provide 'First Responder' response by lifeguards to medical emergencies within the Assigned Area with continued emergency medical services as per the existing Memorandum of Agreement with the FWS and Town of Chincoteague.
2. The FWS will:
- a. Provide annual guidance for management of the OSV zone, to be defined and agreed to in advance through the Annual Operating Plan (AOP) as per Article V of this Agreement.
  - b. Define, on an annual basis through the AOP, the locations, circumstances, and conditions under which NPS lifeguards may operate outside of the Assigned Area (including use of ATVs for emergency response).
  - c. Assume primary responsibility for permitting all special park uses (Special use, research, photographic, etc.) within the Assigned Area.
  - d. Consult with the NPS about any special park uses with potential to affect normal visitor use or NPS operations within the Assigned Area. If it is determined that the

- proposed use will affect visitor use or NPS operations in the assigned area, the NPS will manage the permitting process.
- e. Provide government-owned housing, as available, at standard rates for NPS seasonal employees and volunteers working in the Virginia District of ASIS. The amount of housing available for NPS employees and volunteers will be defined and agreed to in the AOP, as per Article V of this Agreement.
3. The NPS and FWS will jointly:
- a. Define the size of the lifeguarded beach, dates and times of operation, staffing levels, and the number, type and location of lifeguard stands on an annual basis in the AOP.
  - b. Honor entrance passes issued by the other agency
    - i. NPS will, in Maryland, honor valid daily and seven-day entrance passes, Federal Duck Stamps, and CNWR Annual Passes issued by the FWS.
    - ii. FWS will, in Virginia, honor valid seven-day entrance passes, National Park Passes, and ASIS Annual Passes issued by the NPS.
    - iii. Both agencies will honor valid “America the Beautiful” Annual, Senior, Access, and Volunteer passes.

## **B. Interpretive Services**

1. The NPS will:
  - a. Plan, develop, and provide to the public appropriate interpretive and educational programs and activities (including the placement of waysides, kiosks, etc.). Unless otherwise approved by the FWS, these actions will take place exclusively within the Assigned Area or other areas of NPS jurisdiction including NPS-owned bridges, NPS visitor center, and waters within the Seashore boundary.
  - b. Operate the NPS visitor center within the assigned area with sole responsibility for thematic content, activities, staffing, and maintenance.
    - i. Coordinate operation of an Eastern National (EN) sales outlet in visitor center.
    - ii. Avoid the duplication of sales items with the Chincoteague Natural History Association operated sales outlet in the FWS visitor center.

- c. Recruit, train, supervise, and manage volunteers in accordance with NPS policies and practices to assist in providing those visitor services in the assigned area for which the NPS has primary responsibility.
2. The FWS will:
    - a. Allow intermittent use of the FWS visitor center, as available, without charge by NPS for special interpretive programs and events. The schedule and purpose of these special events will be defined and agreed to in the AOP.
    - b. Avoid the duplication of sales items in the FWS visitor center with the Eastern National operated sales outlet in the NPS visitor center.
3. The NPS and FWS will jointly:
    - a. Define the emphasis of each agency's interpretative programs and the locations where each will provide interpretive services to avoid overlap and/or duplication of effort. The types and location of activities will be defined and agreed to in the AOP.
    - b. Consult with one another prior to conducting activities which overlap with the other agency's interpretive activities or locations.
    - c. Define the locations within the Assigned Area where cooperators may provide interpretive services, and adopt scheduling protocols and lines of communication to assure that cooperator programs do not conflict with agency activities. The types and location of cooperator activities will be defined and agreed to in the AOP.
    - d. Provide mutual assistance in interpretive planning and programming. Major or recurring assistance requires advanced approval and will be defined and agreed to in the AOP.
    - e. Review and approve, as appropriate, any materials distributed by the other agency or their authorized cooperators dealing with agency policies and/or management. Review/approval will be by the CNWR Refuge manager and ASIS Superintendent.
    - f. Collaborate in training or cross-training volunteers as necessary to meet shared objectives.
    - g. Share volunteers as necessary and desirable to meet shared objectives. Major or recurring sharing of volunteers will be defined and agreed to in the AOP.

**C. Visitor and Resource Protection**

1. The NPS and FWS will jointly:
  - a. Integrate the law enforcement operations and activities of both agencies within ASIS/CNWR to enhance the existing agency partnership, eliminate employee confusion and lack of direction during incidents, and provide quality resource and visitor protection services within the limits of existing resources and staffing.
    - i. All activities of the NPS/FWS integrated law enforcement operation will be conducted as per the ASIS/CNWR Cooperative Law Enforcement Agreement.
    - ii. For the purpose of this Agreement, ASIS/CNWR is defined as the NPS and FWS lands and waters within the Virginia portion of ASIS, and the lands and waters within CNWR and Wallops Island NWR.
  - c. Provide ‘First Responder’ response to medical emergencies with continued emergency medical services provided as per the existing Memorandum of Agreement between the NPS, FWS and Town of Chincoteague.
  - d. Respond to and support emergency operations within ASIS/CNWR including, but not limited to wild land fires, hazardous material spills, storms and other weather related emergencies as per the ASIS/CNWR Cooperative Law Enforcement Agreement.
  - e. Support the operation and maintenance of existing and future radio communications equipment and infrastructure.

**D. Facility Management**

1. The NPS will:
  - a. Visitor Use Facilities and Infrastructure
    - i. Conduct all normal maintenance, repair, and upkeep of NPS visitor use facilities and infrastructure, including roads, bridges, and parking lots within the Assigned Area and other locations of NPS jurisdiction. All such activities shall be consistent with NPS policies, procedures, and standards.
    - ii. Consult with FWS prior to initiating any new construction or substantive modification/repair/rehabilitation of NPS visitor use facilities and infrastructure,

- including the use or movement of sand resources within the Assigned Area, to ensure compatibility with the CNWR mission.
- iii. Conduct all necessary compliance and permitting actions associated with facility management activities in the Assigned Area and other locations of NPS jurisdiction.
- b. Operational Facilities and Infrastructure
    - i. Conduct all maintenance, repair, and upkeep of NPS operational facilities and infrastructure in the areas assigned for that purpose by the FWS within CNWR and Wallops Island NWR.
    - ii. Consult with FWS prior to initiating any substantive modification/repair/rehabilitation of NPS operational facilities and infrastructure to ensure compatibility with the CNWR mission.
    - iii. Conduct all necessary compliance and permitting actions associated with the management of NPS operational facilities and infrastructure.
  - c. Assateague Beach Coast Guard Station  
Provide normal maintenance, repair, and upkeep of the former Assateague Beach Coast Guard Station complex and associated utility systems.
  - d. Signage  
Provide and maintain appropriate and adequate signage in the Assigned Area and other locations of NPS jurisdiction.
  - e. State Line Fence  
Maintain the state line fence separating ASIS and CNWR for the primary purpose of restricting the movement of NPS horses and permitted OSVs onto the Refuge
2. The FWS will:
- a. Provide sites within the CNWR complex on both the Island and mainland sufficient to support NPS operational activities including vehicle/equipment storage, facility management, and other operational needs including housing for seasonal/temporary NPS employees.

- b. Provide the NPS with year round access across CNWR lands to the former Assateague Beach Coast Guard Station. The presence of sensitive resources may require the NPS to coordinate travel through certain areas with the FWS.
  - c. Maintain access to the Maryland/Virginia state line, as feasible, and assist the NPS in state line fence maintenance activities when requested and as available.
  - d. Take the lead role in all required compliance and permitting actions related to any future relocation of the Assigned Area and associated construction of new visitor use facilities and infrastructure.
3. The NPS and FWS will jointly:
- a. Assist one another in maintenance and facility management activities to the extent practicable or as agreed to by the Park Superintendent and Refuge Manager. This may include the sharing of equipment, staff, or facilities. Major or recurring assistance will be defined and agreed to in the AOP.
  - b. Identify essential maintenance employees in the AOP who will report during winter weather emergencies to conduct response activities such as snow removal.
  - c. Cooperate in sign management for the Park and Refuge. Except as otherwise agreed to, all signs within the Park/Refuge should be consistent in appearance and refrain from identifying agency names. The exceptions to this general rule are directional signs outside of the Park/Refuge, signs at the Park/Refuge entrance where both agencies should be given full recognition, and signs for the visitor centers which may recognize the operating agency only.

## **E. Land and Resource Management**

1. The FWS will:
  - a. As with the entire Virginia portion of Assateague Island, assume primary responsibility for managing the wildlife and other natural resources within the Assigned Area, with the understanding by both agencies that recreational use will be planned and carried out to minimize adverse impacts.
2. The NPS and FWS will jointly:

- a. Collaborate in natural and cultural resource management and related research activities including, but not limited to, invasive species control, threatened species management, and hunting management. Where appropriate, research findings and other resource information will be shared, activities of mutual interest will be planned jointly, professional expertise will be shared, and technology transfer will occur.
- b. Recognize that each agency has distinct policies and approaches to resource management but that management of the barrier island ecosystem as a whole is environmentally sound.
- c. To the extent allowed by their respective missions, seek to manage the land and waters of Assateague in a manner that protects, restores, and enhances the ecological health of the barrier island system.

#### **F. Interagency Communications and Information Sharing**

1. The NPS and FWS will jointly:
  - a. Notify one another as soon as possible about all incidents, problems, violations, or management actions (e.g. weather emergencies, Refuge closures, storm response) with potential ramifications for the other agency.
  - b. Designate points of contact for each primary operational area covered by this Agreement (visitor services, interpretation, visitor and resource protection, maintenance, resource management, and administration). These individuals will meet at least twice annually (March-April and September-October) to identify and discuss the specifics of the AOP, operational problems or issues, and other matters of mutual concern.
  - c. Coordinate the production and release of all publications, press releases, and other publically distributed information related to the Assigned Area or other areas of shared responsibility.
  - d. Seek to keep one another informed about their respective activities and share all information of potential interest to the other agency.
  - e. Cooperate in the collection, analysis and reporting of visitor use statistics. Insofar as possible, similar methods will be used by both agencies to collect and tabulate visitor use data. Monthly visitor use statistics and reports will be shared between agencies.

**ARTICLE V – ANNUAL OPERATING PLAN**

The NPS and FWS will jointly develop an Annual Operating Plan by December 1<sup>st</sup> of each year covering cooperative activities for the following calendar year. The AOP will define specific details of the aforementioned cooperative operational activities authorized by this Agreement. The AOP will be approved annually by the ASIS Superintendent and the CNWR Refuge Manager.

**ARTICLE VI – TERM OF AGREEMENT**

This Agreement will be effective for a period of five years from the date of final signature, unless it is terminated earlier by one of the parties pursuant to Article VII below.

**ARTICLE VII– MODIFICATION AND TERMINATION**

- A. This Agreement may be modified only by a written instrument executed by the parties.
- B. Either party may terminate this Agreement by providing the other party with thirty (30) days advance written notice. In the event that one party provides the other party with notice of its intention to terminate, the parties will meet promptly to discuss the reasons for the notice and try to resolve their differences.

**ARTICLE VIII – KEY OFFICIALS**

- A. Key officials are essential to ensure maximum coordination and communication between the parties and the work being performed. They are:

1. For the National Park Service:

Patricia Kicklighter  
Superintendent  
Assateague Island National Seashore  
7206 National Seashore Lane  
Berlin, MD 21811  
E-mail: trish\_kicklighter@nps.gov  
Telephone: (410) 629-6080  
Facsimile: (410) 641-1099

2. For the U.S. Fish and Wildlife Service:

Louis Hinds  
Refuge Manager  
Chincoteague National Wildlife Refuge  
PO Box 62  
Chincoteague, VA 23336  
E-mail: louis\_hinds@fws.gov  
Telephone: (757) 336-6122  
Facsimile: (757) 336-5273

- B. Changes in Key Officials – Neither the NPS or FWS may make any permanent change in a key official without written notice to the other party reasonably in advance of the proposed change.

## **ARTICLE IX – SIGNATURES**

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the date(s) set forth below.

FOR THE NATIONAL PARK SERVICE:

Signature: Patricia Kicklighter

Name: Patricia Kicklighter

Title: Superintendent, Assateague Island National Seashore

Date: 1/10/2012

Concur: Dennis R. Reidenbach

Name: Dennis R. Reidenbach

Title: Regional Director, Northeast Region

Date: 3/8/2012

FOR THE U.S. FISH AND WILDLIFE SERVICE:

Signature: Louis S. Hinds

Name: Louis Hinds

Title: Refuge Manager, Chincoteague National Wildlife Refuge

Date: 12, JAN. 2012

Concur: Wendi Weber

Name: Wendi Weber

Title: Regional Director, Northeast Region

Date: 1/31/12



# National Park Service Assigned Area

Memorandum of Understanding G4190120001



## Appendix F



USFWS

*Loggerhead sea turtle hatchlings*

# **Biological Opinion on monitoring and management practices for piping plover, loggerhead sea turtle, green sea turtle, leatherback sea turtle, and seabeach amaranth on Chincoteague NWR**





# United States Department of the Interior



## FISH AND WILDLIFE SERVICE

Ecological Services  
6669 Short Lane  
Gloucester, VA 23061

September 10, 2008

### Memorandum

To: Refuge Manager, Chincoteague National Wildlife Refuge

From: Supervisor, Virginia Field Office

Subject: Biological Opinion on monitoring and management practices for piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), and seabeach amaranth (*Amaranthus pumilus*) on Chincoteague National Wildlife Refuge, Virginia

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion on the proposed species monitoring, piping plover and sea turtle nest exclosures, predator control, hunting program, public beach use, and off-road vehicle (ORV) use within all units of the Chincoteague National Wildlife Refuge (CNWR), Accomack County, Virginia, and the effects of these activities on the endangered green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*), and the threatened piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*), and seabeach amaranth (*Amaranthus pumilus*). The final portion of your completed *Intra-Service Section 7 Biological Evaluation Form* (Enclosure 1) was received by this office on August 7, 2008.

This biological opinion is based on information provided in your *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1), information contained within this office, conversations with CNWR staff and species experts, field investigations, and other sources of information. A complete administrative record of this consultation is on file at this office.

### Consultation History

Consultation history is provided in Appendix A.

## **BIOLOGICAL OPINION**

### I. DESCRIPTION OF THE PROPOSED ACTION

The proposed actions consist of continued species monitoring, piping plover and sea turtle nest exclosures, predator control, public recreational use, off-road vehicle (ORV) use (public and

Refuge Manager, Chincoteague National Wildlife Refuge

2

government vehicles, and public horseback riding will be treated as an ORV for this consultation), hunting programs, and general management activities within the beach and dunal systems of all units of the CNWR. Tables 1 and 2 provide a detailed listing of the types of public beach use that occur on the Assateague Unit and Southern Units of CNWR, respectively. This opinion will address all activities that occur on the beaches of CNWR, as explained in detail in the enclosed *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1) with regards to piping plovers, seabeach amaranth, and nesting sea turtles. The action area comprises all beach areas managed by the refuge. These areas are: Assateague, Assawoman, Metompkin, and Cedar Islands. This opinion supersedes the 2001 biological opinion and establishes new levels of anticipated incidental take. The proposed actions represent both updates of actions consulted on in the 2001 biological opinion and additional activities not addressed in the 2001 biological opinion. The proposed actions are expected to continue for up to five years from the issuance date of this opinion, or until CNWR completes its Comprehensive Conservation Plan (CCP) for the refuge. Once completed, the CCP will guide refuge management, and the Service expects to consult on the management actions proposed in the CCP as a new action.

## II. STATUS OF THE SPECIES

### PIPING PLOVER (*Charadrius melodus*)

On January 10, 1986, the piping plover was listed as endangered or threatened in various parts of its range pursuant to the ESA. Protection of the species under the ESA reflects the species precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). No Critical Habitat has been designated or proposed for piping plovers in the Atlantic Coast breeding area.

The recovery plan for the Atlantic Coast population of the piping plover (U.S. Fish and Wildlife Service 1996a) delineates four recovery units or geographic subpopulations within the population: Atlantic Canada, New England, New York-New Jersey, and Southern (Delaware, Maryland, Virginia, and North Carolina). Recovery criteria established within the recovery plan defined population and productivity goals for each recovery unit, as well as for the population as a whole. Attainment of these goals for each recovery unit is an integral part of a piping plover recovery strategy that seeks to reduce the probability of extinction for the entire population by: (1) contributing to the population total, (2) reducing vulnerability to environmental variation (including catastrophes, such as hurricanes, oil spills, or disease), (3) increasing likelihood of genetic interchange among subpopulations, and (4) promoting recolonization of any sites that experience declines or local extirpations due to low productivity or temporary habitat succession.

| <b>Assateague Island Areas</b>      | <b>Wild Beach</b>              | <b>Public Beach</b>            |                            | <b>Overwash</b>                             | <b>Hook</b>                                 | <b>Tom's Cove</b>                         |
|-------------------------------------|--------------------------------|--------------------------------|----------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------------|
| <b>Areas from North to South</b>    | <b>VA state line to D-dike</b> | <b>D-dike to Parking Lot 1</b> | <b>Parking Lots 1 to 5</b> | <b>Parking Lot 5 to Coast Guard Station</b> | <b>Coast Guard Station to end of Island</b> | <b>NPS waters adjacent to Refuge land</b> |
| Walking/Wildlife Observation        | 1,2,3,4                        | 1,2,3,4                        | 1,2,3,4                    | 1,3,4                                       | 3,4                                         | 1,2,3,4                                   |
| Sunbathing/Swimming                 |                                | 1,2,3,4                        | 1,2,3,4                    | 1,3,4                                       | 3,4                                         | 1,2,3,4                                   |
| Pony Penning (2 days in July)       | 2                              | 2                              | 2                          |                                             |                                             |                                           |
| Fishing*                            |                                | 1,2,3,4                        | 1,2,3,4                    | 1,2,3,4                                     | 3,4                                         | 1,2,3,4                                   |
| ORV - public*                       |                                |                                |                            | 1,2,3,4                                     | 3,4                                         |                                           |
| ORV – LE                            | 1,2,3,4                        | 1,2,3,4                        | 1,2,3,4                    | 1,2,3,4                                     | 1,2,3,4                                     | 1,2,3,4                                   |
| EE and Interpretation               |                                |                                | 1,2,3,4                    |                                             |                                             |                                           |
| SUP – EE                            |                                | 1,2,3,4                        | 1,2,3,4                    |                                             |                                             |                                           |
| Weddings                            |                                | 1,2,3,4                        | 1,2,3,4                    | 1,3,4                                       |                                             |                                           |
| Kite flying                         |                                |                                | 1,2,3,4                    |                                             |                                             |                                           |
| Shell collecting/beach combing      |                                | 1,2,3,4                        | 1,2,3,4                    | 1,3,4                                       | 3,4                                         | 1,2,3,4                                   |
| Research w/ SUP                     | 1,2,3,4                        | 1,2,3,4                        | 1,2,3,4                    | 1,2,3,4                                     | 1,2,3,4                                     | 1,2,3,4                                   |
| Beach clean-up - vehicles (1 day)   | 3                              | 3                              | 3                          | 3                                           | 3                                           |                                           |
| Biological surveys                  | 1,2,3,4                        | 1,2,3,4                        |                            | 1,2,3,4                                     | 1,2,3,4                                     | 1,2,3,4                                   |
| Shorebird management                | 1,2,3,4                        | 1,2,3,4                        |                            | 1,2,3,4                                     | 1,2,3,4                                     | 1,2,3,4                                   |
| NPS maintenance                     |                                |                                | 1,2,3,4                    | 1,3                                         | 1,3                                         |                                           |
| Picnicking                          |                                | 1,2,3,4                        | 1,2,3,4                    | 1,3,4                                       | 3,4                                         | 1,2,3,4                                   |
| Campfires                           |                                |                                | 1,2,3,4                    |                                             |                                             |                                           |
| Horseback riding                    |                                |                                |                            | 1,3,4                                       | 3,4                                         | 3,4                                       |
| Big game hunting                    |                                |                                |                            |                                             | 3,4                                         | 3,4                                       |
| Boat landing                        |                                |                                |                            | 3,4                                         | 3,4                                         | 1,2,3,4                                   |
| Coast Guard Station - NPS           |                                |                                |                            | 1,3,4                                       |                                             | 1,2,3,4                                   |
| Other Agency activities w/SUP       |                                |                                | 1,2,3,4                    | 1,3,4                                       | 3,4                                         |                                           |
| Shell fishing access                |                                |                                |                            |                                             |                                             | 1,3,4                                     |
| Commercial filming - SUP            |                                |                                | 1,2,3,4                    |                                             |                                             |                                           |
| Agency tours and Junkets            | 1,2,3,4                        | 1,2,3,4                        | 1,2,3,4                    | 1,2,3,4                                     | 1,2,3,4                                     | 1,2,3,4                                   |
| Emergency Activities                | 1,2,3,4                        | 1,2,3,4                        | 1,2,3,4                    | 1,2,3,4                                     | 1,2,3,4                                     | 1,2,3,4                                   |
| Predator Management                 | 1,2,4                          | 1,2,4                          |                            | 1,2,4                                       | 1,2,4                                       | 1,2                                       |
| 1 = Spring (Mar 15 - June 15)       |                                |                                |                            |                                             |                                             |                                           |
| 2 = Summer (June 16 - Labor Day)    |                                |                                |                            |                                             |                                             |                                           |
| 3 = Fall (Labor Day - Thanksgiving) |                                |                                |                            |                                             |                                             |                                           |
| 4 = Winter (Thanksgiving - Mar 16)  |                                |                                |                            |                                             |                                             |                                           |

Refuge Manager, Chincoteague National Wildlife Refuge

4

| <b>Southern Islands</b>                                                                                                                                     | <b>Assawoman</b> | <b>Metompkin</b> | <b>Cedar*</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|---------------|
| Walking/Wildlife Observation                                                                                                                                | 3,4              | 1,2,3,4          | 1,2,3,4       |
| Sunbathing/swimming                                                                                                                                         | 3,4              | 1,2,3,4          | 1,2,3,4       |
| Fishing                                                                                                                                                     | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| ORV – Public                                                                                                                                                | n/a              | n/a              | 1,2,3,4       |
| ORV – LE                                                                                                                                                    | 1,2,3,4          | n/a              | n/a           |
| Shell collecting/beach combing                                                                                                                              | 3,4              | 1,2,3,4          | 1,2,3,4       |
| Research w/ SUP                                                                                                                                             | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| Surveys – biology                                                                                                                                           | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| Shorebird management                                                                                                                                        | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| Picnicking                                                                                                                                                  | 3,4              | 1,2,3,4          | 1,2,3,4       |
| Hunting                                                                                                                                                     | n/a              | n/a              | 3,4           |
| Boating                                                                                                                                                     | 1,2,3,4          | 1,2,3,4          | n/a           |
| Other Agency use w/ SUP                                                                                                                                     | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| Commercial filming w/ SUP                                                                                                                                   | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| Agency Tours                                                                                                                                                | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| Emergency Access                                                                                                                                            | 1,2,3,4          | 1,2,3,4          | 1,2,3,4       |
| Predator Control                                                                                                                                            | 1,2,4            | 1,2,3,4          | 1,2,3,4       |
| 1 = Spring (Mar 15 - June 15)                                                                                                                               |                  |                  |               |
| 2 = Summer (June 16 - Labor Day)                                                                                                                            |                  |                  |               |
| 3 = Fall (Labor Day - Thanksgiving)                                                                                                                         |                  |                  |               |
| 4 - Winter (Thanksgiving - Mar 16)                                                                                                                          |                  |                  |               |
| *The inability to determine ownership limits restrictions placed on the island, therefore, CNWR has limited control of public use across the entire island. |                  |                  |               |

The plan further states: “A premise of this plan is that the overall security of the Atlantic Coast piping plover population is profoundly dependent upon attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood of survival of a recovery unit will also reduce the probability of persistence of the entire population.” In accordance with the Endangered Species Consultation Handbook (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998), since recovery units have been established in an approved recovery plan, this Biological Opinion considers the effects of the proposed project on piping plovers in the Southern Recovery Unit, as well as the Atlantic Coast population as a whole.

Species Description - Piping plovers are small, sand-colored shorebirds, approximately 17 centimeters (cm) (7 inches) long with a wingspread of about 38 cm (15 inches) (Palmer 1967). The Atlantic Coast population, which is the focus of this Biological Opinion, breeds on sandy, coastal beaches from Newfoundland to North Carolina, and winters along the Atlantic Coast from North Carolina south, along the Gulf Coast to Texas, and in the Caribbean (U.S. Fish and Wildlife Service 1996a). Additional detailed information on the piping plover, its life history,

Refuge Manager, Chincoteague National Wildlife Refuge

5

and the population dynamics of the Atlantic population are provided in the recovery plan (U.S. Fish and Wildlife Service 1996a).

Life History - Piping plovers generally begin returning to their Atlantic Coast nesting beaches in mid-March (Coutu *et al.* 1990, Cross 1990, Goldin 1990, MacIvor 1990, Hake 1993). Males establish and defend territories and court females (Cairns 1982). Piping plovers are monogamous, but usually shift mates between years (Wilcox 1959, Haig and Oring 1988, MacIvor 1990), and less frequently between nesting attempts in a given year (Haig and Oring 1988, MacIvor 1990, Strauss 1990). Plovers are known to begin breeding as early as one year of age (MacIvor 1990, Haig 1992); however, the percentage of birds that breed in their first adult year is unknown.

Piping plovers nest on the ground above the high tide line on coastal beaches, on sand flats at the ends of sand spits and barrier islands, on gently sloping foredunes, in blowout areas behind primary dunes, and in washover areas cut into or between dunes. In the central portions of their Atlantic Coast range, the birds may also nest on areas where suitable dredge material has been deposited. Nest sites are shallow, scraped depressions in substrates ranging from fine-grained sand to mixtures of sand and pebbles, shells or cobble (Bent 1929, Burger 1987, Cairns 1982, Patterson 1988, Flemming *et al.* 1988, MacIvor 1990, Strauss 1990). Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass or other vegetation (Patterson 1988, Flemming *et al.* 1990, MacIvor 1990). Plover nests may be very difficult to detect, especially during the six to seven day egg-laying phase when the birds generally do not incubate the eggs within the nest cup (Goldin 1994).

Eggs may be present on the beach from early April through late July. Clutch size for an initial nest attempt is usually four eggs, one laid every other day. Eggs are pyriform in shape, and variable buff to greenish brown in color, marked with black or brown spots. The incubation period usually lasts 27-28 days. Full-time incubation usually begins with the completion of the clutch and is shared equally by both sexes (Wilcox 1959, Cairns 1977, MacIvor 1990). Eggs in a clutch usually hatch within four to eight hours of each other, although the hatching period of one or more eggs may be delayed by up to 48 hours (Cairns 1977, Wolcott and Wolcott 1999).

Piping plovers generally fledge only a single brood per season, but may reneest several times if eggs are lost. Chicks are precocial, meaning they immediately can run from the nest cup upon hatching (Wilcox 1959, Cairns 1982). They may move with their parents hundreds of meters (m) from the nest site during their first week of life (U.S. Fish and wildlife Service 1996a), and chicks may increase their foraging range up to 1,000 meters before they fledge (are able to fly) (Loegering 1992). At CNWR, Daisey (2006) found that brood movements averaged  $60.1 \pm 28.0$  m/day in 2004 and  $68.8$  m/day in 2005 (range =  $5.4 - 120.8$  m/day;  $28.9 - 122.2$  m/day, respectively). Chicks remain together with one or both parents until they fledge at 25 to 35 days of age. Depending on their date of hatching, flightless chicks may be present from mid-May

Refuge Manager, Chincoteague National Wildlife Refuge

6

until late August, although most fledge by the end of July (Patterson 1988, Goldin 1990, MacIvor 1990, Howard *et al.* 1993).

Cryptic coloration is a primary defense mechanism for this species; eggs, adults, and chicks all blend in with their typical beach surroundings. Chicks sometimes respond to vehicles and/or pedestrians by crouching and remaining motionless (Cairns 1977, Tull 1984, Goldin 1993, Hoopes 1993). Adult piping plovers also respond to intruders (avian and mammalian) in their territories by displaying a variety of distraction behaviors, including squatting, false brooding, running, and injury feigning, in an effort to lure the predators away from the nest or chicks. Distraction displays may occur at any time during the breeding season but are most frequent and intense around the time of hatching (Cairns 1977).

Plovers feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929, Cairns 1977, Nicholls 1989). Important feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sand flats, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, or salt marshes (Gibbs 1986, Coutu *et al.* 1990, Hoopes *et al.* 1992, Loegering 1992, Goldin 1993, Elias-Gerken 1994). Studies have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986, Coutu, *et al.* 1990, McConnaughey *et al.* 1990, Loegering 1992, Goldin 1993, Hoopes 1993, Elias-Gerken 1994), and by stage in the breeding cycle (Cross 1990). Adults and chicks on a given site may use different feeding habitats in varying proportion (Goldin 1990). Feeding activities of chicks are particularly important to their survival. Most time budget studies reveal that chicks spend a high proportion of their time feeding. Cairns (1977) found that piping plover chicks typically tripled their weight during the first two weeks post-hatching; chicks that failed to achieve at least 60 percent of this weight gain by the twelfth day were unlikely to survive.

During courtship, nesting, and brood rearing, feeding territories are generally contiguous to nesting territories (Cairns 1977), although instances where brood-rearing areas are widely separated from nesting territories are not uncommon. Feeding activities of both adults and chicks may occur during all hours of the day and night (Burger 1993), and at all stages in the tidal cycle (Goldin 1993, Hoopes 1993).

Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (U.S. Fish and Wildlife Service 1996a). Relatively little is known about migration behavior or habitat use within the Atlantic Coast breeding range (U.S. Fish and Wildlife Service 1996a), but the pattern of both fall and spring counts at migration sites along the southeastern Atlantic Coast demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (National Park Service 2003, Noel *et al.* 2005, Stucker and Cuthbert 2006).

A growing body of information shows that habitats on overwash beaches, accessible bayside flats, unstabilized and recently healed inlets, and moist sparsely vegetated barrier flats are

Refuge Manager, Chincoteague National Wildlife Refuge

7

especially important to piping plover productivity and carrying capacity in the New York-New Jersey and Southern recovery units.

In New Jersey, Burger (1994) studied piping plover foraging behavior and habitat use at three sites that offered the birds access to ocean, dune, and backbay habitats. The primary focus of the study was on the effect of human disturbance on habitat selection, and it found that both habitat selection and foraging behavior correlated inversely with the number of people present. In the absence of people on an unstabilized beach, plovers fed in ocean and bayside habitats in preference to the dunes.

Loefering and Fraser (1995) found that chicks on Assateague Island, Maryland, that were able to reach bayside beaches and the island interior had significantly higher fledgling rates than those that foraged solely on the ocean beach. Higher foraging rates, percentage of time spent foraging, and abundance of terrestrial arthropods on the bay beach and interior island habitats supported their hypothesis that foraging resources in interior and bayside habitats are key to reproductive rates on that site. Their management recommendations stressed the importance of sparsely vegetated cross-island access routes maintained by overwash, and the need to restrict or mitigate human activities that reduce natural disturbance during storms.

Dramatic increases in plover productivity and breeding population on Assateague since the 1991-1992 advent of large overwash events corroborate Loefering and Fraser's conclusions. Piping plover productivity on Assateague, which had averaged 0.77 chicks per pair during the five years before the overwash events, averaged 1.67 chicks/pair in 1992-96. The nesting population on the northern five miles of the island also grew rapidly, doubling by 1995 and tripling by 1996, when 61 pairs nested there (MacIvor 1996). Habitat use is primarily on the interior and bayside of this island.

In Virginia, Watts *et al.* (1996) found that piping plovers nesting on 13 barrier islands between 1986 and 1988 were not evenly distributed along the islands. Beach segments used by plovers had wider and more heterogeneous beaches, fewer stable dunes, greater open access to bayside foraging areas, and proximity to mudflats. They note that characteristics of beaches selected by plovers are maintained by frequent storm disturbance.

At Cape Lookout National Seashore in North Carolina, 13 to 45 pairs of plovers have nested on North and South Core Banks each year since 1992 (National Park Service, 2007). While these unstabilized barrier islands total 44 miles long, nesting distribution is patchy, with all nests clustered on the dynamic ends of the barrier islands, recently closed and sparsely vegetated "old inlets," expansive barrier mudflats, or new ocean-to-bay overwashes. During a 1990 study, 96 percent of brood observations were on bay tidal flats, even though broods had access to both bay and ocean beach habitats (McConnaughey *et al.* 1990).

Refuge Manager, Chincoteague National Wildlife Refuge

8

At Cape Hatteras National Seashore, distribution of nesting piping plovers is also “clumped,” with nesting areas characterized by a wide beach, relatively flat intertidal zone, brackish ponds, and temporary pools formed by rainwater and overwash (Coutu *et al.* 1990).

Notwithstanding the importance of bayside (soundside) flats, ephemeral pools, and sparsely vegetated barrier flats for piping plover nest site selection and chick foraging, ocean intertidal zones are also used by adults and chicks of all ages. For example, between 1993 and 1996 on the Maryland end of Assateague Island, 4 to 12 percent of annual observations of plover broods occurred on the ocean beach (National Park Service and Maryland Department of Natural Resources 1993-1996). A three-year study of piping plover chick foraging activity at six sites on four Virginia barrier islands (Cross and Terwilliger 2000) documented chick use of the ocean intertidal zone at three of six study sites. Intensive observations at Chincoteague National Wildlife Refuge Overwash Zone in 2004, where chicks had unimpeded access to a large undisturbed bayside flat, documented occasional visits to the ocean intertidal zone by six of eleven broods ranging in age from one to 24 days (Hecht 2004 *in litt.*).

Population Dynamics/Status and Distribution - Historical population trends for the Atlantic Coast piping plover have been reconstructed from scattered, largely qualitative records. Nineteenth-century naturalists, such as Audubon and Wilson, described the piping plover as a common summer resident on Atlantic Coast beaches (Haig and Oring 1987). However, by the beginning of the 20th Century, egg collecting and uncontrolled hunting, primarily for the millinery trade, had greatly reduced the population, and, in some areas along the Atlantic Coast, the piping plover was close to extirpation. Following passage of the Migratory Bird Treaty Act (40 Stat. 775; 16 U.S.C. 703-712) in 1918, and changes in the fashion industry that no longer exploited wild birds for feathers, piping plover numbers recovered to some extent (Haig and Oring 1985).

Available data suggest that the most recent population decline began in the late 1940s or early 1950s (Haig and Oring 1985). Starting in 1972, the National Audubon Society's “Blue List” of birds with deteriorating status included the piping plover (Tate 1981). Johnsgard (1981) described the piping plover as “. . . declining throughout its range and in rather serious trouble.” The Canadian Committee on the Status of Endangered Wildlife in Canada designated the piping plover as “Threatened” in 1978 and elevated the species status to “Endangered” in 1985 (Canadian Wildlife Service 1989).

Reports of local or statewide declines between 1950 and 1985 are numerous and many are summarized by Haig and Oring (1985). While Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island, New York, the 1989 population estimate was 191 pairs (U.S. Fish and Wildlife Service 2004). There was little focus on gathering quantitative data on piping plovers in Massachusetts through the late 1960s because the species was commonly observed and presumed to be secure. However, numbers of piping plover breeding pairs declined 50 to 100 percent at seven Massachusetts sites between the early 1970s and 1984 (Griffin and Melvin 1984). Recent experience of biologists surveying piping plovers has shown that counts of these

Refuge Manager, Chincoteague National Wildlife Refuge

9

cryptically colored birds sometimes go up with increased census effort, suggesting that some historic counts of piping plover numbers by one or a few observers, who often recorded occurrences of many avian species simultaneously, may have underestimated the piping plover population. Thus, the magnitude of the species' decline may have been more severe than available numbers imply.

Table 3 summarizes nesting pair counts for the Atlantic Coast piping plover population since listing in 1986 through 2007. Final range-wide numbers for the 2008 breeding season are not yet available, and 2007 data are considered preliminary at this time. The apparent increase in numbers of plover pairs between 1986 and 1989 is thought, at least partially, to reflect the effects of increased survey efforts following the proposed listing of the species in 1986.

The Atlantic Coast population has increased from 790 pairs since listing to a preliminary estimate of 1,887 pairs in 2007 (U.S. Fish and Wildlife Service 2008a) (final 2006 estimate of 1,749 pairs, U.S. Fish and Wildlife Service 2006). Population growth has been greatest in the New England and New York-New Jersey recovery units, with a more modest and recent increase in the Southern unit and an even smaller increase in Atlantic Canada.

Productivity - Productivity needed to maintain a stable population for Atlantic Coast piping plovers is estimated at 1.24 fledged chicks per pair (Melvin and Gibbs 1994). Small populations may be highly vulnerable to extirpation due to variability in productivity and survival rates. The average productivity needed for a stable population may be insufficient to assure a high probability of species survival. To compensate for small populations, the recovery plan establishes productivity goals needed to assure a secure 2,000-pair population at 1.5 chicks per pair in each of the four recovery units, based on data from at least 90 percent of each recovery unit's population.

Table 4 provides a summary of piping plover productivity from 1987 to 2007. Both regional population trends and productivity rates have been uneven. The 10-year (1997-2007) average productivity for piping plovers on the U.S. Atlantic Coast is below the recovery target of 1.5 chicks per pair. Peak productivity in the U.S. occurred in 1994 when average productivity exceeded the recovery plan goal of 1.5 chicks per pair. In most years, average productivity across the Atlantic population remained below the target. While weather events were contributors to egg and chick losses in some years (U.S. Fish and Wildlife Service 1998, 2002a), such periodic natural events are inevitable, and they underscore the need to reduce the species' vulnerability by increasing the breeding population and protecting the species against human caused factors that affect productivity.

## Refuge Manager, Chincoteague National Wildlife Refuge

10

TABLE 3. Estimated abundance of breeding pairs of Atlantic Coast piping plovers, 1986 – 2007. Parentheses denote preliminary estimates.

| State/ RECOVERY UNIT  | Pairs |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |        |        |      |        |
|-----------------------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|--------|------|--------|
|                       | 1986  | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004   | 2005   | 2006 | 2007   |
| Maine                 | 15    | 12   | 20   | 16   | 17   | 18   | 24   | 32   | 35   | 40   | 60   | 47   | 60   | 56   | 50   | 55   | 65   | 61   | 55     | 49     | 40   | 35     |
| New Hampshire         |       |      |      |      |      |      |      |      |      |      |      | 5    | 5    | 6    | 6    | 7    | 7    | 7    | 4      | 3      | 3    | 3      |
| Massachusetts         | 139   | 126  | 134  | 137  | 140  | 160  | 213  | 289  | 352  | 441  | 454  | 483  | 495  | 501  | 496  | 495  | 538  | 511  | (490)  | (475)  | 482  | (557)  |
| Rhode Island          | 10    | 17   | 19   | 19   | 28   | 26   | 20   | 31   | 32   | 40   | 50   | 51   | 46   | 39   | 49   | 52   | 58   | 71   | 70     | 69     | 72   | 73     |
| Connecticut           | 20    | 24   | 27   | 34   | 43   | 36   | 40   | 24   | 30   | 31   | 26   | 26   | 21   | 22   | 22   | 32   | 31   | 37   | 40     | 34     | 37   | 36     |
| NEW ENGLAND           | 184   | 179  | 200  | 206  | 228  | 240  | 297  | 376  | 449  | 552  | 590  | 612  | 627  | 624  | 623  | 641  | 699  | 687  | (659)  | (630)  | 634  | (704)  |
| New York              | 106   | 135  | 172  | 191  | 197  | 191  | 187  | 193  | 209  | 249  | 256  | 256  | 245  | 243  | 289  | 309  | 369  | 386  | 384    | 374    | 422  | (455)  |
| New Jersey            | 102   | 93   | 105  | 128  | 126  | 126  | 134  | 127  | 124  | 132  | 127  | 115  | 93   | 107  | 112  | 122  | 138  | 144  | 135    | 111    | 116  | 129    |
| NY-NJ                 | 208   | 228  | 277  | 319  | 323  | 317  | 321  | 320  | 333  | 381  | 383  | 371  | 338  | 350  | 401  | 431  | 507  | 530  | 519    | 485    | 538  | (584)  |
| Delaware              | 8     | 7    | 3    | 3    | 6    | 5    | 2    | 2    | 4    | 5    | 6    | 4    | 6    | 4    | 3    | 6    | 6    | 6    | 7      | 8      | 9    | 9      |
| Maryland              | 17    | 23   | 25   | 20   | 14   | 17   | 24   | 19   | 32   | 44   | 61   | 60   | 56   | 58   | 60   | 60   | 60   | 59   | 66     | 63     | 64   | 64     |
| Virginia              | 100   | 100  | 103  | 121  | 125  | 131  | 97   | 106  | 96   | 118  | 87   | 88   | 95   | 89   | 96   | 119  | 120  | 114  | 152    | 192    | 202  | 199    |
| North Carolina        | 30    | 30   | 40   | 55   | 55   | 40   | 49   | 53   | 54   | 50   | 35   | 52   | 46   | 31   | 24   | 23   | 23   | 24   | 20     | 37     | 46   | 61     |
| South Carolina        | 3     |      | 0    |      | 1    | 1    |      | 1    |      |      | 0    |      |      |      |      | 0    |      |      |        |        |      | 0      |
| SOUTHERN              | 158   | 160  | 171  | 199  | 201  | 194  | 172  | 181  | 186  | 217  | 189  | 204  | 203  | 182  | 183  | 208  | 209  | 203  | 245    | 300    | 321  | 333    |
| U.S. TOTAL            | 550   | 567  | 648  | 724  | 752  | 751  | 790  | 877  | 968  | 1150 | 1162 | 1187 | 1168 | 1156 | 1207 | 1280 | 1415 | 1420 | (1423) | (1415) | 1493 | (1621) |
| ATLANTIC CANADA*      | 240   | 223  | 238  | 233  | 230  | 252  | 223  | 223  | 194  | 200  | 202  | 199  | 211  | 236  | 230  | 250  | 274  | 256  | 237    | 217    | 256  | (266)  |
| ATLANTIC COAST TOTAL* | 790   | 790  | 886  | 957  | 982  | 1003 | 1013 | 1100 | 1162 | 1350 | 1364 | 1386 | 1379 | 1392 | 1437 | 1530 | 1689 | 1676 | (1660) | (1632) | 1749 | (1887) |

\* Includes minor revisions to 1990-2002 Atlantic Canada estimates made by Canadian Wildlife Service in 2005.

Refuge Manager, Chincoteague National Wildlife Refuge

11

TABLE 4. Estimated productivity of Atlantic Coast piping plovers, 1987 – 2007. Parentheses denote preliminary estimates.

| State/RECOVERY UNIT | Chicks fledged/pair |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |        |        |      |        |
|---------------------|---------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|--------|------|--------|
|                     | 1987                | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004   | 2005   | 2006 | 2007   |
| Maine               | 1.75                | 0.75 | 2.38 | 1.53 | 2.50 | 2.00 | 2.38 | 2.00 | 2.38 | 1.63 | 1.98 | 1.47 | 1.63 | 1.60 | 1.98 | 1.40 | 1.28 | 1.45   | 0.55   | 1.35 | 1.06   |
| New Hampshire       |                     |      |      |      |      |      |      |      |      |      | 0.60 | 2.40 | 2.67 | 2.33 | 2.14 | 0.14 | 1.00 | 1.00   | 0.00   | 0.67 | 0.33   |
| Massachusetts       | 1.10                | 1.29 | 1.59 | 1.38 | 1.72 | 2.03 | 1.92 | 1.81 | 1.62 | 1.35 | 1.33 | 1.50 | 1.60 | 1.09 | 1.49 | 1.14 | 1.26 | (1.30) | (1.00) | 1.33 | 1.25   |
| Rhode Island        | 1.12                | 1.58 | 1.47 | 0.88 | 0.77 | 1.55 | 1.80 | 2.00 | 1.68 | 1.56 | 1.34 | 1.13 | 1.79 | 1.20 | 1.50 | 1.95 | 1.03 | 1.50   | 1.43   | 1.03 | 1.48   |
| Connecticut         | 1.29                | 1.70 | 1.79 | 1.63 | 1.39 | 1.45 | 0.38 | 1.47 | 1.35 | 1.31 | 1.69 | 1.05 | 1.45 | 1.86 | 1.22 | 1.87 | 1.30 | 1.35   | 1.62   | 2.14 | 1.92   |
| NEW ENGLAND avg.    | 1.19                | 1.32 | 1.68 | 1.38 | 1.62 | 1.91 | 1.85 | 1.81 | 1.67 | 1.40 | 1.39 | 1.46 | 1.62 | 1.18 | 1.53 | 1.26 | 1.24 | (1.33) | (1.04) | 1.34 | 1.30   |
| New York            | 0.90                | 1.24 | 1.02 | 0.80 | 1.09 | 0.98 | 1.24 | 1.34 | 0.97 | 1.14 | 1.36 | 1.09 | 1.35 | 1.11 | 1.27 | 1.62 | 1.15 | 1.46   | 1.44   | 1.55 | (1.15) |
| New Jersey          | 0.85                | 0.94 | 1.12 | 0.93 | 0.98 | 1.07 | 0.93 | 1.16 | 0.98 | 1.00 | 0.39 | 1.09 | 1.34 | 1.40 | 1.29 | 1.17 | 0.92 | 0.61   | 0.77   | 0.84 | 0.67   |
| NY-NJ avg.          | 0.86                | 1.03 | 1.08 | 0.88 | 1.04 | 1.02 | 1.08 | 1.25 | 0.97 | 1.07 | 1.02 | 1.09 | 1.35 | 1.19 | 1.28 | 1.49 | 1.07 | 1.23   | 1.28   | 1.36 | (1.03) |
| Delaware            |                     | 0.00 | 2.33 | 2.00 | 1.60 | 1.00 | 0.50 | 2.50 | 2.00 | 0.50 | 1.00 | 0.83 | 1.50 | 1.67 | 1.50 | 1.17 | 2.33 | 1.14   | 1.50   | 1.44 | 1.33   |
| Maryland            | 1.17                | 0.52 | 0.90 | 0.79 | 0.41 | 1.00 | 1.79 | 2.41 | 1.73 | 1.49 | 1.02 | 1.30 | 1.09 | 0.80 | 0.92 | 1.85 | 1.56 | 1.86   | 1.25   | 1.06 | 0.78   |
| Virginia            |                     | 1.02 | 1.16 | 0.65 | 0.88 | 0.59 | 1.45 | 1.66 | 1.00 | 1.54 | 0.71 | 1.01 | 1.21 | 1.42 | 1.52 | 1.19 | 1.90 | 2.23   | 1.52   | 1.19 | 1.16   |
| North Carolina      |                     |      | 0.59 | 0.43 | 0.07 | 0.41 | 0.74 | 0.36 | 0.45 | 0.86 | 0.23 | 0.61 | 0.48 | 0.54 | 0.50 | 0.17 | 0.46 | 0.65   | 0.92   | 0.87 | 0.26   |
| SOUTHERN avg.       | 1.17                | 0.85 | 0.88 | 0.72 | 0.68 | 0.62 | 1.18 | 1.37 | 1.05 | 1.34 | 0.68 | 0.99 | 1.04 | 1.09 | 1.22 | 1.27 | 1.63 | 1.95   | 1.38   | 1.12 | 0.92   |
| U.S. average        | 1.04                | 1.11 | 1.28 | 1.06 | 1.22 | 1.35 | 1.47 | 1.56 | 1.35 | 1.30 | 1.16 | 1.27 | 1.45 | 1.17 | 1.40 | 1.34 | 1.24 | (1.40) | (1.20) | 1.30 | (1.13) |
| ATLANTIC CANADA     |                     | 1.65 | 1.58 | 1.62 | 1.07 | 1.55 | 0.69 | 1.25 | 1.69 | 1.72 | 2.10 | 1.84 | 1.74 | 1.47 | 1.77 | 1.18 | 1.62 | 1.93   | 1.82   | 1.82 | (1.14) |

Refuge Manager, Chincoteague National Wildlife Refuge

12

Southern Recovery Unit Status and Distribution - The Southern Recovery Unit (a portion of the Atlantic Coast population) includes Delaware, Maryland, Virginia, and North Carolina. Some limited plover nesting has occurred in South Carolina. There were approximately 158 plover pairs in the Southern Recovery Unit in 1986 and approximately 333 pairs in 2007 (Table 3). The 2007 total is the highest recorded within the Southern Recovery Unit to date. However, the Southern Recovery Unit, which includes CNWR, continues to fall short of its recovery goal of 400 pairs. During the period of monitoring, the population size has declined in some years, but has consistently rebounded following declines. The numbers have shown a dramatic increase over the last five years, from 204 pairs in 2003 to 333 pairs in 2007 (U.S. Fish and Wildlife Service 2008; Table 3).

In the Southern Recovery Unit, productivity has varied substantially over the past 5 years, with a low of 0.92 chicks per pair recorded in 2007 and a high of 1.96 in 2004 (Table 4). Overall, plover productivity has generally increased in Virginia and throughout the Southern Recovery Unit since 1999, despite declines in some years. High productivity in Virginia from 2000 to 2005 has contributed to population increases in Virginia and in the Southern Recovery Unit (U.S. Fish and Wildlife Service 2008). Continued productivity at or above levels identified in the Recovery plan are attainable with ongoing intensive management efforts, and are expected to result in additional increases in plover populations.

Threats - Intensive management measures to protect piping plovers from disturbance by beach recreationists and their pets have been implemented for the Atlantic population at many nesting sites in recent years. In 2004, about 30 percent of the U.S. Atlantic Coast population of piping plovers nested on federally owned beaches where some protection is afforded under section 7 of the ESA (within the Southern Recovery unit, the majority of plovers occur on public or private conservation lands). The remaining 70 percent of the birds nested on state, town, or privately-owned beaches where plover managers are implementing protections in the face of increasing disturbance from recreation and development. Recreational activities and public use of some federally owned beaches have also increased. Pressure on Atlantic Coast beach habitat from development and human disturbance continues (U.S. Fish and Wildlife Service 1996a). Piping plover protection is dependent on the efforts of Federal, State, and local government agencies, conservation organizations, and private landowners.

Recreational activities can be a source of both direct mortality and harassment of piping plovers. Pedestrians may flush incubating plovers from nests (Flemming *et al.* 1988, Cross 1990, Cross and Terwilliger 1993), exposing eggs to predators or excessive temperatures. Repeated exposure of shorebird eggs on hot days may cause overheating, killing the embryos (Bergstrom 1991); excessive cooling may kill embryos or retard their development, delaying hatching dates (Welty 1982). Pedestrians can also disturb unfledged chicks (Strauss 1990, Burger 1991, Loegering 1992, Hoopes 1993, Goldin 1993), forcing them out of preferred habitats, decreasing available foraging time, and causing expenditure of energy.

Concentrations of pedestrians may deter piping plovers from using otherwise suitable habitat. In Jones Beach Island, New York, Elias-Gerkin (1994) found less pedestrian disturbance in areas selected by nesting piping plovers than areas unoccupied by plovers. Burger (1991, 1994) found that presence of people at several New Jersey sites caused plovers to shift their habitat use away from the ocean front to interior and bayside habitats, and that the time plovers devoted to foraging decreased and the time spent alert increased when more people were present. Burger (1991) also found that when plover chicks and adults were exposed to the same number of people, chicks spent less time foraging and more time crouching, running away from people, and being alert than did adult birds.

Fireworks are highly disturbing to piping plovers (Howard *et al.* 1993). Plovers are also intolerant of kites, particularly as compared to pedestrians, dogs, and vehicles. Biologists believe this may be because plovers perceive kites as potential avian predators, such as gulls, crows, or raptors (Hoopes 1993).

Motorized vehicle use on beaches is an extreme threat to piping plovers, as well as other shorebirds that nest on beaches and dunes. Vehicles can crush eggs, adults, and chicks (Wilcox 1959, Tull 1984, Burger 1987, Patterson *et al.* 1991). In Massachusetts and New York, 18 piping plover chicks and 2 adults were killed by off-road vehicles (ORVs) in 14 documented incidents (Melvin *et al.* 1994). Goldin (1993) compiled records of 34 chick mortalities (30 on the Atlantic Coast and 4 on the Northern Great Plains) due to vehicles. Biologists who monitor and manage piping plovers believe that vehicles kill many more chicks than are found and reported (Melvin *et al.* 1994).

Beaches used by recreational vehicles during nesting and brood-rearing periods generally have fewer breeding plovers than available nesting and feeding habitat can support. In contrast, plover abundance and productivity has increased on beaches where recreational vehicle restrictions during chick-rearing periods have been combined with protection of nests from predators (Goldin 1993).

Once hatched, piping plover broods are mobile and may not remain near the nesting area. Wire fencing placed around nests to deter predators (Rimmer and Deblinger 1990, Melvin *et al.* 1992) is ineffective in protecting chicks from vehicles because chicks typically leave the nest within a day after hatching and move extensively along the beach to feed. Typical behaviors of piping plover chicks increase their vulnerability to vehicles. Chicks frequently move between the upper berm or foredune and feeding habitat within the wrack line and intertidal zone. Chick use of the ocean intertidal zone is lower in the Southern recovery unit compared with more northerly portions of the breeding range. Data from Assateague Island Seashore in Maryland and from Chincoteague NWR demonstrates that many broods make sporadic use of this habitat (National Park Service and Maryland Department of Natural Resources 1993, Hecht 2004 *in litt.*). These movements along the beach and intertidal zone place chicks in the paths of vehicles. Chicks stand, walk, and run along tire ruts, and sometimes have difficulty crossing deep ruts or climbing out of them (Eddings *et al.* 1990, MacIvor 1990, Strauss 1990, Hoopes *et al.* 1992, Goldin 1993,

Refuge Manager, Chincoteague National Wildlife Refuge

14

Howard *et al.* 1993, Hoopes 1994). Chicks sometimes stand motionless or crouch as vehicles pass by, or do not move quickly enough to get out of the way (Tull 1984, Hoopes *et al.* 1992, Goldin 1993).

Vehicles may also significantly degrade piping plover habitat or disrupt normal behavior patterns by crushing wrack into the sand and making it unavailable as cover or a foraging substrate (Hoopes *et al.* 1992, Goldin 1993). Vehicles that are driven too close to the toe of the dune may destroy vegetation that may also provide piping plover cover habitat (Elias-Gerken 1994).

Substantial evidence shows that human activities exacerbate natural predation on piping plovers, their eggs, and chicks (U.S. Fish and Wildlife Service 1996a). Where Wilcox (1959) had observed 92 percent hatching success of nests observed between 1939-1958 on Long Island, New York, and loss of only 2 percent of nests to crows (*Corvus sp.*), Elias-Gerken (1994) documented loss of 21 percent of nests in her study area to crows in 1992-1993. Other important predators of plover eggs and chicks in the recovery unit include foxes (*Vulpes vulpes*), raccoons (*Procyon lotor*), Norway rats (*Rattus norvegicus*), herring gulls (*Larus argentatus*), great black-backed gulls (*Larus marinus*), domestic and feral dogs (*Canis familiaris*) and cats (*Felis catus*), and ghost crabs (*Ocypode quadrata*) (Riepe 1989, Jenkins and Nichols 1994, Jenkins *et al.* 1999, Canale 1997, U.S. Fish and Wildlife Service 1996a).

Predators can be a major source of loss of eggs and juvenile plovers. For example, predators accounted for over half of all piping plover nest losses in New Jersey from 1995-1998 (Jenkins *et al.* 1999). A variety of techniques have been employed to reduce predation on plovers. Most notably, the use of predator exclosures (fences around nests) has demonstrated success to reduce predation on piping plover eggs (Melvin *et al.* 1992, Rimmer and Deblinger 1990) and has been credited with an important role in population increases in some parts of their range (Jenkins and Nichols 1994, Jenkins *et al.* 1999). However, these same devices have also been associated with serious problems including entanglements of birds in the exclosure netting, and attraction of “smart” predators that have learned there is potential prey inside. The downside risks may include not only predation or nest abandonment, sometimes at rates exceeding those that might occur without exclosures, but also induced mortality of adult birds. Exclosures provide no protection for mobile plover chicks, which generally leave the exclosure within a day of hatching and move extensively along the beach to feed.

Although exclosures are contributing to improved productivity and population increases in some portions of the plover's Atlantic Coast range, problems have been noted in some localities. Loegering (1992) reported loss of six nests in exclosures without tops in Maryland in 1988, but nest loss stopped after string tops were added. Cross (1991) found that exclosed nests hatched significantly more often than unexclosed nests over three years on three sites at CNWR, but hatch rates were not significantly improved at all sites or in all years; furthermore, two instances of foxes depredating adult plovers occurred in the vicinity of exclosures. Due to the magnitude

Refuge Manager, Chincoteague National Wildlife Refuge

15

of predation threats to plovers and limitations associated with all currently available solutions, the piping plover recovery plan strongly recommends that on-site managers employ an integrated approach to predator management that considers a full range of management techniques (U.S. Fish and Wildlife Service 1996a).

#### SEABEACH AMARANTH (*Amaranthus pumilus*)

In 1993, seabeach amaranth was added to the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.12) as a threatened species. The listing was based upon the elimination of seabeach amaranth from two-thirds of its historic range, and continuing threats to the 55 populations that were known at the time (U.S. Fish and Wildlife Service 1993).

Species Description - Seabeach amaranth is an annual plant and a member of the Amaranth family (*Amaranthaceae*). Upon germination, the plant initially forms a small, unbranched sprig, but soon begins to branch profusely, forming a low-growing mat. Seabeach amaranth's fleshy stems are prostrate at the base, erect or somewhat reclining at the tips, and pink, red, or reddish in color. The leaves of seabeach amaranth are small, rounded, and fleshy, spinach-green in color, with a characteristic notch at the rounded tip. Leaves are approximately 1.3 to 2.5 cm in diameter, and clustered towards the tip of the stem (Weakley and Bucher 1992). The foliage of seabeach amaranth turns deep red in the fall (Snyder 1996). Plants often grow to 30 cm in diameter, consisting of 5 to 20 branches, but occasionally reach 90 cm in diameter, with 100 or more branches. Flowers and fruits are inconspicuous, borne in clusters along the stems. Seeds are 2.5 millimeters (mm) in diameter, dark reddish-brown, and glossy, borne in low-density, fleshy, indehiscent utricles (bladder-like seed capsules or fruits), 4 to 6 mm long (Weakley and Bucher 1992). The seed does not fill the utricle, leaving an air-filled space (U.S. Fish and Wildlife Service 1996b).

Habitat – Historically, seabeach amaranth was native to Atlantic coast barrier island beaches from Massachusetts to South Carolina. The species' primary habitat consists of overwash flats at accreting ends of barrier islands, and lower foredunes and upper strands of non-eroding beaches. This species occasionally establishes small and temporary populations in secondary habitats including sound side beaches, blowouts in foredunes, and sand or shell dredge spoil or beach nourishment material (Weakley and Bucher 1992).

Seabeach amaranth occupies a narrow beach zone that lies at elevations from 0.2 to 1.5 m above mean high tide, the lowest elevations at which vascular plants regularly occur. Seaward, the plant grows only above the high tide line, as it is intolerant of even occasional flooding during the growing season. Landward, seabeach amaranth does not occur more than approximately one meter above the beach elevation on the foredune, or anywhere behind it, except in overwash areas. The species is, therefore, dependent on a terrestrial, upper beach habitat that is not flooded during the growing season. This zone is generally absent on beaches that are

experiencing high rates of erosion. Seabeach amaranth is never found on beaches where the foredune is scaped by undermining water at high or storm tides (Weakley and Bucher 1992).

Seabeach amaranth usually occurs on a pure silica sand substrate, occasionally containing shell fragments. The U.S. Natural Resources Conservation Service classifies the habitat of seabeach amaranth as either Beach-Foredune Association or Beach (occasionally flooded). Seabeach amaranth habitat occurs within a wetland system classified by Cowardin *et al.* (1979) as Marine System, Intertidal Subsystem, Unconsolidated Shore Class (Weakley and Bucher 1992).

The habitat of seabeach amaranth is sparsely vegetated with annual herbs and, less commonly, perennial herbs (mostly grasses) and scattered shrubs. The number and type of seabeach amaranth's vegetative associates have been found to vary with specific habitat type (*i.e.*, overwash flat, accreting barrier island end, or lower foredune) (Chicone undated). The most constant associates of seabeach amaranth, with which the species almost always co-occurs, are sea rocket (*Cakile edentula*) and seabeach spurge (*Chamaesyce polygonifolia*) (Weakley and Bucher 1992).

Biogeography and Range - Seabeach amaranth is limited by its habitat requirements to a very narrow strip of barrier islands and mainland oceanfront beach strands along the Atlantic coast. The original range of this species extended from Cape Cod in Massachusetts to central South Carolina, a stretch of coast approximately 1,600 km (994 miles) long. This stretch correlates with a geographic range of low tidal amplitude. Tidal amplitude and the relative importance of tidal versus wave energy in shaping coastal morphology are thought to limit the geographic range of seabeach amaranth, rather than availability of sandy beach substrates or sea water temperatures. The range of seabeach amaranth is characterized by islands developed by high wave energy, low tidal energy, frequent overwash, and frequent breaching by hurricanes with resulting formation of new inlets (Weakley and Bucher 1992). Some authors have observed that seabeach amaranth tends to occur on south or southeast facing coasts (Weakley and Bucher 1992, Snyder 1996), but a range-wide analysis of beach orientation has not been conducted.

Historic records of seabeach amaranth are known from nine states. Largely due to human activities, the species was eliminated from seven of these states by the 1980s, remaining only in North and South Carolina. Seabeach amaranth is still considered extirpated from two states: Massachusetts and Rhode Island. Since 1990, the species has been rediscovered in five states from which it had previously been believed to be extirpated. Table 5 gives the dates of rediscovery and the last previously known occurrence of the plant in each state.

| State    | Date Rediscovered | Date of Last Previously Known Occurrence    |
|----------|-------------------|---------------------------------------------|
| New York | July 2000         | 1950 (Van Schoik and Antenen, 1993)         |
| Delaware | August 2000       | 1913 (U.S. Fish and Wildlife Service 1996b) |
| Maryland | August 1998       | 1875 (McAvoy 2000)                          |
| Virginia | September 2001    | 1973 (U.S. Fish and Wildlife Service 1996b) |

To date, explanations for seabeach amaranth's rediscovery in the northern part of its range remain speculative. Sites in these five states may have been re-colonized by long-distance transport of seeds by wind or currents. At some sites, seeds may have been long buried in sediments used in beach nourishment projects. This hypothesis requires that seeds can remain viable after prolonged off-shore burial, an unknown factor. In Maryland's Assateague Island National Seashore, the NPS has allowed a previously stabilized foredune system to return to more natural conditions. This change in beach management, and the possible existence of a persistent seed bank, have been cited as factors in the species' return to the area (Ramsey *et al.* 2000).

The current known range of naturally occurring seabeach amaranth is from Water Mill Beach on Long Island, New York, south to Dewees Island in South Carolina; a few reintroduction efforts south of Dewees Island have been unsuccessful (Young 2001, Hamilton 2000a, Ed Eudaly 2008, pers. comm).

### Life History

Seabeach amaranth occupies a highly specific and restricted niche as a "fugitive" species in the narrow upper beach zones of newly formed, accreting barrier island ends and non-eroding beach strands. A dynamic, early successional pioneer species, seabeach amaranth is termed a "fugitive" because its populations are constantly shifting to newly disturbed areas. The plant is eliminated from existing habitats by competition and erosion, and colonizes newly formed habitats by dispersal and (probably) long-lived seed banks. A poor competitor, seabeach amaranth is eliminated from sites where perennials have become established, probably because of root competition for scarce water and nutrient supplies (Weakley and Bucher 1992). Seabeach amaranth acts as a capable sand binder (Weakley and Bucher 1992), which is typical of pioneer beach plants. The species is not likely to be a young or recently evolved species, considering its isolation within the genus (it has no apparently close relatives) and its possession of numerous adaptations to the peculiar environment in which it grows (U.S. Fish and Wildlife Service 1996b).

Seabeach amaranth habitat exists in dynamic conditions. The same physical forces (*e.g.*, storms, extreme high tides) that create the plant's specific and ephemeral coastal habitat also destroy it. Coastal storms are probably the single most important natural limitation on the abundance of seabeach amaranth. Existing habitat is eroded away, but new habitat is created by island overwash and breaching. Therefore, seabeach amaranth requires extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. Such conditions allow the species to move around in the landscape, occupying suitable habitat as it becomes available (U.S. Fish and Wildlife Service 1996b).

Density and Distribution - Density of seabeach amaranth is extremely variable within and between populations. The species generally occurs in a sparse to very sparse distribution pattern, even in the most suitable habitats. A typical density is 100 plants per linear km of beach, though occasionally on accreting beaches, dense populations of 1,000 plants per km can be found. Island-end sand flats generally have higher densities than oceanfront beaches (Weakley and Bucher 1992). Comparing overwash flats, accreting barrier island ends, and lower foredunes, Chicone (undated) found that seabeach amaranth plants growing in foredune habitats tended to be larger, healthier, and have fewer associates. Seabeach amaranth has been found to have a strongly clumped distribution (Hancock 1995).

Within its primary habitats, seabeach amaranth tends to be concentrated in the line of wrack material deposited by high tides (Mangels 1991, Weakley and Bucher 1992, Hancock 1995, McAvoy 2000). Observations from New Jersey and Maryland suggest that plants within the wrack line tend to be larger (U.S. Fish and Wildlife Service 2002b). Pauley *et al.* (1999), however, found that plots centered on seabeach amaranth had a lower percent area covered by litter material than random plots, suggesting that litter material may be an advantageous microhabitat for seabeach amaranth only when it contains higher levels of organic material and moisture than bare sand, as in the wrack line.

Life Cycle and Phenology - Individual plants live only one season, with a single opportunity to produce seed. The species over-winters entirely as seeds. Germination of seedlings begins in April and continues at least through July. In the northern part of the range, germination occurs slightly later, typically late June through early August. Reproductive maturity is determined by size rather than age, and flowering begins as soon as plants have reached sufficient size. Flowering sometimes begins as early as June in the Carolinas, but more typically commences in July and continues until the death of the plant. Seed production begins in July or August and reaches a peak in most years in September. Seed production likewise continues until the plant dies. Senescence and death occur in late fall or early winter (U.S. Fish and Wildlife Service 1996b).

Seabeach amaranth seems capable of essentially indeterminate growth (Weakley and Bucher 1992). However, predation and weather events, including rainfall, hurricanes, and temperature extremes, have significant effects on the length of the species' reproductive season. As a result

of one or more of these influences, the flowering and fruiting period can be terminated as early as June or July (U.S. Fish and Wildlife Service 1993).

Reproduction - As an annual, seabeach amaranth reproduces solely by sexual reproduction by seed, with no vegetative or clonal form of reproduction. The species is monoecious (male and female flowers on the same plant), and, based on morphology of the flower and inflorescence, most likely wind pollinated. Seabeach amaranth is capable of self fertilization, an advantageous adaptation for a pioneer species, allowing the founding of a new colony by a single propagule. Self fertilization likely plays a large, probably dominant, role in seed production (Weakley and Bucher 1992). Once it reaches maturity, seabeach amaranth flowers and fruits continuously until death or senescence. Late season plants may continue flowering and fruiting with few or no leaves, sometimes producing an aberrant, dense, terminal inflorescence (Weakley and Bucher 1992). Even very small plants produce flowers under conditions of a short (12-hour) photoperiod (Jolls and Sellars 2000), likely an opportunistic adaptation to permit small, late germinating plants to reproduce at the end of the growing season. Nearly all adult seabeach amaranth plants produce seeds, and fertility is assumed to be high (Weakley and Bucher 1992). Fruit production is correlated with plant weight (Hancock 1995), and large plants are estimated to produce several thousand fertile seeds over a fruiting season (Weakley and Bucher 1992). Within the genus *Amaranthus*, this is a very low reproductive rate, but seabeach amaranth has apparently evolved a strategy of producing fewer, larger seeds than other members of its genus. Under favorable conditions, seabeach amaranth shows good reproductive success (Weakley and Bucher 1992).

Seed Dispersal - Seabeach amaranth seeds are dispersed by a variety of mechanisms. The fleshy tissues and air pocket of the utricle cause the fruit to have a lower density than the bare seed. Seeds retained in utricles are easily blown about, deposited in depressions, the lee behind plants, or in the surf. Naked seeds are also commonly encountered in the field, and are also dispersed by wind, but to a much lesser degree than seeds retained in utricles. Naked seeds tend to remain in the lee of the parent plant, or get moved to nearby depressions (Weakley and Bucher 1992). Observations from South Carolina indicate that seabeach amaranth seeds are also dispersed in the guts of birds, and deposited with their droppings (Hamilton 2000b).

Many utricles remain attached to the parent plant and are never dispersed, leading to *in situ* “planting.” This phenomenon has also been observed in sea rocket, and may be an adaptation to dynamic beach conditions. If conditions remain favorable at the site of the parent plant, the seed source for retention of that site is guaranteed. If conditions become unsuitable, other seeds have been dispersed to colonize new sites (Weakley and Bucher 1992).

Germination - Fresh seabeach amaranth seeds are physiologically dormant (Baskin and Baskin 1994, 1998). The tough seedcoat requires some physical modification before germination can occur. The primary mechanism(s) for breaking seed dormancy in the field is not known, but possible factors include abrasion, cold, imbibing of water, and gradual breakdown over time (Weakley and Bucher 1992, Hamilton 2000c, Jolls and Sellars 2000, Hancock 1995; Baskin and

Refuge Manager, Chincoteague National Wildlife Refuge

20

Baskin 1994, 1998). Once dormancy is broken, light and high temperatures (25-35° C) are required for germination (Hancock 1995, Baskin and Baskin 1994, 1998). This high temperature requirement causes seabeach amaranth to germinate later in the season than other dune associates, and limits the time in which new seedlings can grow. Rainfall is also significant in promoting germination (Hancock 1995).

Initial studies have found that seabeach amaranth seedlings cannot emerge from a depth of more than one centimeter (Hancock 1995) or two centimeters (U.S. Fish and Wildlife Service 2002b). Results of these studies, combined with the finding that light is required for germination, are strong evidence that deep burial may completely prevent germination and seedling emergence (Jolls *et al.* 2001). Seabeach amaranth may have less opportunity to emerge and become established compared to other dune species such as sea rocket, as mean emergence of seedlings (growth rate of the newly sprouted seed) is less than predicted for the species' seed mass (Hancock 1995).

Natural Limiting Factors - Except where suitable habitat has persisted long enough for perennials to become established, the primary limiting factors of seabeach amaranth under natural conditions are abiotic. Abiotic limiting factors are expected for a fugitive species that occupies dynamic, early successional habitats. Weather is an important limiting factor, given the relatively narrow temperature and rainfall requirements for germination and seedling establishment. Flooding, drought, or unseasonable temperatures may impair seabeach amaranth survival and reproduction. Weather also limits abundance of the species through its effects on winds, which may cause burial of seeds and plants by sand. In addition to decreasing germination and seedling establishment, burial may also impact reproduction by covering adult plants prior to seed set. This effect was observed in South Carolina (Hamilton 2000b), and may have occurred in Maryland (U.S. Fish and Wildlife Service 2002b).

Under natural conditions, interspecific competition for water and nutrients, especially with perennials, may be a significant biotic limiting factor of seabeach amaranth. Weakley and Bucher (1992) cite intraspecific competition as a possible factor in the mortality of young plants, but Hancock (1995) found no evidence of intraspecific density effects. If intraspecific competition does limit seabeach amaranth abundance, its effects are likely small compared to the effects of competition with perennial species, which possess superior abilities to extract water and nutrients from the porous sand. Predators and disease are discussed below under threats.

Population Dynamics - Although the longevity of seabeach amaranth seeds is unknown, several lines of evidence suggest that seed banks may be an important factor in this species' life history (Weakley and Bucher 1992, Baskin and Baskin 1998). The relative roles of fresh and banked seeds are unknown (U.S. Fish and Wildlife Service 1996b). In experimental plots in Maryland, a few late-season seedlings emerged from the current year's seed crop (U.S. Fish and Wildlife Service 2002b), however the contribution of same-season seed to the current year's population and seed crop is likely small. For a sexually reproducing annual plant, natality is comprised of two components, the seed production rate (or fecundity) and the germination rate.

The viability rates of both fresh and banked seeds are uncertain; more is known about mortality of the plants. Substantial mortality of young plants occurs in some years, prior to reproduction. Hancock (1995) found only seven percent survival of seedlings to 40 days of age, with mortality caused primarily by high tide flooding. Flooding resulted in almost 100 percent mortality of propagated plants at three of six experimental transplant sites in South Carolina in 1999. At a fourth site, drifting sand covered most of the transplants, with only 10 of 196 plants (about 5 percent) surviving to produce seed (Hamilton 2000b). Burial by blowing sand may have also affected reproduction in New Jersey and Maryland in 2000 (Service observation, U.S. Fish and Wildlife Service 2002b). Unfavorable conditions early in the growing season, including drought, burial, and especially flooding and other storm damage, may reduce seed production by 90 percent (Weakley and Bucher 1992) to 98 percent (Hancock 1995).

Once past the stage of germination and early growth, mortality rates are generally lower. In the Carolinas, mortality of older plants tends to be caused primarily by webworm predation (Weakley and Bucher 1992). Larger plants may be able to withstand saltwater inundation better than smaller plants; however, prolonged salt water inundation kills almost all plants, regardless of size (Hancock 1995). Storms later in the growing season can effectively and abruptly curtail reproduction for the year (Weakley and Bucher 1992). Plants that have not died from other causes senesce and die in late fall or early winter.

Genetic Variability - Preliminary results from two initial genetic studies of seabeach amaranth suggest that the species' genetic variability is low. A study by Salisbury State University looked for genetic differences in nuclear DNA within and across three groups: propagated plants from Maryland, wild plants from Maryland, and wild plants from Delaware. Overall, genetic variability was found to be low. Wild and propagated Maryland plants were similar, as might be expected, since the propagated plants were produced from wild plants taken from the same area (U.S. Fish and Wildlife Service 2002b). Higher levels of genetic variability were found within the sample of plants from Delaware. A second study by Strand (2002) analyzed non-coding regions of nuclear and chloroplast DNA taken from seed and dry leaf samples from New York, New Jersey, North Carolina, and South Carolina. This study found no observable genetic variation among any of the samples. Although the results of these two studies are consistent, these results must be interpreted with caution. Lack of detection does not prove a lack of genetic variability, which might be present in other regions of the genome, or detectable through other techniques (Jolls and Sellars 2000, Strand 2002, U.S. Fish and Wildlife Service 2002b).

#### Population Status and Distribution

As might be expected for a fugitive annual plant of dynamic barrier beach habitats, populations of seabeach amaranth at any given site are extremely variable (Weakley and Bucher 1992).

Population size at a site often fluctuates by several orders of magnitude from year to year. The primary reasons for the natural variability of seabeach amaranth are the dynamic nature of its habitat, and the significant effects of stochastic factors such as weather and storms on mortality and reproductive rates. Although wide fluctuations in species populations tend to increase the risk of extinction, variable population sizes are a natural condition for seabeach amaranth, and the species is well adapted to its ecological niche.

Because variability in population size is so great among years, a single survey is a poor measure of a population's health. Assessing site-specific population trends is difficult even with several years of surveys. Weakley and Bucher (1992) suggest that a 5 to 10 year average is a more meaningful measure for assessing the vigor of a local seabeach amaranth population. However long-term, consecutive, annual data are available for only a few sites in New York. Estimates of population sizes for seabeach amaranth across its range are imprecise, given available survey data. Early (pre-1987) survey data are limited. Range-wide surveys were conducted in 1987, 1988, and 1990 (excluding states where the species was considered extirpated at the time). Annual statewide surveys have been conducted subsequently in New York, but no comprehensive surveys of North or South Carolina have been carried out since 1990. Suitable areas in New Jersey, Delaware, and Maryland were thoroughly surveyed in 2000, but these efforts did not necessarily extend state-wide. Approximately 14 locations in Virginia were surveyed in 2000, and no seabeach amaranth was found (Belden 2000). In 2001, seabeach amaranth was found on Assateague Island, Virginia, most likely the result of a restoration program in Assateague Island National Seashore in Maryland (U.S. Fish and Wildlife Service 2002b).

Over the last seven years, the number of plants in each state has fluctuated greatly (see Table 6). In Delaware the numbers have always been low, with a high count for 2002 of 423 plants. New York has always produced the highest number of plants, with the 2000 numbers also being the highest count for the state (244,608 plants). In 2006, 1,551 plants were counted in Maryland and Virginia. Of these 1,551 plants, all but 13 were found on the Maryland side of Assateague Island. Numbers of plants within CNWR (see Virginia numbers in Table 6) has experienced major fluctuations since its rediscovery in 2001.

Threats - Habitat Loss and Degradation - In the geologic past, seabeach amaranth has persisted through even relatively rapid episodes of sea level rise and barrier island retreat. A natural barrier island landscape, even a retreating one, contains localized accreting areas, especially in the vicinity of inlets (U.S. Fish and Wildlife Service 1996b).

Erosion is accelerated in many areas by human-induced factors such as reduced sediment loads reaching coastal areas due to damming of rivers, and beach stabilization structures. When the shoreline is "hardened" by artificial structures (*e.g.* seawalls, bulkheads), overwash and inlet formation are curbed. Erosion may also be increasing due to sea level rise and increased storm activity caused by global climate change (U.S. Fish and Wildlife Service 1993).

Refuge Manager, Chincoteague National Wildlife Refuge

23

Table 6. Seabeach amaranth (*Amarathus pumilus*) numbers by year and state.

| Year | New York | Delaware | New Jersey | Maryland | Virginia | North Carolina | South Carolina | TOTAL # of plants for each year |
|------|----------|----------|------------|----------|----------|----------------|----------------|---------------------------------|
| 1987 | 0        | 0        | 0          | 0        | 0        | 3,395          | 1,341          | 4,736                           |
| 1988 | 0        | 0        | 0          | 0        | 0        | 4,433          | 1,800          | 6,233                           |
| 1989 | 0        | 0        | 0          | 0        | 0        | 0              | 0              | 0                               |
| 1990 | 331      | 0        | 0          | 0        | 0        | 1,127          | 188            | 1,646                           |
| 1991 | 2,251    | 0        | 0          | 0        | 0        | 1,170          | 0              | 3,421                           |
| 1992 | 422      | 0        | 0          | 0        | 0        | 32,160         | 15             | 32,597                          |
| 1993 | 195      | 0        | 0          | 0        | 0        | 22,214         | 0              | 22,409                          |
| 1994 | 182      | 0        | 0          | 0        | 0        | 13,964         | 560            | 14,706                          |
| 1995 | 599      | 0        | 0          | 0        | 0        | 33,514         | 6              | 34,119                          |
| 1996 | 2,263    | 0        | 0          | 0        | 0        | 8,357          | 0              | 10,620                          |
| 1997 | 11,918   | 0        | 0          | 0        | 0        | 1374           | 2              | 13,294                          |
| 1998 | 10,699   | 0        | 0          | 2        | 0        | 11,490         | 141            | 22,332                          |
| 1999 | 31,196   | 0        | 0          | 1        | 0        | 588            | 196            | 31,981                          |
| 2000 | 244,608  | 32       | 1,039      | 4        | 0        | 103            | 2,312          | 248,098                         |
| 2001 | 205,233  | 83       | 5,813      | 869      | 9        | 5037           | 231            | 217,275                         |
| 2002 | 193,412  | 423      | 10,908     | 801      | 56       | 4440           | 0              | 210,040                         |
| 2003 | 114,535  | 13       | 5,084      | 459      | 22       | 11,290         | 1,381          | 132,784                         |
| 2004 | 30,942   | 4        | 6,820      | 531      | 2        | 11,213         | 2,110          | 51,622                          |
| 2005 | 16,813   | 6        | 5,795      | 489      | 69       | 19,976         | 671            | 43,819                          |
| 2006 | 32,553   | 40       | 6,522      | 1,538    | 13       | 3,190          | 721            | 44,577                          |

Attempts to halt beach erosion through hard structures (*i.e.*, sea walls, jetties, groins, bulkheads) appear invariably to destroy habitat for seabeach amaranth. In the Carolinas, seabeach amaranth is not found on shorelines where bulkheads, sea walls, or rip rap zones have been constructed. Such armoring generally occurs in the primary habitat of the plant, and water and wind erosion lower the profile of the beach seaward of the armoring. The upper beach habitat required by

seabeach amaranth (above inundation by tidal action) ceases to exist as the beach is steadily eroded. Groins have mixed effects on seabeach amaranth. Immediately updrift from a groin, accretion sometimes provides or maintains, at least temporarily, habitat for seabeach amaranth; immediately downdrift, erosion usually destroys seabeach amaranth habitat. In the long term, groins (if they are successful) stabilize updrift beaches, allowing succession to perennials, and rendering even the updrift side only marginally suitable for seabeach amaranth. Widespread construction of sea walls, jetties, and other hard stabilization structures in New Jersey, New York, and other northern states is associated with the extirpation of seabeach amaranth from the northern part of its range (U.S. Fish and Wildlife Service 1996b).

Even minor structures and non-structural beach stabilization techniques, such as sand fences and beachgrass planting, are generally detrimental to seabeach amaranth (U.S. Fish and Wildlife Service 1993). Dune stabilization and vertical sand accretion caused by sand fences appear to be detrimental to seabeach amaranth. The effects of dune stabilization by planting vegetation are similar (U.S. Fish and Wildlife Service 1996b). Seabeach amaranth only very rarely occurs when sand fences and vegetative stabilization have taken place and, in these situations, is present only as rare, scattered individuals or short-lived populations (Weakley and Bucher 1992).

Beach nourishment can have positive site-specific impacts on seabeach amaranth. Although more study is needed before the long-term impacts can be accurately assessed, seabeach amaranth has colonized several nourished beaches, and has thrived in some sites through subsequent re-applications of fill material (U.S. Fish and Wildlife Service 1993). However, on the landscape level, beach nourishment is similar to other beach stabilization efforts in that it stabilizes the shoreline and curtails the natural geophysical processes of barrier islands. These effects are detrimental to the range-wide persistence of the species. In addition, beach nourishment may cause site-specific adverse effects by crushing or burying seeds or plants, or by altering the beach profile or upper beach micro-habitats in ways not conducive to seabeach amaranth colonization or survival. Deeply burying seeds during any season can have serious effects on populations; this also applies to the placement of dredge spoil (U.S. Fish and Wildlife Service 1996b). Burial of the seed bank may be particularly detrimental to isolated populations, as no nearby seed sources are available to re-colonize the nourished site. Adverse effects of beach nourishment may be compounded if accompanied by artificial dune construction and stabilization with sand fencing and/or beach grass, or if followed by high levels of erosion and scarping of the upper beach.

As a fugitive species dependent on a dynamic landscape and large-scale geophysical processes, seabeach amaranth is vulnerable to habitat fragmentation and isolation of small populations (U.S. Fish and Wildlife Service 1993). Rendering 50 to 75 percent of a coastline permanently unsuitable may doom seabeach amaranth, because any given area will become unsuitable at some time due to natural forces. If a seed source is no longer available in the vicinity, seabeach amaranth will be unable to reestablish itself when the area once again provides suitable habitat. In this way, the species can be progressively eliminated even from generally favorable stretches

of habitat surrounded by permanently unfavorable areas. Fragmentation of habitat in the northern part of the species range contributed to the regional extirpation during the last century. Areas of suitable habitat were separated from one another by distances too great to allow recolonization following natural catastrophes (Weakley and Bucher 1992).

*Recreational Impacts* - Intensive recreational use of beaches can threaten seabeach amaranth populations, both through direct damage and mortality of plants, and by impacting habitat. Light pedestrian traffic, even during the growing season, usually has little effect on seabeach amaranth (U.S. Fish and Wildlife Service 1993). Substantive impacts generally occur only on narrow beaches, or beaches which receive heavy recreational use. In such areas, seabeach amaranth populations are sometimes eliminated or reduced by repeated trampling. While pedestrian traffic appears to be a minor problem in the Carolinas, the heavier traffic borne by northern beaches near major population centers may have been partially responsible for the past extirpation of seabeach amaranth in those regions (U.S. Fish and Wildlife Service 1996b).

Off-road vehicle (ORV) use on the beach during the growing season can have detrimental effects on the species, as the fleshy stems of this plant are brittle and easily broken. Plants generally do not survive even a single pass by a truck tire (Weakley and Bucher 1992). Sites where vehicles are allowed to run over seabeach amaranth plants often show severe population declines. Dormant season ORV use has shown little evidence of significant detrimental effects, unless it results in massive physical erosion or degradation of the site, such as compacting or rutting of the upper beach. In some cases, winter ORV traffic may actually provide some benefits for the species by setting back succession of perennial grasses and shrubs with which seabeach amaranth cannot compete successfully. However, extremely heavy ORV use, even in winter, may have some negative impacts, including pulverization of seeds (Weakley and Bucher 1992).

Beach grooming, more common on northern beaches, may also have contributed to the previous extirpation of seabeach amaranth from that part of its range. Motorized beach rakes, which remove trash and vegetation from bathing beaches, do not allow seabeach amaranth to colonize long stretches of beach (U.S. Fish and Wildlife Service 1996b). In New Jersey, plants were found along a nearly continuous length of beach, noticeably interrupted by stretches that are routinely raked.

*Herbivory* - Predation by webworms (caterpillars of small moths) is a major source of mortality and lowered fecundity in the Carolinas, often defoliating plants by early fall (U.S. Fish and Wildlife Service 1993). Defoliation at this season appears to result in premature senescence and mortality, reducing seed production, the most basic and critical parameter in the life cycle of an annual plant. Webworm predation may decrease seed production by more than 50 percent (Weakley and Bucher 1992). In the Carolinas, four species of webworm collected from seabeach amaranth have been identified: beet webworm (*Loxostege similialis*), garden webworm (*Achyra rantalis*), southern beet webworm (*Herpetogramma bipunctalis*), and Hawaiian beet webworm (*Spoladea recurvalis*). Webworm herbivory of seabeach amaranth has

not been documented in Delaware or Maryland. Although the five webworms so far identified on seabeach amaranth are all native species, their use of barrier islands has probably been altered by changes in the coastal plain landscape (*i.e.*, extensive agricultural use), the development of barrier islands, and the introduction of weedy plants that can also serve as host plants. All five webworms are probably much more abundant now than they were in pre-Columbian times. For this reason, the level of predation that seabeach amaranth is experiencing is likely unnaturally high (U.S. Fish and Wildlife Service 1996b). Webworm herbivory is probably a contributing, rather than a leading factor in the decline of seabeach amaranth. However, in combination with extensive habitat alteration, severe herbivory could threaten the existence of the species (Weakley and Bucher 1992).

*Utilization and Collection* - Seabeach amaranth is generally not threatened by over-utilization or collection, as it does not have showy flowers, and is not a component of the commercial trade in native plants. However, because the species is easily recognizable and accessible, it is vulnerable to taking, vandalism, and the incidental trampling by curiosity seekers. Seabeach amaranth is an attractive and colorful plant, with a prostrate growth habit that could lend itself to planting on beach front lots. The species' effectiveness as a sand binder could make it even more attractive for this purpose. In addition, seabeach amaranth is being investigated by the USDA and several universities and private institutes for its potential use in crop development and improvement. Over-collection and the development of genetically altered, domesticated varieties are potential, but currently unrealized, threats to the species (U.S. Fish and Wildlife Service 1993).

*New Threats* - New threats to seabeach amaranth have been documented since the species was listed in 1993. These factors are lesser threats than habitat modification, but may increase the risk of extinction by compounding the effects of other, more severe threats.

Several additional herbivores of seabeach amaranth have been observed including deer (*Odocoileus virginianus*), Sika deer/elk (*Cervus nippon*), eastern cottontail (*Sylvilagus floridanus*), and migratory song birds (Van Schoik and Antenen 1993), as well as feral horses in Maryland (U.S. Fish and Wildlife Service 2002b). Hancock (1995) suggests that grasshoppers may feed on seabeach amaranth, but does not indicate whether this was actually observed. There is also strong circumstantial evidence for seabeach amaranth herbivory by grasshoppers (U.S. Fish and Wildlife Service 2002b). Minor insect damage was noted on a few New Jersey plants in 2000, and larval insects were observed feeding on seabeach amaranth in 2001; to date, no species have been identified. In addition, a cluster of New Jersey plants appeared to have been damaged by a congregation of loafing gulls (*Larus* spp.), based upon feathers and droppings. As with webworms, the abundance of these newly documented predators on barrier islands is increased by human activities.

Asiatic sand sedge (*Carex kobomugi*) has been suggested as another potential threat to seabeach amaranth. This sedge is strongly rhizomatous and dune-forming (National Park Service and Maryland Natural Heritage Program 2000). Asiatic sand sedge was introduced to the east coast

Refuge Manager, Chincoteague National Wildlife Refuge

27

(New Jersey to Virginia) from east Asia in the 1930s for erosion control and as a sand stabilizer. The species is known to crowd out native dune species (Virginia Department of Conservation and Recreation and Virginia Native Plant Society undated). Asiatic sand sedge may be detrimental to seabeach amaranth by direct competition, and by reducing habitat suitability through sand stabilization and dune building. Control programs have been implemented in managed natural areas where this species occurs.

The first known disease of seabeach amaranth was documented in South Carolina in 2000. During the 2000 growing season, a fungus (*Albugo* sp.) was observed on seabeach amaranth in several South Carolina sites (Strand and Hamilton 2000). This pathogen is a white rust or water mold. Lesions developed on the leaves during flowering, starting in July; leaves later fell off (U.S. Fish and Wildlife Service 2002b). Effects on infected individuals were significant, resulting in death of the plants two to four weeks after lesions were first observed. Anecdotal observations suggest that isolated plants tended to avoid infection (Strand and Hamilton 2000).

Rangewide Trends - Total population trends can disguise important regional trends. Recent population increases have occurred almost entirely in the northern part of the species range (see Table 6). Seabeach amaranth has undergone a geographic expansion, reappearing in five states over 11 years, after decades of extirpation from the entire northern portion of its range. New York sites account for virtually all of the recent increases in total population size rangewide, offsetting lower numbers in the south. Although natural population variability and survey effort must be considered, the recent trend in North Carolina appears downward. The low 1999 and 2000 plant totals in that state are especially noteworthy given the relatively high survey effort in these years (approximately 75 percent of known sites visited). In South Carolina, the species experienced a 90 percent reduction in that state following 1988 storms, including Hurricane Hugo. However, survey efforts since 1998 suggest that populations may have recovered in some areas of South Carolina.

Despite the natural variability of seabeach amaranth's population size and distribution and inconsistent survey efforts, some trends can be discerned from the available data. The species has undergone a significant geographic expansion, both in terms of the number and distribution of occupied states and counties. Since the first intensive surveys in 1987, the species' extant range has increased approximately 650 km (404 miles) to the north, but contracted about 50 km (31 miles) to the south. Numerically, the population has seen a dramatic increase. Equally notable is the geographic shift of the species' stronghold (in terms of total numbers) from North Carolina to New York.

Despite the geographic expansion and booming New York populations, seabeach amaranth is still vulnerable to local and regional extirpation. The primary threat to seabeach amaranth, habitat alteration, has not significantly diminished since the species was listed, and new threats have been subsequently discovered. Small population sizes in many locations increase the risk that seabeach amaranth will become locally extirpated. Almost 44 percent of sites documented

Refuge Manager, Chincoteague National Wildlife Refuge

28

in 2000 contained fewer than 10 plants, including more than 60 percent of sites in North Carolina (Young 2001, McAvoy 2000, National Park Service 2001a, 2001b, Jolls and Sellars 2000, U.S. Army Corps of Engineers 2001, Hamilton 2000a).

One final trend of note is the propagation of seabeach amaranth in greenhouses and laboratories, and the transplanting of propagated individuals or seed back into the wild. Such programs have been undertaken in Delaware, Maryland, North Carolina, and South Carolina (McAvoy 2000, National Park Service and Maryland Natural Heritage Program 2000, Jolls and Sellars 2000, Hamilton 2000b). These efforts have met with mixed results; thus a long term trend cannot be predicted.

LOGGERHEAD SEA TURTLE (*Caretta caretta*), GREEN SEA TURTLE (*Chelonia mydas*), and LEATHERBACK SEA TURTLE (*Dermochelys coriacea*)

Loggerhead sea turtles were listed as federally threatened in the U.S. in 1978 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a), the green sea turtle was listed as endangered in 1978 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b), and the leatherback sea turtle was listed as endangered in 1970 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). There is designated critical habitat outside of Virginia for the green and leatherback sea turtles, but none has been designated for the loggerhead sea turtle.

This account emphasizes sea turtle nesting and breeding biology, which is the subject of this biological opinion. Additional information about the life history of these sea turtle species and their habitat use, behavior, and survival at sea can be found in other documents, including the recovery plans (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a, 1991b, 1992), five-year status reviews (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a, 2007b, 2007c), and other sources (National Research Council 1990).

Species Description - The loggerhead is the smallest of the three turtles, with a mean carapace length of 92 cm and a mean mass of 133 kg (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a), compared to 102 cm and 136 kg for the green sea turtle (National Research Council 1990). Green sea turtles nest primarily in the tropics and are rarer nesters at higher latitudes, while loggerheads have significant nesting populations outside the tropics (National Research Council 1990). Leatherback sea turtles are the largest turtle and the largest living reptile in the world. Mature males and females can be as long as six and a half feet (2 m) and weigh almost 2000 lbs. (900 kg). The leatherback is the only sea turtle that lacks a hard, bony shell. The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support minor nesting colonies of the leatherback, but represent the most significant nesting activity within the United States (James *et al.* 2005).

Life History and Population Dynamics - Loggerhead females are believed to reach sexual maturity at a minimum age of 30 years (Snover 2002). At the start of the breeding season, they migrate from foraging areas on the continental shelf to mating areas in the waters near their nesting beaches (Schroeder *et al.*, 2003). Reproductive females exhibit the desire to return to their birthplace to lay their eggs (Miller *et al.* 2003). Females may be inseminated by multiple males (Bollmer *et al.* 1999). After mating, males return to their foraging areas while the females remain in the waters near their natal beaches to emerge onto their nesting beaches to lay eggs. The following account of nesting biology is a synopsis of Miller *et al.* (2003).

Loggerhead females tend to nest on high wave energy, sandy ocean beaches. Gravid females emerge from the swash zone and crawl toward the dune line until they encounter a suitable nest site, typically on open sand at the seaward base of a dune, but sometimes in vegetation. The female clears away surface debris with the front flippers, creating a “body pit,” then excavates a flask-shaped nest cavity with her hind flippers. Loggerheads lay an average of 112 eggs per nest. After laying, the female covers the nest with sand using all four flippers. Once the nest-covering phase is complete, she crawls back into the sea. Individual females may nest 1 to 6 times per nesting season, at intervals of 12-16 days, during the late spring to late summer. Intervals between nests shorter than 10 days indicate that the previous nest attempt was likely aborted due to disturbance. Mature loggerheads nest every two to three years, on average (Schroeder *et al.* 2003). Nest incubation period (from laying to hatching) depends on temperature, and ranges from 48 to 90 days at the extremes. Emergence of hatchlings from the nest cavity usually occurs within four days of hatch, but may take up to two weeks longer. Hatchling emergence from nests usually occurs at night when temperatures are lower and diurnal predators are inactive. Hatching success typically approaches 80%; after hatchlings leave the beaches, they typically fall prey to a variety of predators, including birds, fish, and sharks (National Research Council 1990).

Sex ratio of hatchlings depends on temperature during incubation. Below 84° Fahrenheit (29° Celsius), more males are produced than females, and above that temperature more females are produced (Carthy *et al.* 2003). Furthermore, fluctuating incubation temperatures often produce more females than stable temperatures, and temperature, hydration, and gas exchange during incubation can determine hatchling size, early swimming behavior, growth rate, and hatchling robustness (Carthy *et al.* 2003). Newly emerged hatchlings immediately head for the sea, most likely orienting toward the water by moving toward the brightest horizon and away from dark silhouettes (Lohmann and Lohmann 2003). Sea turtles are most negatively sensitive to blue and green light, and loggerheads in particular are averse to yellow light (Witherington and Martin 1996). Once in the sea, hatchling loggerheads swim into the waves and eventually enter the open ocean, where they will spend the first 6.5 to 11.5 years of their lives primarily at the top of the water column, until finally moving to foraging areas on the continental shelf (Bolten 2003).

Green sea turtles nest in two, three, or four year intervals, and may lay as many as nine clutches within a nesting season (National Marine Fisheries Service and U.S. Fish and Wildlife Service

Refuge Manager, Chincoteague National Wildlife Refuge

30

1991b). Clutch size varies from 75-200 eggs, and incubation ranges from about 45-75 days (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b).

Leatherback sea turtles nest in two to three year intervals, and average five to seven clutches per nesting season (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). Leatherbacks average fewer eggs per clutch, 70-80 eggs, and incubation ranges from 55-75 days (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992).

Nesting habitat - Less is known about factors that cue nest site selection than about anthropogenic disturbances that discourage nesting (Miller *et al.* 2003). Typical nesting areas are sandy, wide, open beaches backed by low dunes, with a flat, sandy approach from the sea (Miller *et al.* 2003). Nesting is nonrandom along the shoreline, but studies of the physical characteristics associated with nests versus random or non-nesting sites on the beach have produced varying results. Some factors that have been found to determine nest selection in certain studies are beach slope (3 of 3 studies), temperature (2 of 3 studies), distance to the ocean (1 of 3 studies), sand type (2 of 2 studies), and moisture (1 of 3 studies), although the results were occasionally contradictory (Miller *et al.* 2003). Data indicates that the leatherback sea turtle prefers beaches with proximity to deep water and generally rough seas (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). Other factors examined but not found to be significant were sand compaction, erosion, pH, and salinity. Although the process of nest site selection is not well understood, a successful nest must be laid in a low salinity, high humidity, well-ventilated substrate that is not prone to flooding or burying due to tides and storms, and where temperature is optimal for development (Miller *et al.* 2003).

Status and Distribution – Approximately 58,000 loggerhead nests were estimated in the U.S. Atlantic in 1983 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a), and between 53,000 and 92,000 nests from 1989 to 1998 (Turtle Expert Working Group 2000). Within the northern subpopulation (north Florida to Virginia), studies in South Carolina and Georgia have documented a decline in number of nests (Ehrhart *et al.* 2003). Based on genetic evidence, male loggerheads disperse freely among sites within the U.S. Atlantic population, while females are faithful to their natal sites (Bowen *et al.* 2005). Because sex ratio is determined by temperature during incubation (Miller *et al.*, 2003), the northern part of the U.S. Atlantic population, which includes Virginia, apparently provides a disproportionate number of males to the larger population (Mrosovsky *et al.* 1984, Hanson *et al.* 1998, Hawkes *et al.* in review).

“Analyses of historic and recent abundance information by the Marine Turtle Specialist Group (MTSG) indicate that extensive population declines for the green sea turtle have occurred in all major ocean basins. The MTSG analyzed population trends at 32 index nesting sites around the world and found a 48-65% decline in the number of mature females nesting annually over the past 100-150 years. The two largest nesting populations of green turtles are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Great Barrier Reef in Australia,

Refuge Manager, Chincoteague National Wildlife Refuge

31

where an annual average of 22,500 and 18,000 females nest per season, respectively. In the U.S., green turtles nest primarily along the central and southeast coast of Florida; present estimates range from 200 - 1,100 females nesting annually.” (National Marine Fisheries Service 2008) In the southeast U.S., the majority of green turtle nesting occurs in Florida. The green turtle nesting population of Florida appears to be increasing based on 19 years (1989 – 2007) of index nesting data from throughout the State ([http://research.myfwc.com/features/view\\_article.asp?id=27537](http://research.myfwc.com/features/view_article.asp?id=27537)).

“Because adult female leatherbacks frequently nest on different beaches, nesting population estimates and trends are especially difficult to monitor. In the Pacific, the World Conservation Union (IUCN) notes that most leatherback nesting populations have declined more than 80%. In other areas of the leatherback's range, observed declines in nesting populations are not as severe, and some population trends are increasing or stable. In the Atlantic, available information indicates that the largest leatherback nesting population occurs in French Guyana, but the trends are unclear. Some Caribbean nesting populations appear to be increasing, but these populations are very small when compared to those that nested in the Pacific less than 10 years ago. Nesting trends on U.S. beaches have been increasing in recent years.” (National Marine Fisheries Service 2008) Similar to the green turtle, in the southeast U.S., the majority of leatherback nesting occurs in Florida. The leatherback nesting population of Florida appears to be increasing based on 19 years (1989 – 2007) of index nesting data from throughout the State ([http://research.myfwc.com/features/view\\_article.asp?id=27537](http://research.myfwc.com/features/view_article.asp?id=27537)).

Threats - Threats to the loggerhead sea turtles on the nesting grounds are similar to those faced by the green and leatherback sea turtles. The following threats affect all three species, though there may be some differences in susceptibility among the three turtle species. In addition to these threats affecting turtle nesting, turtles face a variety of threats during their time at sea that affect growth and survival during all life stages. These threats are discussed in greater detail in the five-year status reviews for the three sea turtle species (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a, 2007b, 2007c).

*Weather and Tides* - Storm events may erode beaches and destroy nests, or cause nest failure due to flooding or piling of eroded sand on the nest site. Beach erosion due to wave action may also decrease the availability of suitable nesting habitat (Steinetz *et al.* 1998), leading to a decline in nesting rate on a particular beach.

*Predation* - Predation of eggs and young by mammals, birds, and ghost crabs may eliminate up to 100% of the nests and any hatchlings that emerge on beaches where it is not managed (National Research Council 1990).

*Human Activities* - Crowding of nesting beaches by pedestrians can disturb nesting females and prevent laying (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Furthermore, the use of flashlights and campfires may interfere with sea-finding behavior by hatchlings. Beach driving, including pedestrian traffic, ORV use, and beach cleaning, poses a

Refuge Manager, Chincoteague National Wildlife Refuge

32

risk of injury to females and live stranded turtles, can leave ruts that trap hatchlings attempting to reach the ocean (Hosier *et al.* 1981, Cox *et al.* 1994), can disturb adult females and cause them to abort nesting attempts, and can interfere with sea-finding behavior if headlights are used at night (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Driving directly above incubating egg clutches can cause sand compaction, which may decrease hatching and emergence success and directly kill pre-emergent hatchlings (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a). Artificial lighting on human structures may affect turtle behavior in a similar manner (Witherington and Martin 1996). Beach cleaning can directly destroy nests. Poaching is a problem in some countries, and occurs at a low level in the United States (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2007a).

An increased human presence may also lead to an increase in the presence of domestic pets that can depredate nests, and an increase in litter that may attract wild predators (National Research Council 1990). When artificial lighting impairs sea-finding behavior of nesting females and emerging hatchlings, the affected animals face increased exposure to the elements and predation.

The rate of habitat loss due to erosion and escarpment formation may be increased when humans attempt to stabilize the shoreline, either through renourishment (Dolan *et al.* 1973), or placement of hard structures such as sea walls or pilings (Bouchard *et al.* 1998). ORV traffic may alter the beach profile, leading to steeper foredunes (Anders and Leatherman 1987), which may be unsuitable for nesting. Improperly placed erosion-control structures such as drift-fencing can act as a barrier to nesting females. Humans may also introduce exotic vegetation in conjunction with beach development, which can overrun nesting habitat, make the substrate unsuitable for digging nest cavities, invade nests and desiccate nests, or trap hatchlings.

Reduced nesting success on constructed/augmented beaches could result due to sand compaction, escarpment formation, and changes in the beach profile. Sand compaction has been shown to negatively impact sea turtles, particularly concerning beach nourishment projects. Research has shown that placement of very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson *et al.* 1987, Nelson and Dickerson 1988). Significant reductions in nesting success (i.e., false crawls occurred more frequently) have been documented on severely compacted nourished beaches (Nelson and Dickerson 1987, Nelson *et al.* 1987), and increased false crawls may result in increased physiological stress to nesting females. Sand compaction may also increase the length of time required to excavate nests and result in increased physiological stress (Nelson and Dickerson 1988).

### III. ENVIRONMENTAL BASELINE

As defined in 50 CFR 402.02, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas. The “action area” is defined as all areas affected directly or indirectly by the federal action, and not merely the immediate area involved in the action. The direct and indirect effects

Refuge Manager, Chincoteague National Wildlife Refuge

33

of the actions and activities resulting from the federal action must be considered with the effects of other past and present federal, state, or private activities, and the cumulative effects of certain future state or private activities within the action area.

Description of the Action Area - For the purposes of this consultation, the Service has determined that the action area for this project will encompass all barrier beach units of CNWR, including Assateague, Assawoman, Metompkin, and Cedar Islands. Detailed information concerning the action area is described in the enclosed *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1).

#### Status of the Species in the Action Area

Piping plover (*Charadrius melodus*): There has been an increasing trend in the number of nesting pairs of plovers at all CNWR units from 1996, when monitoring was initiated at all CNWR units, to present (Table 7). CNWR's breeding plover population increased from 32 pairs in 1988 to its high of 118 pairs in 2005. Numbers declined slightly in 2006 and 2007, but remain well above numbers recorded a decade ago. In the last five years (2003-2007) nest productivity improved and has reached a weighted average of 1.53, well above the 1.24 believed to be necessary to maintain a stable population (Melvin and Gibbs 1994), and has reached the 1.5 believed to be necessary to maintain a secure population (U.S. Fish and Wildlife Service 1996a). The increase in productivity on CNWR units can be linked to the monitoring effort, use of nest enclosures, predator control efforts, and the closure of the primary nesting areas implemented by the refuge staff. These efforts have resulted in increasing numbers, and are responsible for the significant increases shown for the Southern Recovery Unit. Understanding the highly dynamic habitat conditions of these coastal islands is a key to the long term maintenance of plovers at CNWR.

Plover habitat on CNWR has changed over time as a result of natural erosion and accretion, and the relative suitability of plover habitat in different areas has also changed as a consequence. Accretion and increasing beach elevation, particularly on the Overwash and the recreational beach areas has led to increased plover use (Hecht 2008, pers. comm.). Around 1999, coastal processes began to form suitable habitat at the northern end of the Overwash and southern end of the parking lots. Habitat suitability around the south end of the parking lot/public beach attracted a breeding pair which nested there in 2005 (Hecht 2008, pers. comm.). Suitability of habitat decreased between May 2006 and Feb 2008, but still appeared capable of supporting at least one nesting pair (Hecht. 2008 pers. comm.). Habitat suitability was probably also enhanced by the removal of the asphalt parking lot and installation of shell material (Hecht 2008, pers. comm.). As a result of natural coastal processes, the beach conditions and habitat suitability will likely continue to change, resulting in improving conditions for plovers in some areas and declining conditions in other areas.

Refuge Manager, Chincoteague National Wildlife Refuge

34

| <b>Year</b>       | <b>No. plover pairs</b> | <b>No. plover chicks fledged</b> | <b>Plover fledging rate (chicks/pair)</b> |
|-------------------|-------------------------|----------------------------------|-------------------------------------------|
| 1988 <sup>a</sup> | 32                      | 27                               | 0.84                                      |
| 1989 <sup>a</sup> | 32                      | 36                               | 1.13                                      |
| 1990 <sup>a</sup> | 42                      | 24                               | 0.57                                      |
| 1991 <sup>a</sup> | 38                      | 30                               | 0.79                                      |
| 1992 <sup>a</sup> | 36                      | 19                               | 0.53                                      |
| 1993 <sup>b</sup> | 41                      | 56                               | 1.37                                      |
| 1994 <sup>b</sup> | 41                      | 71                               | 1.73                                      |
| 1995 <sup>b</sup> | 45                      | 44                               | 0.98                                      |
| 1996 <sup>c</sup> | 51                      | 83                               | 1.63                                      |
| 1997 <sup>c</sup> | 62                      | 43                               | 0.69                                      |
| 1998 <sup>c</sup> | 62                      | 69                               | 1.11                                      |
| 1999 <sup>c</sup> | 55                      | 74                               | 1.35                                      |
| 2000 <sup>c</sup> | 63                      | 98                               | 1.56                                      |
| 2001 <sup>c</sup> | 73                      | 134                              | 1.84                                      |
| 2002 <sup>c</sup> | 76                      | 95                               | 1.25                                      |
| 2003 <sup>c</sup> | 72                      | 147                              | 2.04                                      |
| 2004 <sup>c</sup> | 97                      | 221                              | 2.28                                      |
| 2005 <sup>c</sup> | 118                     | 167                              | 1.42                                      |
| 2006 <sup>c</sup> | 117                     | 121                              | 1.03                                      |
| 2007 <sup>c</sup> | 98                      | 110                              | 1.12                                      |

<sup>a</sup> Data from Assateague Island.  
<sup>b</sup> Data from Assateague, Assawoman, and Metompkin Islands.  
<sup>c</sup> Data from Assateague, Assawoman, Metompkin, and Cedar Islands.

Seabeach amaranth (*Amaranthus pumilus*): Seabeach amaranth was rediscovered in Virginia in 2001, the last previously known prior occurrence was in 1973 (U.S. Fish and Wildlife Service 1996b). Population numbers at CNWR have been low (Table 8), and limited primarily to the Wild Beach portion of the refuge. In 2005, there were 69 plants located in the Wild Beach section of the refuge on Assateague Island (the highest count since 2001). The numbers dropped to 13 plants in 2006. The number of plants within CNWR complex has experienced major fluctuations in numbers since its rediscovery in 2001.

Refuge Manager, Chincoteague National Wildlife Refuge

35

**Table 8. Number of seabeach amaranth (*Amaranthus pumilus*) plants and distribution by year on Assateague Island, Chincoteague National Wildlife Refuge, Virginia. There are no records of any surveys on the Southern Islands Unit.**

|                   | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|-------------------|------|------|------|------|------|------|
| <b>Wild Beach</b> | 9    | 56   | 22   | 1    | 69   | 13   |
| <b>Hook</b>       |      |      |      | 1    |      |      |

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*): From 1974 to 2006, there were 17 confirmed sea turtle nests on CNWR (Table 9), all of which were loggerheads. Ten of these nests were located north of the Public Beach area in what is referred to as the Wild Beach area. The other seven nests were located south of the Public Beach area (six in the Overwash area, and one on the Hook). At this time, there has been no confirmed successful nesting by green or leatherback sea turtles within CNWR. In 2006, there were indications that a green sea turtle may have nested at CNWR. In 2006, a park biologist at Assateague Island National Seashore (Maryland) observed a nesting attempt by a leatherback sea turtle (MacPherson, 2008, pers. comm.). These events make it essential to include these two species in the biological opinion. With global warming, the refuge lands in Virginia may become more favorable climatically to both the green and leatherback sea turtles for nesting.

**Table 9. Loggerhead sea turtle (*Caretta caretta*) crawl and nest distribution by area on Chincoteague National Wildlife Refuge, Virginia, 1974-2006.**

|                           | Hook | Over-wash | Wild Beach | Assawoman Island | Metompkin Island | Cedar Island | TOTAL |
|---------------------------|------|-----------|------------|------------------|------------------|--------------|-------|
| <b>False Crawls</b>       | 13   | 4         | 4          | 1                | 0                | 0            | 22    |
| <b>Nests</b>              | 1    | 6         | 10         | 0                | 0                | 0            | 17    |
| <b>Unknown Crawl Type</b> | 1    | 0         | 0          | 0                | 0                | 0            | 1     |

#### IV. EFFECTS OF THE ACTION

The effects of beach management activities on all units of CNWR and actions the refuge will take to minimize impacts are discussed in the enclosed *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1), and are summarized below.

Refuge Manager, Chincoteague National Wildlife Refuge

36

### Direct Effects

Piping plover (*Charadrius melodus*): Refuge management activities will continue to have an overall positive effect on plover populations. Marking and enforcing restricted public use areas and seasonal closures to protect plover nesting benefits plovers by reducing human activity during the nesting season. Active and passive predator control activities also protect the birds by offering safe havens inside the nest enclosures and by reducing the numbers of predators. This intensive management has resulted in and will continue to gather data that is assisting in the understanding of plover biology and appropriate management techniques. CNWR has been improving plover habitat within the North Wash Flats area of Assateague Island since the 1990s, by removing vegetation, and recreating nesting and foraging habitat that was lost when dunes were built on the island in the 1960s. These management efforts have been aided by improving beach habitat conditions in that area that resulted from natural beach processes. Thus, there has been an overall increase in suitable nesting habitat at the Assateague Island section of CNWR since the plover was listed in 1986. Over the last three years, the refuge has supported about 35% of the nesting population of the Southern Recovery Unit, and CNWR management has increased plover numbers and nesting success on their lands.

During plover management and monitoring, there is a small chance that CNWR staff may not find a nest, and could destroy eggs or chicks during ORV use while conducting the surveys. Such an accident happened in 2000, but revised plover monitoring protocols have ensured that this has not happened since. Likewise, an unseen nest close to or within the west side of the public Overwash zone could have the same result.

Human disturbance of nesting and foraging plovers on Assateague Island may also occur. Disturbances from pedestrian and vehicle traffic (including horseback riders) may prevent a successful breeding attempt or result in the separation of chicks from the adults, or prevent chicks from reaching feeding areas or avoiding predators. The refuge closure of nesting areas to public use (especially closures to ORVs and horseback riding), predator control measures, and general management practices have greatly reduced the likelihood of disturbance and have generally provided plovers with safe areas to nest. However, some disturbance resulting from CNWR personnel, ORVs, and pedestrian activity outside of closed areas, such as the intertidal zone of the Wild Beach, may result in disturbance to nesting plovers. Since the Assateague Island unit is opened to ORVs and other public use after the nesting season, it is likely that there is some small impact to plovers that migrate along the barrier islands during their fall migration to their wintering grounds. This impact would be from interference with foraging due to the human and ORV use of the beaches. CNWR's restrictions on access to the dunes immediately adjacent to the beaches may reduce the effects of disturbance to foraging plovers on the beach by providing a readily available refuge from disturbance.

As plover numbers have increased on Assateague Island and habitat suitability has increased north of the Overwash Zone, there is an increasing chance that plovers may attempt to nest on the Public Beach or adjacent shell/sand parking lots. There was a nest adjacent to the parking lot in 2005, which led to closure of a portion of the lot, and a plover brood briefly used the area in 2007 (Hecht 2008, pers. comm.). Nesting has not occurred to date within the parking lot since the habitat is not particularly conducive to plover nesting due to the lack of intertidal foraging habitat close to the sandy/shell beach and parking lot substrates. However, there is a small risk that plovers may attempt to nest in these areas early in the season before the parking lots and Public Beach receive intense public use. Due to the overlay of a National Seashore on the Assateague Island beach, the CNWR is presented with a dilemma in managing this scenario should it occur. Current plans would be that if a plover nest occurred on the public beach, CNWR would put an enclosure over the nest and would fence off a 25 – 50 foot buffer around the enclosure to preclude human access. If a nest would occur in the parking lot, CNWR would put an enclosure around the nest, but would not further limit human or vehicle access. These protocols are less than what is recommended in the plover management guidelines within the Recovery Plan, and would increase risk to plovers from human disturbance, crushing of nests and/or young, nest abandonment, or egg mortality resulting from exposure. If a nest is crushed, it could result in the destruction or loss of one to four eggs. Any pairs that successfully hatch chicks from nests on the recreational beach or on the parking lots may be forced to move their broods into territories of pairs already established in the Overwash Zone, inducing agonistic interactions and reducing overall chick survival. However, it has been over ten years since the parking lots were converted from a paved surface to packed shell/sand, and there has not been a confirmed attempt by a plover to nest within the parking lot during that time. Therefore, while there is a risk of take of plovers under this scenario, it remains low. CNWR has committed to evaluate whether the Public Beach could be shifted to the north into an area that does not have suitable plover nesting habitat as part of its CCP process.

CNWR's Southern Units (Assawoman, Metompkin, and Cedar Islands) are not permanently staffed and are accessible to the public only by boat. Cedar and Assawoman Islands are currently staffed several days per week from April through August, and CNWR and The Nature Conservancy personnel visit Metompkin Island at least weekly during the nesting season. Future staffing levels are subject to change as a result of changing Refuge budgets. Assawoman and Metompkin Units are open to the public for daytime use, and the public may only access a limited area at the tips of the islands within the intertidal zone. However, since refuge enforcement staffing is limited, some unauthorized public use may occur at any time of the year. Members of the boating public have been known to stop at these and other islands for breaks from fishing, picnicking, or solitude. Unauthorized pedestrian activities (including dogs) may harass adults or chicks or may crush eggs. The extent of unauthorized use of the southern islands is unknown, but is believed to have been reduced over time due to better public information and patrols by Service and State staff (Ruth Boettcher 2008, pers. comm.). Plover productivity rates on Assawoman and Metompkin Islands are such that the Service does not believe unauthorized human use is a severe problem. Cedar Island has more human use since

parts of the island are in private ownership, and there are some unregulated ORVs on that island. However, plover nesting rates on Cedar Island also do not indicate that human disturbance is a significant issue on that island at the present time. Development of intermixed private land could increase human disturbance.

While each of the management practices and human activities at CNWR units will result in low risks to plovers, taken together, it is anticipated that there will still be some adverse effects on nesting plovers. Such effects may be due to incidental human disturbance of nesting and foraging adults and their young, or due to the accidental loss of eggs or chicks from nesting pairs that have not been seen by drivers of ORVs (official vehicles or the public). These effects are most likely to occur within the Public Beach and Overwash zones on Assateague Island and on the southern units of Assawoman, Metompkin, and Cedar Islands. It is anticipated that up to five pairs of nesting plovers on CNWR units over the next five years may have their productivity (number of fledged young per year) reduced by these human actions.

To evaluate the overall significance of this level of take, a comparison with what is considered to be the normal productivity at CNWR is warranted. Over the past five years (2001 – 2006), the average plover productivity rate for all CNWR units was 1.6 chicks per pair. This is one of the highest productivity rates within the Atlantic Coast recovery population, and is due to the intensive management conducted by the refuge. Using this average plover productivity rate for CNWR (which indicates the rate of loss for eggs and nestlings), five nesting pairs would be expected to produce approximately 21 eggs (based on the 2001-2006 average, including clutches of less than four eggs and renesting), and of these, eight chicks would be expected to fledge. Human disturbance and ORV use is anticipated to result in the loss of five of these eight chicks (although actual mortality could occur during either the egg or the pre-fledgling stages). This would be a decrease of approximately 0.7% of the plover chicks that would otherwise be expected to fledge at CNWR units over a five year period. Notwithstanding the special importance of protecting plovers in the limited suitable habitats in the Southern Recovery Unit, this loss is considered sustainable over the short-term life of this consultation and biological opinion, and will not significantly affect the status of the overall population of the Southern Recovery Unit. The Refuge plans to complete its CCP in about five years. During the CCP process, the refuge has committed to evaluate other options to situate intensive recreational use away from suitable plover habitat and to continue to implement plover nesting habitat enhancement within the Wash Flats area.

Seabeach amaranth (*Amaranthus pumilus*): Activities by CNWR staff for management and protection of nesting plovers and sea turtles have a net positive effect on seabeach amaranth. Seabeach amaranth occurrences are often located during these other management activities, which result in better protection of the plants. The CNWR staff annually surveys for the plant and records any locations. If plants are found in public use or ORV use areas, signs and symbolic fencing will provide protection and reduce the risk of inadvertent disturbance to plants. As a result of closure of nesting areas for protection of the plover and sea turtles, seabeach

amaranth that occur in these areas can complete most of its life cycle removed from the threat of crushing from public ORV use. Some recreationists walk on the Wild Beach, though most stay close to the parking lots. These pedestrians may knowingly or unknowingly walk over plants if they use the beach above the tidal zone in potential seabeach amaranth habitat. Horses that are herded over the dunes to the beach during the annual pony penning in July may potentially crush plants, but refuge efforts to mark each plant, plover, or turtle nest along the route and use staff and volunteers to watch each area should prevent this from happening. Crushing of a plant or plants by the public, staff, horses, or ORVs may occur in some circumstances, but is unlikely due to the actions taken by the refuge to protect the dune and beach areas. CNWR's restrictions on walking on the upper beach, prohibitions on ORV use in the dunes, and efforts to educate the public should decrease trampling in almost all cases. This form of take is considered insignificant.

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*): The effects of refuge management activities and public use on sea turtles are primarily limited to the Assateague Island unit, since no turtles have been known to nest on Assawoman, Metompkin or Cedar Islands since 1974. Management activities on Assateague should have a net positive effect on sea turtle nesting due primarily to *in situ* protection of nests. Active and passive predator control, conducted primarily for plover nest protection, will also help nesting sea turtles by reducing the number of potential sea turtle nest predators on the refuge. All sea turtle nests will be left in place and protected from threats as outlined in the attached *Intra-Service Section 7 Biological Evaluation Form* (Enclosure 1). Following the protocols established in Enclosure 1, CNWR staff will make a determination of how to provide protection to each nest based on the nest timing, location, and any possible site-specific issues. All turtle nests on Assateague will be excavated to confirm the presence of eggs. While this excavation process has a slight possibility of damage to the eggs, it is a standard procedure recommended and used by all sea turtle experts in the United States. The nests will then be protected by predator exclosures and symbolic fencing to prevent public trespass. Any turtle nests that occur in the Overwash zone when that area is re-opened to vehicles after the end of the plover nesting season (generally about September 1), will also be protected with a light barrier. In addition to the barriers, human nest sitters (staff or volunteers) will be used at night during the hatch window to protect nests in areas where the location of the nest and the width of the beach is such that an ORV cannot pass landward of the nest. The nest sitters will prevent vehicles from passing seaward of turtle nests while hatchling turtles are on the beach to prevent injury to hatchling turtles.

The approach to sea turtle protection used by the refuge in management of the species will allow for natural nesting on all CNWR units. While this approach will reduce anthropogenic effects on turtle nesting, some nests may still be affected by storm tides, erosion, and other natural processes that affect turtle nesting. The *in situ* protection and proposed management of nests on Assateague Island makes it unlikely that eggs and hatchling turtles will be lost due to crushing by ORVs or entrapment in vehicle ruts, unless unseen turtle nests occur, ORV drivers disobey

Refuge Manager, Chincoteague National Wildlife Refuge

40

protocols, and/or nest sitters are not available each night during the hatch window due to unforeseen circumstances. Disturbance to nesting turtles can still occur prior to egg-laying. ORV use by CNWR personnel and by recreational users outside of closure areas and periods for nesting plovers, may compact beach sand and/or disturb female turtles attempting to nest, potentially resulting in false crawls or fewer nests on Assateague Island beaches. Because the beach closure to ORVs for the plover nesting period generally coincides with the peak of turtle nesting, the risk of ORV disturbance is relatively low.

### Indirect Effects

Indirect effects to piping plovers and sea turtles could include an increased predation rate due to human activity. Human activity on the islands may result in trash on the ground, which could both attract predators and increase the carrying capacity of the predators due to increased food availability. The increased numbers of predators may increase risk of disturbance, nest loss, and adult mortality of plovers and increase losses of sea turtle eggs and nests. Plovers may expend more energy in predator surveillance and avoidance, and that energy expenditure could decrease overall fitness. This risk is low because recreational use of these sites is light, except at the Overwash zone. In the Overwash zone, recreational use of the beach is allowed prior to plover hatching season and it is intensively supervised. Activities on the beaches by CNWR personnel may have some similar effects, but the risk is relatively low. Continued ORV use on the beaches may also increase ruts, compact sand, and destabilize some portions of the beach.

Interrelated and Interdependent Actions - An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No activities that are interrelated to or interdependent with the proposed action are known at this time.

## V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Future federal, State, local or private actions that are anticipated to occur within the action area, (i.e., units of CNWR) will either be carried out by, or will require a permit from, the Service. These actions will therefore require a section 7 consultation. The Service is not aware of any future State, local or private actions that could occur within the action area that would not be subject to a section 7 review. However, there are private lands on Cedar Island that may not be subject to a section 7 review, including private activities such house construction, and ORV and other human beach use. Likewise, on the section of Metompkin Island not owned by the

Refuge Manager, Chincoteague National Wildlife Refuge

41

Service, public use restrictions may be different than those established by the Service. Based on the distribution and productivity of piping plovers on these islands (Enclosure 1, Table 1, of *Piping Plover Intra-Service Section 7 Biological Evaluation Form*), it would appear that nesting success of plovers is affected more by habitat suitability than on the limited human use of Cedar or Metompkin Islands.

## VI. CONCLUSION

Piping plover (*Charadrius melodus*): After reviewing the status of the piping plover, the environmental baseline for the action area, and the effects of the proposed actions, it is the Service's biological opinion that these activities, as proposed, are not likely to jeopardize the continued existence of the piping plover. The 117 pairs counted in 2006 and the 98 counted in 2007 on CNWR units represent a significant portion of the Southern Recovery Unit numbers (over 30 percent). Adverse effects are of very limited geographic scope and/or magnitude, and the refuge is developing options to further reduce them. Plovers in the Southern Recovery Unit are still imperiled; however, the management activities at CNWR will provide a net benefit to the plovers and aid in the recovery of the plover in this recovery unit. No critical habitat exists within the action area; therefore, none will be affected.

Seabeach amaranth (*Amaranthus pumilus*): After reviewing the status of seabeach amaranth, the environmental baseline for the action area, and the effects of the proposed actions, it is the Service's biological opinion that these activities, as proposed, are not likely to jeopardize the continued existence of seabeach amaranth. No critical habitat has been designated for this species; therefore, none will be affected.

The Service bases this determination on the low level of anticipated adverse effects coupled with the protection gained by the management activities and the broad distribution and relative size of the range-wide seabeach amaranth population.

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*): After reviewing the status of the three sea turtles, the environmental baseline for the action area, and the effects of the proposed actions, it is the Service's biological opinion that these activities, as proposed, are not likely to jeopardize the continued existence of loggerhead, green or leatherback sea turtles. No critical habitat has been designated for the loggerhead sea turtle, and no critical habitat for either the green or leatherback sea turtles occurs within the action area; therefore, none will be affected.

The Service bases this determination of no jeopardy on the low level of anticipated adverse effects coupled with the protection gained by the management activities. Furthermore, there is a low level of nesting use by sea turtles relative to the total population size nesting within the broader region, and the likelihood that any nest would suffer direct impacts is small. The management activities at CNWR should provide a net benefit to the turtles.

Refuge Manager, Chincoteague National Wildlife Refuge

42

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by CNWR for the exemption in section 7(o)(2) to apply. CNWR has the continuing duty to regulate the activities covered by this incidental take statement. If CNWR (1) fails to assume and implement the terms and conditions, or (2) fails to require any permittee or other party to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, CNWR must report the progress of the action and its impact as specified in the incidental take statement [50 CFR 402.14(i)(3)].

Section 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plants species. However, limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of state law or regulations or in the course of any violation of a state criminal trespass law.

#### **AMOUNT OR EXTENT OF TAKE**

Piping plover (*Charadrius melodus*):

The Service anticipates that up to five pairs of nesting plovers on CNWR units over the next five years may have their productivity (number of fledged young per year) reduced by human actions. Of this number, no more than one nest or brood is expected to be taken in any one year as a result of the proposed actions. Take, in the form of harassment of adults and/or young may interfere with breeding, feeding, or sheltering. This is most likely to

occur if plovers nest in the Public Beach Area, where reduced buffers will provide limited protection. Take of eggs or young may be caused directly by a vehicle crushing a plover egg or chick, or by entrapment of chicks due to creation of ruts in sand that impede chick movements. Though unlikely, any unauthorized pedestrian use may prevent plovers from using the beach and intertidal areas for foraging. Detection of mortality or injury to piping plover eggs and chicks is extremely difficult due to their small size, and because their coloration blends with the beach substrate. Dead chicks and eggs may be covered with wind-blown sand, washed away by tides, or consumed by scavengers. Because detection of take of piping plovers is difficult, the discovery of a single crushed egg or chick due to suspected human causes is considered to indicate the level of anticipated annual take has been reached.

This level of incidental take is expected to continue until CNWR completes the CCP for the refuge (approximately five years from this Opinion), at which time the proposed action is expected to be replaced by revised management, which will be subject to a reinitiation of consultation.

Loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*):

The Service expects incidental take of all species of sea turtles will be difficult to detect for the following reasons: (1) turtles nest primarily at night and all nests are not found due to natural factors, such as rainfall, wind, and tides that may obscure crawls, and human-caused factors, such as pedestrian and vehicular traffic, which may obscure crawls and result in nests being destroyed because they were missed during a nesting survey and nest protection program; (2) the total number of hatchlings and the reduction in hatching and emergence success due to disturbance of nests is difficult to determine; (3) impacts to nesting females in the form of harassment are not likely to be noticed and recorded; and 4) locating individual hatchling sea turtles that have been injured or killed is unlikely.

Incidental take in the form of injury or death of loggerhead sea turtle eggs, hatchlings, and nesting turtles, as well as harm and harassment of both adult and hatchling turtles may result from the proposed action. Incidental take may include collisions with nesting turtles resulting in injury or death, crushing an undetected turtle nest by either staff- or civilian-operated ORVs, creation of ruts in sand that impede hatchlings from moving from nest to water, interference with sea-finding behavior in hatchling turtles leading to disorientation resulting from artificial and vehicle lighting, and impacts to nests resulting from sand compaction or vibration caused by ORV use. The *in situ* management of nests is expected to reduce take since no nests will be moved and nests will be protected from potential human disturbance. No more than three loggerhead sea turtle nests are expected to be taken or lost due to direct or indirect impacts during the five year period covered by this biological opinion, and no more than one loggerhead sea turtle nest is expected to be taken

Refuge Manager, Chincoteague National Wildlife Refuge

44

in any one year. No adult turtles are anticipated to be killed due to the intensive monitoring program for piping plovers during the majority of the sea turtle egg laying period, and no incidental take of adult sea turtles in the form of death or injury from ORV use is authorized. No green sea turtle or leatherback sea turtle nest loss is expected to occur due to their rarity, and no incidental take of these species is authorized.

### EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat. The action area encompasses a relatively small portion of the rangewide habitat of each of the species addressed in this opinion, and a small portion of each species' population. The proposed action includes a variety of protective measures that are intended to minimize incidental take. For these reasons, the effect of the take anticipated in this biological opinion is not expected to significantly affect any of the species considered.

### REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the likelihood of incidental take of piping plovers, seabeach amaranth, and sea turtles:

1. Proposed activities and access to plover and sea turtle nesting areas, must be timed and conducted to minimize impacts to the species.
2. Monitoring of the species' populations on CNWR units, as well as the effectiveness of the protection measures.

### TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, CNWR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. The proposed action represents an interim plan anticipated to be in place for five years as the refuge works on its CCP. The proposed action, and the provisions of this biological opinion, including terms and conditions, are expected to be replaced by another section 7 consultation on the actions proposed by the CCP once it is completed.

#### *Refuge Management Actions*

1. Human activities, both pedestrian and vehicular, shall be restricted in all piping plover and sea turtle nesting areas, and known locations of seabeach amaranth, on all CNWR

units in accordance with the plans developed in *the Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1). Pedestrian and vehicle corridors shall be moved, constricted, or temporarily closed if territorial, courting, nesting, or brooding plovers or sea turtle nests may be disturbed by human activities, or if disturbance is anticipated because of unusual tides. The exception to this is the Overwash zone on Assateague Island (see Condition #2) and the Public Beach Area.

2. The Overwash zone on Assateague Island is divided into two areas: (1) the plover nesting area, and 2) the Off-road Recreational Vehicle (ORV) access corridor (see Enclosure 1, Figure 3, of the *Piping Plover Intra-Service Section 7 Biological Evaluation Form*). The plover nesting area is closed from March 15 through August 31 or until all plovers have fledged, but the ORV corridor seaward of this area stays open until two days before the first expected plover hatch date, and the closure continues until all plover chicks in the area have fledged. The area that shall be closed will be 200 meters north of the northern-most plover brood.
3. In the event that plovers nest on the Public Beach or adjacent parking lots on Assateague Island, the refuge will at a minimum exclose a twenty-five foot radius buffer zone around the nest to protect the nest, and will notify the Virginia Field Office (VAFO) within 24 hours or the next work day. It is important that the refuge complete its Comprehensive Conservation Plan (CCP) by the end of the five year period anticipated in this Biological Opinion. Within the CCP shall be alternative management methods to reduce the potential take of plovers in these public use areas and the Overwash zone.
4. During the plover breeding and sea turtle nesting seasons, official vehicle use (FWS and NPS) of the Assateague Island unit beach shall be limited to that considered essential in the judgment of the Refuge Manager. Official vehicle use will be confined to daylight hours when possible. Vehicle speed shall not exceed ten miles an hour. Vehicles should avoid creating deep ruts that could impede plover chick or sea turtle hatchling movements. If vehicles are creating deep ruts that could impede hatchlings, CNWR shall take appropriate measures to correct the situation as outlined in the *Intra-Service Section 7 Biological Evaluation Forms* (Enclosure 1), and these measures shall be taken at least five days prior to the anticipated hatch date.
5. Personnel who monitor plovers shall maintain and regularly update a log of the locations of nests and unfledged plover chicks and sea turtle nests on the Assateague Island unit. Drivers of official vehicles (FWS and NPS) and public ORV users shall be kept up-to-date by CNWR staff regarding the most current information on locations of nests and unfledged plovers and sea turtles.
6. Night use of the beach by official vehicles during the plover and sea turtle breeding season shall be limited to the greatest extent possible. Except in extreme emergencies,

during night trips a person with a flashlight should walk ahead of the vehicle while within this 400-meter area to look for plovers.

7. The refuge shall insure that the local fire department continues to maintain the fence line to prevent horses from being on the dunes and beach areas to prevent take of plovers, seabeach amaranth, or sea turtle nests. The refuge will take all precautions to insure that during the annual pony penning event, the public and horses while on the Wild Beach do not impact any listed species (if plover chicks and/or turtle nests are present the horses and public will be routed away from them).

#### *Monitoring and Notification*

1. Sea turtle crawl and nest searches will be conducted June through the end of September. Surveys for seabeach amaranth will be conducted in conjunction with piping plover and sea turtles.
2. If nesting of green or leatherback sea turtles are confirmed on the Assateague Island unit, CNWR staff shall notify the VAFO within 24 hours (or the next work day) to discuss appropriate management actions to ensure that no take of the eggs or hatchlings of these species occur, due to the rarity of these species at the northern end of their ranges and because no incidental take of these species has been anticipated.
3. A log shall be maintained by CNWR that records the date, time, permit number, and purpose of each vehicle trip (government and private vehicles) through all Assateague beach segments when unfledged plover chicks or sea turtle nests are present.
4. CNWR prepares annual monitoring/survey reports on piping plover productivity, sea turtle nesting activity, and seabeach amaranth locations. These reports shall be submitted to VAFO and the national piping plover and sea turtle coordinators no later than December 1 of each year. Reports shall be sent to VAFO via electronic transmission or at the address below, and to the appropriate addresses for the national coordinators:

Supervisor  
Virginia Field Office  
U.S. Fish and Wildlife Service  
6669 Short Lane  
Gloucester, Virginia 23061  
(804) 693-6694

5. The CNWR must notify the Virginia Field Office at the address and phone number above within 24 hours (or next work day) of any deaths, nests impacted, or other impacts to the species addressed in this opinion as a result of human activity. Any reports of mortality

or injury due to vehicles shall be accompanied by the vehicle log or monitoring log of the day and previous day that impact occurred. Care must be taken in handling dead specimens of any proposed or listed species that are found to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the Act. The reporting of dead specimens is required to enable the Service to determine if the approved take has been reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities taken to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

CNWR can take the following actions to improve management of the three listed species that utilize the beaches of the refuge, and aid in the management and recovery of these species:

1. Within the Public Beach zone and adjacent parking lots on Assateague Island, should any plovers attempt to nest in these areas, follow the Piping Plover Recovery Plan guidelines on protection distances, which are substantially greater than 25 – 50 feet (U.S. Fish and Wildlife Service, 1996).
2. Expedite the evaluation of alternate transportation and alternate public beach options on Assateague Island in a period shorter than five years, in conjunction with the National Park Service. Flexibility to respond to natural habitat formation by moving the Public Beach to portions of the barrier island where habitat conditions are currently unsuitable (or only marginally suitable) for piping plover breeding, closure of the beach parking lots and the Overwash zone during the summer and fall shorebird and sea turtle nesting and migration periods, and providing a new parking area with tram service to the beach are measures that could be taken to further reduce incidental take.
3. Over the last two years there has been limited nesting by plovers on the Wild Beach. In the 1960s, overwash habitat here and elsewhere on Assateague Island was lost in this area when the extensive artificial sand dune system was created. The refuge should continue and expand the restoration of the dynamic beach and overwash system that existed in the Wild Beach and elsewhere prior to the dune construction. This would restore natural processes to an extensive

Refuge Manager, Chincoteague National Wildlife Refuge

48

area that would be isolated from high public use and act as a safe zone for the plover, sea turtles, and other nesting shorebirds.

4. Monitor the use of CNWR beach by piping plovers (and other shorebirds) during the fall migration period to determine the extent and locations of important foraging areas with the refuge. See for example National Park Service (2003).
5. To further reduce the impacts of unauthorized public use of the southern islands (Assawoman, Metompkin, and Cedar), the refuge should increase staff presence to three days a week during the nesting season, including weekend patrols.
6. As part of the CCP process, the refuge should assess all management activities to determine if there are additional management actions that could be taken to reduce and avoid the take of beach dwelling listed species. The pony operation on the refuge should also be evaluated for its impacts on refuge resources.
7. Within constraints of available staff time and other refuge priorities, continue to facilitate piping plover research. For example, a 2007 pilot study using harnesses to attach radio transmitters to piping plovers (Cohen *et al.* 2007), hosted by CNWR on short notice, provided valuable information for future research on effects of off-shore wind turbines on Atlantic Coast piping plovers. Other past studies with broad benefits for rangewide piping plover recovery have included investigations of seabird colony effects on piping plover fledging success and brood movement (Daisey 2006), research on effects of ghost crabs on piping plover breeding success conducted on the Wild Beach (Wolcott and Wolcott 1999), and breeding ecology (Cross 1996).

In order for VAFO to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, VAFO requests notification of the implementation of any conservation recommendations not included in the description of the proposed action or biological opinion.

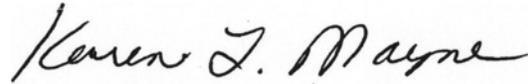
### **REINITIATION NOTICE**

This concludes formal consultation on the actions outlined in the Intra-Service consultation form. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that it causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or designated critical habitat that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Refuge Manager, Chincoteague National Wildlife Refuge

49

VAFO appreciates this opportunity to work with CNWR on the proposed actions. Please contact Mike Drummond at (804) 693-6694, extension 114 if you require additional information.



Karen L. Mayne

#### Enclosures

cc: Superintendent, Assateague Island National Seashore, Berlin, MD (Scott Bentley)  
USFWS, Sudbury, MA (Anne Hecht)  
CBFO, Annapolis, MD (Andy Moser)  
Virginia Department of Game and Inland Fisheries (Ruth Boettcher)  
ARD, ES, Region 5, Hadley, MA (Michael Thabault)  
Chief, Refuges, Region 5, Hadley, MA (Tony Leger)  
Endangered Species Coordinator, Region 5, Hadley, MA (Martin Miller)

Refuge Manager, Chincoteague National Wildlife Refuge

50

### LITERATURE CITED

- Anders, F. and S. Leatherman. 1987. Disturbance of beach sediment by off-road vehicles. *Environmental Geology and Water Sciences* 9:183-189.
- Baskin, J.M. and C.C. Baskin. 1994. Seed germination studies in the rare plant species *Aeschynomene virginica* and *Amaranthus pumilus*. Final report to the Maryland Department of Natural Resources (small procurement contract I.D. No. 17345). Annapolis, Maryland. 8 pp.
- Baskin, J.M. and C.C. Baskin. 1998. Seed dormancy and germination in the rare plant species *Amaranthus pumilus*. *Castanea* 63:493-494.
- Belden, A. Jr. 2000. 2000 inventory for *Amaranthus pumilus* Raf. *In: Virginia Natural Heritage Technical Report 00-17*. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Richmond, Virginia. 17 pp. + appendix.
- Bent, A.C. 1929. Life histories of North American shorebirds. *U.S. Natural Museum Bulletin* 146:236-246
- Bergstrom, P.W. 1991. Incubation temperatures of Wilson's plovers and killdeers. *Condor* 91: 634-641.
- Boetcher, R. 2008. Personal communication. Virginia Department of Game and Inland Fisheries, Richmond, Virginia.
- Bollmer, J.L., M.E. Irwin, J.P. Rieder, and P.G. Parker. 1999. Multiple paternity in loggerhead turtle clutches. *Copeia* 1999:475-478.
- Bolten, A.B. 2003. Active swimmers, passive drifters: the oceanic juvenile stage of loggerheads in the Atlantic System. Pp. 63-78 in Bolten, A.B. and B.E. Witherington (eds). *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.
- Bouchard, S. K. Moran, M. Tiwari, D. Wood, A. Bolten, P.J. Eliazar, and K.A. Bjorndal. 1998. Effects of exposed pilings on sea turtle nesting activity at Melbourne Beach, Florida. *Journal of Coastal Research* 14:1343-1347.
- Bowen, B.W., A.L. Bass, L. Soares, and R.J. Toonen. 2005. Conservation implications of complex population structure: lessons from the loggerhead turtle (*Caretta caretta*). *Molecular Ecology* 14:2389-2402.

- Refuge Manager, Chincoteague National Wildlife Refuge 51
- Burger, J. 1987. Physical and social determinations of nest-site selection in piping plover in New Jersey. *The Condor* 89:811-818.
- Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plovers (*Charadrius melodus*). *Journal of Coastal Research* 7:39-52.
- Burger, J. 1993. Nocturnal foraging behavior of the piping plovers (*Charadrius melodus*) in New Jersey. *Auk* 111(3):579-587.
- Burger, J. 1994. The effect of human disturbance on foraging behavior and habitat use in the piping plover (*Charadrius melodus*). *Estuaries* 17(3):695-701.
- Cairns, W.E. 1977. Breeding biology of piping plovers in Southern Nova Scotia. M.S. Thesis. Dalhousie University, Halifax, Nova Scotia. 115 pp.
- Cairns, W.E. 1982. Biology and behavior of piping plovers. *Wilson Bulletin* 94:531-545.
- Canadian Wildlife Service. 1989. Canadian piping plover recovery plan. Ontario, Canada. 18 pp.
- Canale, S.B. 1997. 1997 piping plover nesting summary. New Jersey Division of Fish and Wildlife, Trenton, New Jersey. 29 pp.
- Carthy, R.R., A.M. Foley, and Y.Matsuzawa. 2003. Incubation environment of loggerhead turtle nests: effects on hatching success and hatchling characteristics. Pp. 144-154 in Bolten, A.B. and B.E. Witherington (eds). *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.
- Chicone, R. Jr. Undated. A Survey of *Amaranthus pumilus* in Horry and Georgetown Counties, South Carolina, September and October, 1998. Undergraduate Independent Study Program, Biology Department, Coastal Carolina University, Conway, South Carolina. 7 pp. + figures.
- Cohen, J., J. Fraser, and S. Karpanty. 2007. Development of a radio transmitter attachment method for piping plover research on migration through proposed wind power sites. Report to USFWS and VA Dept. of Game and Inland Fisheries. Virginia Tech, Blacksburg, VA. 8 pp.
- Coutu, S.D., J.D. Fraser, J.L. McConnaughy, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Hatteras National Seashore. Unpublished report to the National Park Service.

Refuge Manager, Chincoteague National Wildlife Refuge 52

- Cowardin, L., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington D.C. 103 pp.
- Cox, J.H., H.F. Percival, and S.V. Colwell. 1994. Impact of vehicular traffic on beach habitat and wildlife at Cape Sans Blas, Florida. Cooperative Fish and Wildlife Unit Technical Report No. 50. 44 pp.
- Cross, R.R. 1990. Monitoring management and research of the piping plover at Chincoteague National Wildlife Refuge. Unpublished report. Virginia Department of Game and Inland Fisheries, Richmond, Virginia. 68 pp.
- Cross, R.R. 1996. Breeding ecology, success, and population management of the piping plover at Chincoteague National Wildlife Refuge, Virginia. M.S. Thesis. College of William and Mary, Virginia.
- Cross, R.R. and K. Terwilliger. 1993. Piping plover flushing distances recorded in annual surveys in Virginia 1986-1991. Virginia Department of Game and Inland Fisheries, Richmond, Virginia. 5 pp.
- Daisey, A.A. 2006. Seabird Colony Effects on Piping Plover (*Charadrius melodus*) Fledging Success and Brood Movement at Chincoteague National Wildlife Refuge, Virginia. Master's thesis. University of Maryland Eastern Shore. 118 pp.
- Dolan, R., P.J. Godfrey, And W.E. Odum. 1973. Man's impact on the barrier islands of North Carolina. *American Scientist*. 61:152-162.
- Eddings, K.J., C.R. Griffin, and S.M. Melvin. 1990. Productivity, activity patterns, limiting factors, and management of piping plovers at Sandy Hook, Gateway National Recreation Area, New Jersey. Unpublished report. Department of Forestry and Wildlife Management, University of Massachusetts, Amherst, Massachusetts. 79 pp.
- Ehrhart, L.M., D.A. Bagley, and W.E. Redfoot. 2003. Loggerhead turtles in the Atlantic Ocean: geographic distribution, abundance, and population status. Pp. 157-174 in Bolten, A.B. and B.E. Witherington (eds). *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.
- Elias-Gerken, S.P. 1994. Piping plover habitat suitability on Central Long Island, New York Barrier Islands. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 247 pp.

Refuge Manager, Chincoteague National Wildlife Refuge 53

- Eudaly, E. 2008. Personal communication. U.S. Fish and Wildlife Service, Charleston, South Carolina.
- Flemming, S.P., R.D. Chiasson, P.C. Smith, P.J. Austin-Smith, and R.P. Bancroft. 1988. Piping plover status in Nova Scotia related to its reproductive and behavioral responses to human disturbance. *Journal of Field Ornithology* 59(4):321-330.
- Gibbs, J.P. 1986. Feeding ecology of nesting piping plovers in Maine. Unpublished report to Maine Chapter, The Nature Conservancy, Topsham, Maine. 21 pp.
- Goldin, M.R. 1990. Reproductive ecology and management of piping plover (*Charadrius melodus*) at Breezy Point, Gateway National Recreation Area, New York - 1990. Unpublished report. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area, Long Island, New York. 16 pp.
- Goldin, M.R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at Breezy Point, Gateway National Recreation Area, New York. Master of Science Thesis. University of Massachusetts Department of Forestry and Wildlife Management, Amherst, Massachusetts. 128 pp.
- Goldin, M.R. 1994. Breeding history, and recommended monitoring and management practices for piping plovers (*Charadrius melodus*) at Goosewing Beach, Little Compton, Rhode Island (with discussion of Briggs Beach). Report for the U.S. Department of the Interior, Fish and Wildlife Service, Hadley, Massachusetts. 36 pp.
- Griffin, C.R. and S.M. Melvin. 1984. Research plan on management, habitat selection, and population dynamics of piping plovers on outer Cape Cod, Massachusetts. University of Massachusetts. Research proposal submitted to the U.S. Department of the Interior, Fish and Wildlife Service, Newton Corner, Massachusetts. 5 pp.
- Haig, S.M. 1992. Piping plover. *In*: A. Poole, P. Stettenheim, and F. Gill (editors), *The Birds of North America*, No. 2. The Academy of Natural Sciences, Philadelphia, Pennsylvania; The American Ornithologists' Union, Washington, D.C.
- Haig, S.M., and L.W. Oring. 1985. The distribution and status of the piping plover throughout the annual cycle. *Journal of Field Ornithology* 56:334-345.
- Haig, S.M. and L.W. Oring. 1988. Mate, site, and territory fidelity in piping plovers. *The Auk* 105:268-277.

Refuge Manager, Chincoteague National Wildlife Refuge

54

Hake, M. 1993. 1993 summary of piping plover management at Gateway NRA Breezy Point District. Unpublished report. Gateway National Recreation Area, Long Island, New York. 29 pp.

Hamilton, R.D. II. 2000a. Cultured *Amaranthus* transplanted to the wild; *Amaranthus* seeds sown in 1999; SC Seabeach Amaranth Populations. Unpublished data. Waddell Mariculture Center. Bluffton, South Carolina. 3 pp.

Hamilton, R.D. II. 2000b. DNR Restoration Program for *Amaranthus pumilus*. Unpublished report. Waddell Mariculture Center. Bluffton, South Carolina. 3 pp.

Hamilton, R.D. II. 2000c. Techniques for the propagation of *Amaranthus pumilus*. Unpublished report. Waddell Mariculture Center. Bluffton, South Carolina. 4 pp.

Hancock, T.E. 1995. Ecology of the threatened species seabeach amaranth (*Amaranthus pumilus* Rafinesque). M.S. Thesis. University of North Carolina at Wilmington. Wilmington, North Carolina. 28 pp.

Hanson, J., Wibbels, T. and Martin, E. M. 1998. Predicted female bias in sex ratios of hatchling loggerhead sea turtles from a Florida nesting beach. *Canadian Journal of Zoology* 76: 1850-1861.

Hawkes, L.A., Broderick A.C., Godfrey, M.H., and Godley, B.J. In review. Investigating the potential impacts of climate change on marine turtles.

Hecht, A. 2004. Email sent to David Rabon. Use of ocean intertidal zone by piping plover chicks for foraging. U.S. Fish and Wildlife Service, Sudbury, Massachusetts.

Hecht, Anne. 2007. Personal communication. U.S. Fish and Wildlife Service, Hadley, MA.

Hecht, Anne. 2008. Personal communication. U.S. Fish and Wildlife Service, Hadley, MA.

Hoopes, E.M. 1994. Breeding ecology of piping plovers nesting at Cape Cod National Seashore - 1994. U.S. Department of the Interior, National Park Service, Cape Cod National Seashore, South Wellfleet, Massachusetts. 34 pp.

Hoopes, E.M. 1993. Relationship between human recreation and piping plover foraging ecology, and chick survival. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 106 pp.

Refuge Manager, Chincoteague National Wildlife Refuge

55

- Hoopes, E.M., C.R. Griffin, and S.M. Melvin. 1992. Relationships between human recreation and piping plover foraging ecology and chick survival. Unpublished report. University of Massachusetts, Amherst, Massachusetts. 77 pp.
- Hosier, P.E., Kochhar, M., and V. Thayer. 1981. Off-road vehicle and pedestrian track effects on the sea-approach of hatchling loggerhead turtles. *Environmental Conservation* 8:158-161.
- Howard, J.M., R.J. Safran, and S.M. Melvin. 1993. Biology and conservation of piping plovers at Breezy Point, New York. Unpublished report. Department of Forestry and Wildlife Management, University of Massachusetts, Amherst, Massachusetts. 34 pp.
- James, M.C., C.A. Ottensmeyer and R.A. Myers. 2005. Identification of high-use habitat and threats to leatherback sea turtles in northern waters: new directions for conservation. *Ecology Letters* 2005(8):195-201.
- Jenkins, C.D., S.B. Canale, and T.M. Shutz. 1999. Vertebrate wildlife conservation, piping plover population survey. Federal Aid Report, Project No. IV-B. New Jersey Division of Fish and Wildlife, Trenton, New Jersey. 24 pp.
- Jenkins, C.D. and A. Nichols. 1994. Piping plover survey and threat assessment, piping plover threat assessment and management. Federal Aid Report, Projects No. XIV and XIV-B. New Jersey Division of Fish and Wildlife, Trenton, New Jersey. 17 pp.
- Johnsgard, P.A. 1981. The plovers, sandpipers, and snipes of the world. University of Nebraska Press, Lincoln, Nebraska. 423 pp.
- Jolls, C.L, A. Cooley, and J.D. Sellars. 2001. Germination ecology of seabeach amaranth, *Amaranthus pumilus*, in controlled environments. *Bulletin of the Association of Southeastern Biologists* 48(2).
- Jolls, C.L. and J.D. Sellars. 2000. Germination ecology and restoration of seabeach amaranth (*Amaranthus pumilus* Raf., Amaranthaceae). Final report contract number C00432, Department of Agriculture and Consumer Services, Plant Conservation Program, State of North Carolina. Department of Biology, East Carolina University, Greenville, North Carolina. 29 pp. + appendices.
- Loefering, J.P. 1992. Piping plover breeding biology, foraging ecology, and behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 247 pp.
- Loefering, J.P. and J.D. Fraser. 1995. Factors affecting piping plover chick survival in different brood-rearing habitats. *Journal of Wildlife Management* 59:646-655.

Refuge Manager, Chincoteague National Wildlife Refuge

56

- Lohmann, K.J. and C.M.F. Lohmann. 2003. Orientation mechanisms of hatchling loggerheads. Pp. 44-62 in Bolten, A.B. and B.E. Witherington (eds). *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.
- MacIvor, L.H. 1990. Population dynamics, breeding ecology, and management of piping plovers on Outer Cape Cod, Massachusetts. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 100 pp.
- Mangels, C. 1991. Seabeach amaranth in New York State. *New York Flora Association Newsletter* 2(2):7-8.
- MacIvor, L.H. 1990. Population dynamics, breeding ecology, and management of piping plovers on outer Cape Cod, Massachusetts. M.S. Thesis. University of Massachusetts, Amherst, MA. 100 pp.
- MacPherson, Sandy. 2008. Personal communication. U.S. Fish and Wildlife Service, Jacksonville, FL.
- McAvoy, W.A. 2000. *Amaranthus pumilus* Raf. (seabeach amaranth, Amaranthaceae) Rediscovered in Sussex County, Delaware. *Bartonia*. In press.
- McConnaughey, J.L., J.D. Fraser, S.D. Coutu, and J.P. Loegering. 1990. Piping plover distribution and reproductive success on Cape Lookout National Seashore. Unpublished report to the National Park Service. 83 pp.
- Melvin, S.M. and J.P. Gibbs. 1994. Viability analysis for the Atlantic Coast population of piping plovers. Unpublished report to the U.S. Department of Interior, Fish and Wildlife Service, Sudbury, Massachusetts. 16 pp.
- Melvin, S.M., A. Hecht, and C.R. Griffin. 1994. Piping plover mortalities caused by off-road vehicles on Atlantic coast beaches. *Wildlife Society Bulletin* 22:409-414.
- Melvin, S.M., L.H. MacIvor, and C.R. Griffin. 1992. Predator exclosures: a technique to reduce predation of piping plover nests. *Wildlife Society Bulletin* 20:143-148.
- Miller, J.D., C.J. Limpus, and M.H. Godfrey. 2003. Nest site selection, oviposition, eggs, development, hatching, and emergence of loggerhead turtles. Pp. 125-143 in Bolten, A.B. and B.E. Witherington (eds). *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.

Refuge Manager, Chincoteague National Wildlife Refuge 57

Mrosovsky, N., S.R. Hopkins-Murphy, and J.I. Richardson. 1984. Sex ratio of sea turtles: seasonal changes. *Science* 225: 739-741.

National Marine Fisheries Service. 2008. NOAA Fisheries, Office of Protected Resources Website ([www.nmfs.noaa.gov](http://www.nmfs.noaa.gov)).

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991a. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C. 64 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991b. Recovery Plan for U.S. Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C. 52 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1992. Recovery plan for leatherback turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2007a. Loggerhead sea turtle (*Caretta caretta*) 5-year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Jacksonville, FL. 67 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2007b. Green sea turtle (*Chelonia mydas*) 5-year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Jacksonville, FL. 102 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2007c. Leatherback sea turtle (*Dermochelys coriacea*) 5-year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland and U.S. Fish and Wildlife Service, Jacksonville, FL. 79 pp.

National Park Service. 2001a. Seabeach amaranth surveys 1996-2000, Cape Hatteras National Seashore. U.S. Department of the Interior, National Park Service, Cape Hatteras National Seashore, Manteo, North Carolina. Unpublished data. 7 pp.

National Park Service. 2001b. Seabeach amaranth counts 1993-2000, Cape Lookout National Seashore. U.S. Department of the Interior, National Park Service, Cape Lookout National Seashore, Harkers Island, North Carolina. Unpublished data. 1 pp.

Refuge Manager, Chincoteague National Wildlife Refuge

58

National Park Service. 2003. Abundance and distribution of non-nesting piping plovers (*Charadrius melodus*) at Cape Lookout National Seashore, North Carolina, 2000-2003. Unpublished report. Cape Lookout National Seashore, Harkers Island, NC.

National Park Service. 2007. Piping plover (*Charadrius melodus*) monitoring at Cape Lookout National Seashore. 2007 summary report. Harkers Island, NC.

National Park Service and Maryland Natural Heritage Program. 2000. Seabeach amaranth restoration, Assateague Island National Seashore, study plan for project funded by threatened and endangered species approved recovery plan component of National Park Service Natural Resources Preservation Program FY00-02. U.S. Department of the Interior, National Park Service, Assateague Island National Seashore, Berlin, Maryland. 15 pp.

National Research Council, Committee on Sea Turtle Conservation. 1990. Decline of sea turtles: causes and prevention. National Academy Press. Washington, D.C. 259 pp.

Nelson, D.A. and D.D. Dickerson. 1987. Correlation of loggerhead turtle nest digging times with beach sand consistency. Abstract of the 7th Annual Workshop on Sea Turtle Conservation and Biology.

Nelson, D.A. and D.D. Dickerson. 1988. Effects of beach nourishment on sea turtles. *In* Tait, L.S. (ed.). Proceedings of the Beach Preservation Technology Conference '88. Florida Shore & Beach Preservation Association, Inc., Tallahassee, Florida.

Nelson, D.A., K. Mauck, and J. Fletemeyer. 1987. Physical effects of beach nourishment on sea turtle nesting, Delray Beach, Florida. Technical Report EL-87-15. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Nicholls, J.L. 1989. Distribution and other ecological aspects of piping plovers (*Charadrius melodus*) wintering along the Atlantic and Gulf Coasts. M.S. Thesis. Auburn University, Auburn, Alabama. 150 pp.

Noel, B.L., C.R. Chandler, and B. Winn. 2005. Report on migrating and wintering piping plover activity on Little St. Simons Island, Georgia in 2003-2004 and 2004-2005. Report to U.S. Fish and Wildlife Service.

Palmer, R.S. 1967. Piping plover. Pages 168-169 *in* Stout, G.D. (ed.). The shorebirds of North America. Viking Press, New York.

Refuge Manager, Chincoteague National Wildlife Refuge

59

- Patterson, M.E. 1988. Piping plover breeding biology and reproductive success on Assateague Island. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 131 pp.
- Patterson, M.E., J.D. Fraser, and J.W. Roggenbuck. 1991. Factors affecting piping plover productivity on Assateague Island. *Journal of Wildlife Management* 55(3):525-531.
- Pauley, E.F., M.B. Dietsch, and R.E. Chicone, Jr. 1999. Survival, growth, and vegetation associations of the threatened *Amaranthus pumilus* (seabeach amaranth) on a South Carolina barrier island. Association of Southeastern Biologists Annual Meeting, April 1999. Wilmington, North Carolina. 1 p.
- Ramsey, S., W.R. Tyndall, and C. Lea. 2000. The federally threatened *Amaranthus pumilus* Raf. (seabeach amaranth, Amaranthaceae) rediscovered on Assateague Island after 31 years. *Castanea* 65:165-167.
- Riepe, D. 1989. Environmental assessment, management plan for the threatened piping plover (*Charadrius melodus*), Breezy Point District, Gateway National Recreation Area. U.S. Department of the Interior, National Park Service, Brooklyn, New York. 26 pp. + appendices.
- Rimmer, D.W. and R.D. Deblinger. 1990. Use of predator exclosures to protect piping plover nests. *Journal of Field Ornithology* 61:217-223.
- Schroeder, B.A., A.M. Foley, and D.A. Bagley. 2003. Nesting patterns, reproductive migrations, and adult foraging areas of loggerhead turtles. Pp. 114-124 in Bolten, A.B. and B.E. Witherington (eds). *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.
- Snover, M.L. 2002. Growth and ontogeny of sea turtles using skeletochronology: methods, validation, and application to conservation. Ph.D. Dissertation, Duke University, Durham, NC. 144 pp.
- Snyder, D. 1996. Field survey for populations of *Amaranthus pumilus* in New Jersey. State of New Jersey, Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program. Trenton, New Jersey. 18 pp.
- Steinitz, M.J., M. Salmon, and J. Wyneken. 1998. Beach renourishment and loggerhead turtle reproduction: a seven year study at Jupiter Island, Florida. *Journal of Coastal Research* 14: 1000-1013.

- Refuge Manager, Chincoteague National Wildlife Refuge 60
- Strand, A.E. 2002. Characterization of geographic genetic structure in *Amaranthus pumilus*. Department of Biology, College of Charleston. Charleston, South Carolina. 25 pp.
- Strand, A.E. and R. Hamilton. 2000. Outline of current and potential *Amaranthus pumilus* restoration ecology research projects. Waddell Mariculture Center, South Carolina Department of Natural Resources. Bluffton, South Carolina. 8 pp.
- Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in populations of piping plovers subjected to human disturbance (1982-1989). Ph.D. Dissertation. Tufts University, Medford, Massachusetts. 143 pp.
- Stucker, J.H., and F.J. Cuthbert. 2006. Distribution of non-breeding Great Lakes piping plovers along Atlantic and Gulf of Mexico coastlines: 10 years of band resightings. Report to U.S. Fish and Wildlife Service.
- Tate, J. 1981. The blue list for 1981. *American Birds* 35:3-10.
- Tull, C.E. 1984. A study of nesting piping plovers of Kouchibouguac National Park 1983. Unpublished report. Parks Canada, Kouchibouguac National Park, Kouchibouguac, New Brunswick. 85 pp.
- Turtle Expert Working Group. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444. 115 pp.
- U.S. Army Corps of Engineers. 2001. *Amaranthus* data 1996-2000. Wilmington District, Wilmington, North Carolina. Unpublished data. 7 pp.
- U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; determination of seabeach amaranth (*Amaranthus pumilus*) to be a threatened species. 58 FR 18035-18042.
- U.S. Fish and Wildlife Service. 1996a. Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan. U.S. Department of the Interior, Fish and Wildlife Service, Hadley, Massachusetts. 245 pp.
- U.S. Fish and Wildlife Service. 1996b. Recovery Plan for seabeach amaranth (*Amaranthus pumilus*) Rafinesque. U.S. Department of the Interior, Fish and Wildlife Service, Atlanta, Georgia. 55 pages + appendices.

Refuge Manager, Chincoteague National Wildlife Refuge 61

- U.S. Fish and Wildlife Service. 1998. 1997 status update: U.S. Atlantic Coast piping plover population. U.S. Department of the Interior, Fish and Wildlife Service, Sudbury, Massachusetts. 8 pp.
- U.S. Fish and Wildlife Service. 2002a. 2000-2001 status update: U.S. Atlantic Coast piping plover population. U.S. Department of the Interior, Fish and Wildlife Service, Sudbury, Massachusetts. 9 pp.
- U.S. Fish and Wildlife Service. 2002b. Seabeach amaranth (*Amaranthus pumilus*) life history, status, and threats. U.S. Department of the Interior, Fish and Wildlife Service, Pleasantville, New Jersey. 28 pp.
- U.S. Fish and Wildlife Service. 2004. 2002-2003 status update: U.S. Atlantic Coast piping plover population. U.S. Department of the Interior, Fish and Wildlife Service, Sudbury, Massachusetts. 8 pp.
- U.S. Fish and Wildlife Service. 2006. 2006 Atlantic coast piping plover abundance and productivity estimates. Accessed August 30, 2008 at <http://www.fws.gov/northeast/pipingplover/pdf/final06.pdf>
- U.S. Fish and Wildlife Service. 2007. Chincoteague National Wildlife Refuge 2007 Piping Plover and Beach Nesting Bird Report. U.S. Department of the Interior, Fish and Wildlife Service, Chincoteague, Virginia. 31 pp.
- U.S. Fish and Wildlife Service. 2008. Preliminary 2007 Atlantic Coast Piping Plover Abundance and Productivity Estimates. U.S. Department of the Interior, Fish and Wildlife Service, Sudbury, Massachusetts. 2 pp.
- U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered species consultation handbook, provisions for conducting consultation and conference activities under section 7 of the Endangered Species Act. U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, National Marine Fisheries Service, Washington, D.C. 154 pp + appendices.
- Van Schoik, R. and S. Antenen. 1993. *Amaranthus pumilus* - Long Island, New York. Final report submitted by the Long Island Chapter of The Nature Conservancy to the New York State Department of Environmental Conservation. 13 pp.
- Virginia Department of Conservation and Recreation and Virginia Native Plant Society. Undated. Invasive alien plant species of Virginia: Asiatic Sand Sedge (*Carex kobomugi*) Ohwi. Fact Sheet. Richmond, Virginia. 1 p.

Refuge Manager, Chincoteague National Wildlife Refuge 62

Watts, B.D., D.S. Bradshaw, and R.R. Cross. 1996. Annual plover survey of the Virginia barrier islands: a ten year summary. *Raven* 67:84-89.

Weakley, A., and M. Bucher. 1992. Status survey of seabeach amaranth (*Amaranthus pumilus* Rafinesque) in North and South Carolina, second edition (after Hurricane Hugo). Report to North Carolina Plant Conservation Program, North Carolina Department of Agriculture, Raleigh, North Carolina, and Asheville Field Office, U.S. Department of the Interior, Fish and Wildlife Service, Asheville, North Carolina. 149 pp. + appendices.

Welty, J.C. 1982. The life of birds. Sauders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Wilcox, L. 1939. Notes on the life history of the piping plover. *Birds of Long Island* 1:3-13

Wilcox, L. 1959. A twenty year banding study of the piping plover. *Auk* 76:129-152.

Witherington, B.E. and R.E. Martin. 1996. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. FMRI Technical Report TR-2. Florida Marine Research Institute. 73 pp.

Wolcott, D.L., and T.G. Wolcott. 1999. High mortality of piping plovers on beaches with abundant ghost crabs: correlation, not causation. *Wilson Bulletin* 111:321-329.

Young, S.M. 2001. Final Report, *Amaranthus pumilus*, seabeach amaranth, Global Positioning Satellite Survey - Long Island 2000. Unpublished report. New York Natural Heritage Program., Latham, New York. 4 pp. + appendices.

APPENDIX A – CONSULTATION HISTORY

- 12/15/06 Initial email contact between CNWR and VAFO about the need to initiate an *Intra-Service Section 7 Consultation* for management activities not covered under the 2001 Biological Opinion.
- 01/23/07 VAFO staff conduct a site visit to CNWR to discuss management activities and public use issues.
- 02/23/07 Email from Sandy MacPherson (Service sea turtle coordinator) to VAFO regarding concerns about sea turtle nest relocation as a conservation tool.
- 02/28/07 Email from CNWR to VAFO providing a table showing monthly management activities for Assateague Island, and the Southern Island Unit (Assawoman, Metompkin, and Cedar Islands).
- 02/26/07 Email from CNWR to VAFO providing 2006 seabeach amaranth survey data.
- 04/03/07 Email from CNWR to VAFO providing the portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of nesting sea turtles on the refuge.
- 04/03/07 Email from CNWR to VAFO providing the portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of piping plover on the refuge.
- 04/19/07 Email from CNWR to VAFO providing the final portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of seabeach amaranth on the refuge.
- 04/23/07 Email from CNWR to VAFO providing an updated version of the *Intra-Service Section 7 Biological Evaluation Form* for sea turtles and piping plovers.
- 04/23/07 VAFO sent email notice to CNWR of the receipt of final *Intra-Service Section 7 Biological Evaluation Form* and the initiation of formal consultation.
- 05/17/07 Email from Service piping plover coordinator, Anne Hecht, to VAFO and CNWR concerning the possible issue of piping plovers nesting on the public beach parking lots.
- 05/30/07 Email from CNWR to VAFO providing modifications to the *Intra-Service Section 7 Biological Evaluation Form* on management of piping plovers.
- 06/19/07 Email from Service piping plover coordinator, Anne Hecht, to VAFO and CNWR providing more data concerning the possible issue of piping plovers nesting on the public beach parking lots.

- 06/20/07 Email from CNWR acting refuge manager, Susan Rice, to VAFO providing input to the possible use of beach parking lots by nesting piping plovers.
- 06/20/07 - 09/20/07 Period of discussion between VAFO and CNWR regarding plover issues, and how to handle sea turtle nesting at the refuge. CNWR agrees to develop a supplement to the *Intra-Service Section 7 Biological Evaluation Form* showing how it will manage turtle nesting and ORV use at the refuge.
- 09/21/07 VAFO via email, requested Service sea turtle coordinator, Sandy MacPherson, provide input on how to determine acceptable take levels for CNWR.
- 10/18/07 VAFO sent copy of the draft Terms and Conditions section of the biological opinion to CNWR for comments.
- 10/18/07 VAFO sent draft copy of biological opinion to Anne Hecht for review and comments.
- 10/07 - 2/08 Period of discussion between VAFO and CNWR on plover take and turtle management actions.
- 02/12/08 Meeting at CNWR between refuge staff (Lou Hinds, Kim Halpin, Sue Rice, Amanda Daisey, Eva Savage), VAFO staff (Karen Mayne, Mike Drummond), and the Service piping plover coordinator (Anne Hecht) to discuss issues of refuge operations and possible impacts to listed species. The outcome of this meeting was the agreement that this consultation would be comprehensive for all activities that impact piping plovers, seabeach amaranth and sea turtles on all units of the refuge. It was agreed that the previous 2001 biological opinion had not addressed the issue of possible nesting by plovers on the public beach parking lots. This opinion will be comprehensive, it will include all activities covered in the 2001 biological opinion, and also the parking lot issue.
- 02/13/08 - 04/24/08 Period of discussion between VAFO, CNWR, and species experts regarding the updated *Intra-Service Section 7 Biological Evaluation Forms* submitted by the refuge. The main focus of these discussions was the protection of sea turtle nests from ORV use at the refuge.
- 04/03/08 Email from CNWR to VAFO providing the final portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of piping plovers on the refuge.
- 05/23/08 Email from CNWR staff to VAFO providing the final portion of the *Intra-Service Section 7 Biological Evaluation Form* for management of sea turtles on the refuge.

08/07/08 E-mail from CNWR to VAFO providing a revised Intra-Service Biological Assessment on sea turtles to correct the wording of the proposed action.

Enclosure 1

MDrummond: 6/27/2008

Filename: P:\Endangered Species\Opinions\multiplespecies\CNWR IntraService BO 9-10-08.doc

## Appendix G

Moa Lin/USFWS



*View of refuge*

# **Some Notes on Sea Level Rise and Projected Impacts on Chincoteague National Wildlife Refuge**



## Some Notes on Sea Level Rise and Projected Impacts on Chincoteague National Wildlife Refuge

Author: Ralph Tiner, Regional Wetland Coordinator, Northeast Region

Date: August 12, 2009

### Introduction

Since the origin of the Earth, roughly 4.5 billion years ago, huge changes have occurred including the formation of continents, creation of the various oceans, and major climate shifts initiating numerous continental glaciations and causing fluctuations in sea levels. Given the recent changes in climate (e.g., melting of glaciers and polar ice, observed decreases in ice and snow, and rising air and ocean temperatures) and our interest in how this might affect the future of Chincoteague National Wildlife Refuge, the emphasis of this note is on the fluctuations of sea level in the Mid-Atlantic region and predictions of where sea level is going in the future. Chincoteague NWR has been listed as one of the 10 most endangered refuges threatened by global warming in a Defenders of Wildlife report (Schlyer 2006).

For the last million years, the Earth's climate has changed from a cold ice age to a warm interglacial period back to an ice age roughly every 100,000 years. These changes have had enormous impacts on plant and animal life, human societies, and on sea level with lowest levels during cold periods and highest levels during warm periods. So changing sea level is not a recent phenomenon. During the warmest interglacial period about 130,000 years ago, the Earth's temperature was 2-3° F warmer than today's temperatures and ocean levels were 13-20 feet higher than today (Pew Center on Global Climate Change 2007).

The most recent cycle started over 100,000 years ago, when a 39-42°F (4-10° C) drop in global temperatures over thousands of years caused a major change in climate. Winter snows did not melt completely in summer in northern latitudes and as the snowpack accumulated, the weight of the snow caused ice to form below the surface. Ice formed on slopes then began to move downslope forming a glacier. This eventually led to the buildup and advance of continental ice sheets into lower latitudes. About 25,000 years ago, the Laurentide ice sheet moved out of Canada and about 18,000 years ago extended as far south as northern New Jersey and northeastern Pennsylvania on the East Coast. At this time, nearly half of North America was covered by a continental glacier over one mile thick in places (Figure 1). At this time, a significant amount of the Earth's fresh water was locked in glacial ice. Consequently, much fresh water was not returned to the oceans, leading to a significant drop in sea level: it was roughly 400 feet (120m) below its current level (Figure 2). What is now the "continental shelf" was the "coastal plain" 25,000 years ago (yellow areas in Figures 1 and 3). The Mid-Atlantic coast was roughly 40-50 miles offshore of its presentday location (Figure 3). This area was exposed for about 10,000 thousand years and was occupied by tundra and boreal forest much like what is found in Canada today. Elk, moose, and grizzly bears were dominant mammals

(Davis 2006). The waters were cold like Arctic waters and supported species like walrus, sea lions, and bearded seals (Harington 2008).

Figure 1. General extent of glacial ice and exposed continental shelves more than 25,000 years ago. (Source: Short 2008)

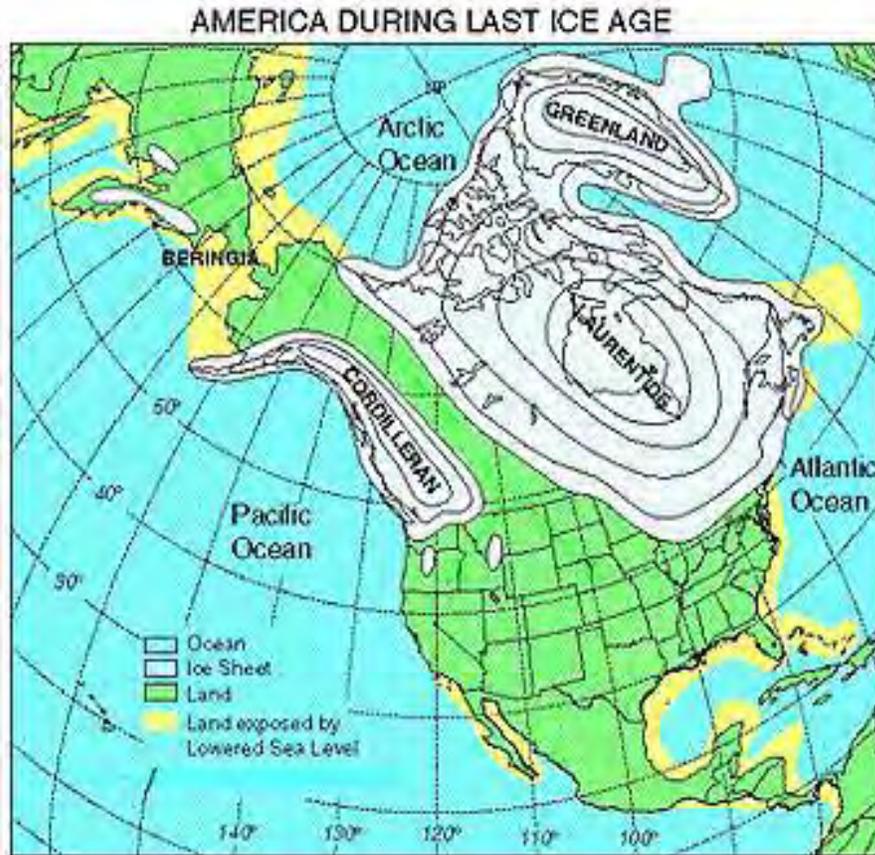


Figure 2. Changes in sea level over the past 18,000 years. (Source: Titus et al. 2009)

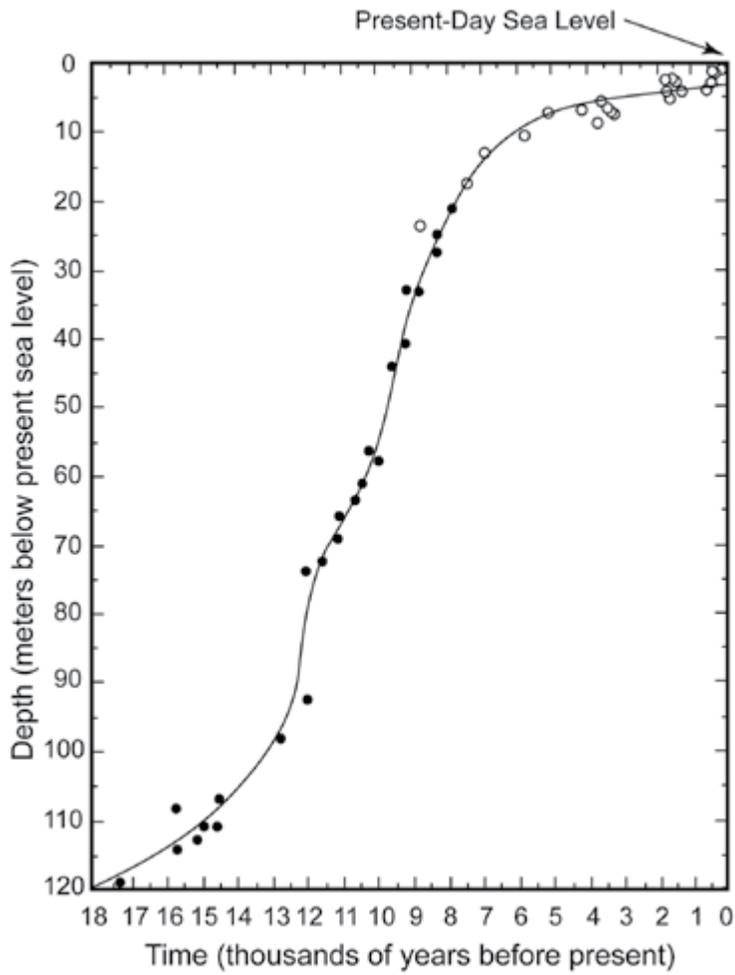
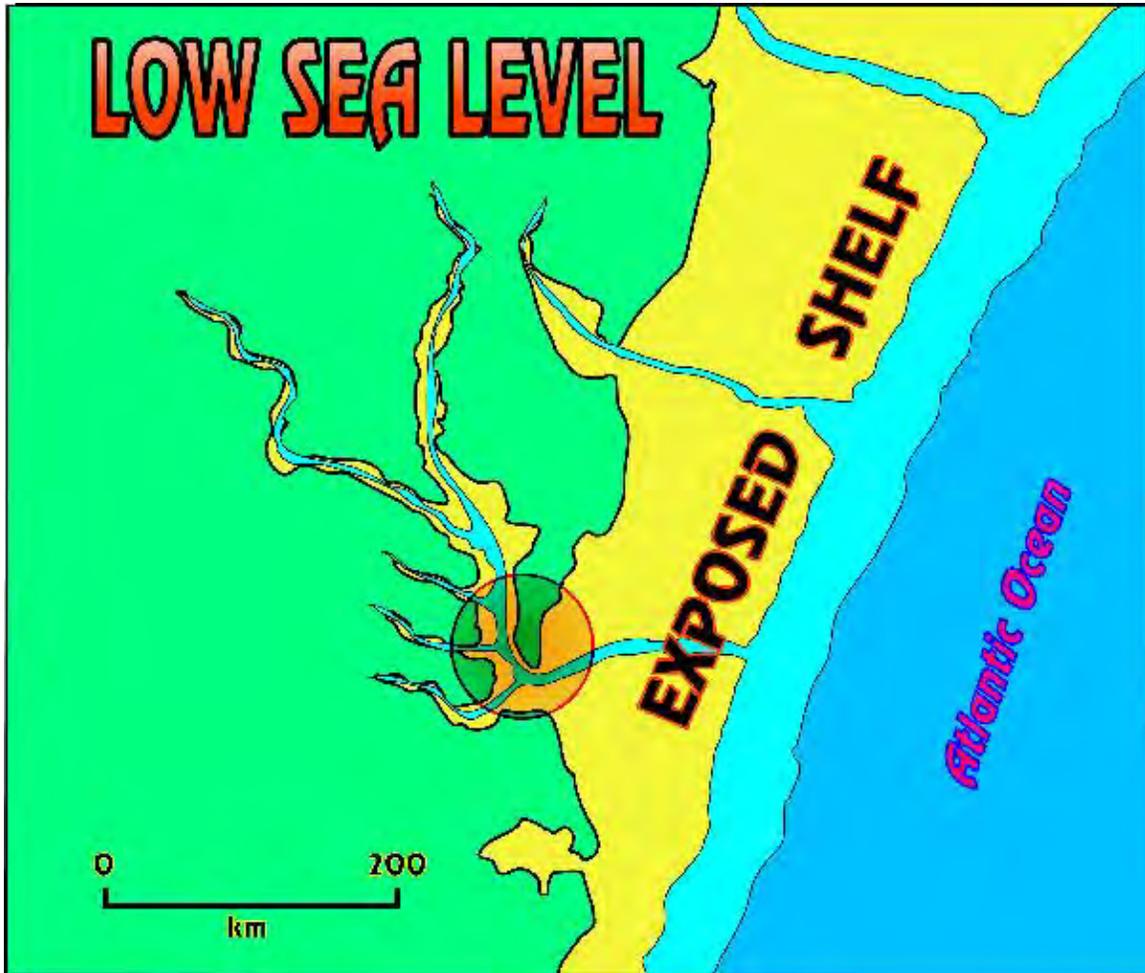


Figure 3. The western Atlantic shoreline showing continental shelf (yellow area), the “shore” more than 15,000 years ago when sea level was at its lowest recent level. (Source: U.S. Geological Survey, Coastal and Marine Geology, Woods Hole Field Center)



Climate began to change again about 15,000 years ago and the warmer temperatures caused the Laurentide glacier to begin melting. The meltwater ran off the land and into the ocean causing sea levels to rise. The rise was not a steady one, but was marked by a rapid increase from 15,000 to 8,000 years ago, at rates as high as 0.5m per decade (Hansen 2007)! Around 6,000 years ago, the rate of sea level slowed to 0.5mm/year due to a reduction in the rate of ice melting. This allowed shorelines to stabilize and the Mid-Atlantic shoreline may have looked much like it does today (minus the human-induced alterations, of course). These more stable conditions promoted the formation of barrier islands and spits that facilitated the establishment of coastal marshes in sheltered lagoons behind the protective barriers and along the low-lying shores of tidally influenced rivers. As sea level continued to rise at modest rates (less than 2mm/year), most tidal marshes were able to keep pace with the higher levels by raising their elevations through accumulation of organic matter and/or increased sedimentation, while others were able to move landward to suitable lowlands that would now be flooded frequently by tidal waters. This process continued for thousands of years and is still taking place where suitable lowlands are available for “marsh migration.” Dead trees or stumps in today’s marshes provide direct evidence of this migration (Figure 4). Human development of the coastal plain, however, has prevented this natural process in many places by the construction of bulkheads and similar structures that harden shorelines.

Figure 4. Dead trees in the marshes are a familiar site in some coastal wetlands.



## Recent Sea-level Rise Rates

As global temperature rise, two main factors cause sea level to rise: 1) warming ocean waters expand (thermal expansion) and 2) melting of polar ice and continental glaciers (adds more water to the oceans). Reduction of snow cover and melting of mountain glaciers also contribute to sea level rise. Land subsidence is an important local factor affecting “relative” sea level rise. In some cases, human activities such as extraction of oil, gas, and groundwater in coastal regions that accelerate subsidence exacerbate the adverse impact of sea-level rise on coastal lands.

From 3000 years ago to the late 1800s (the beginning of the “industrial revolution”), the rate of sea-level rise was very low: 0.1-0.2mm/year (Titus et al. 2009). During the last century, the average global rise in sea level was 1.7mm/year (Church and White 2006). From 1993-2003, the rate of sea-level rise rose an average of 3.1mm/year (IPCC 2007). It is not clear whether this increase is simply a decadal response or an indicator of a longer term trend. It is, however, very likely that the losses of polar ice sheets during this decade significantly contributed to the increase (Titus et al. 2009).

## Predicting the Future

At the outset, it is vital that due to the increased attention being given to sea level rise, readers recognize that information on this topic as well as climate change in general is expanding at a great pace. The discussion herein is based on information available in August 2009. We expect that in the future, additional information will be available to modify current predictions and expectations. In the 1990s, the United Nations Environment Programme and the World Meteorological Organization created the Intergovernmental Panel for Climate Change (IPCC), a multi-national scientific committee, to examine and interpret scientific information on climate change and its impacts on the environment and society.

The 2007 IPCC report on global climate change lowered predictions from their 1995 report. Now a 0.6-1.9 foot (7-23 inch or 18-59cm) increase in sea level is predicted over the next 100 years, whereas earlier, they were predicting a 0.3-2.9 foot rise by 2100. The new estimate excludes any increase in meltwater from the Greenland and Antarctica ice sheets. The IPCC admits that this is a very conservative estimate. Moreover, recent observations of accelerated ice flow and melting from Greenland and from western Antarctica glaciers could contribute substantially to increasing current sea levels (Titus et al. 2009). If the Greenland ice sheet disappeared, it would add 23 feet (7m) to sea level (IPCC 2007). (Note: During the last interglacial period, 125,000 years ago, reductions of polar ice led to a 13-20 foot (4-6m) rise in sea level.) It is interesting to note that the projected rise may not be a simple steady increase in sea levels, but instead may be rapid due to a quick collapse of large portions of the polar ice sheets (Pew Center on Global Climate Change 2007). A 2007 study that accounted for continued increases in greenhouse gas emissions predicted that sea level could rise 1.6-4.5 feet (0.5-1.4m) by the end of the 21<sup>st</sup> century (Rahmstorf 2007). This work and the view of other

climatologists suggest that global sea level could rise by 3.3 feet or more (one meter or more) by 2100 and that it may rise meters more over the next several centuries.

### Mid-Atlantic Impacts

In the Mid-Atlantic region (New Jersey through Virginia), sea level is rising due to global changes and to land subsidence. During the past century, sea-level rise rates were higher than global rates, ranging from 2.4-4.4 mm/year which translated to about a one-foot rise (0.3m) by 2000. These rates are the highest rates of sea-level rise in the United States, excluding Louisiana and Texas where human-induced coastal subsidence is significant contributing factor (Titus et al. 2009).

Rising seas are already changing the coast, submerging the lowest tidal wetlands, eroding coastal beaches, increasing flooding of lowlands, and altering salinity regimes in coastal waters. Low salt marshes are being converted to tidal flats, while existing tidal flats are becoming permanently inundated shallow water habitats. In places of more pronounced erosion, marshes are changing directly to shallow waters. With increased tidal flooding, high marshes are changing to low marshes, and low-lying uplands or neighboring freshwater wetlands are becoming high marshes. Also, salt water is penetrating further upstream changing the local ecology. While this process has occurred in the past, the pace at which these changes are happening has accelerated and their magnitude has increased in recent times. These changes have important consequences to fish and wildlife dependent on estuaries. The rapidity of the changes will likely overwhelm the ability of many animals to adapt to the new conditions.

Climate change may also increase storm frequency and intensity which will further threaten shorelines and coastal resources. The shoreline of Assateague Island, already threatened by erosion from the current sea-level rise rate, is even more vulnerable with predicted increases of 2mm/year (Figure 5). If the rate increases by a little as 2mm/year, the island may begin migrating landward and may break up into smaller sections (segmentation). This same rate will likely pose increased risk to backbarrier marshes (Figure 6). The impacts of a 7mm/year rise would be devastating.

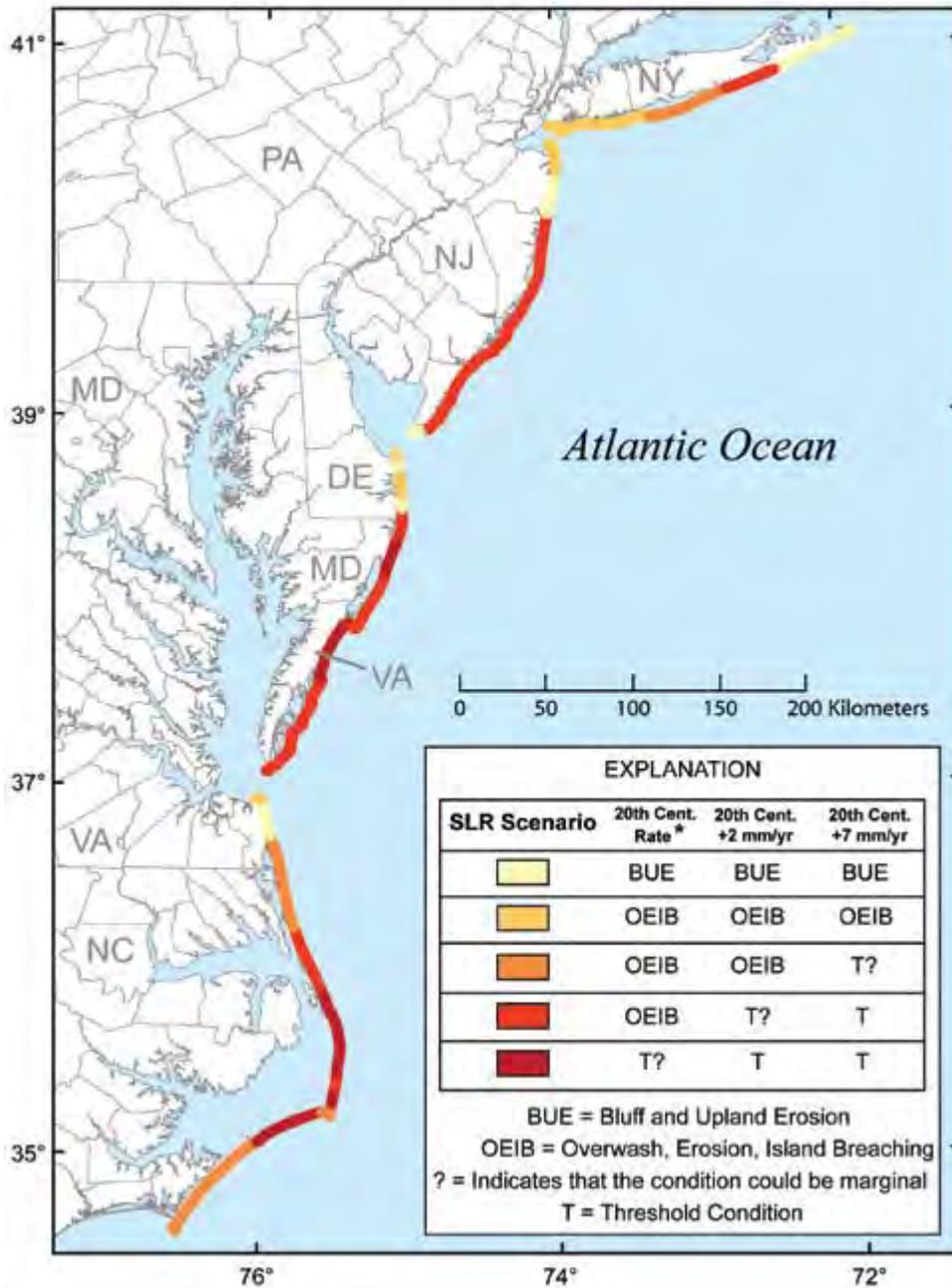


Figure 5. Map showing that Assateague Island may already be near its threshold condition and that just a 2mm/year rise in the rate of sea-level rise will push it over the threshold which may initiate barrier beach migration and segmentation. (Source: Titus et al. 2009)

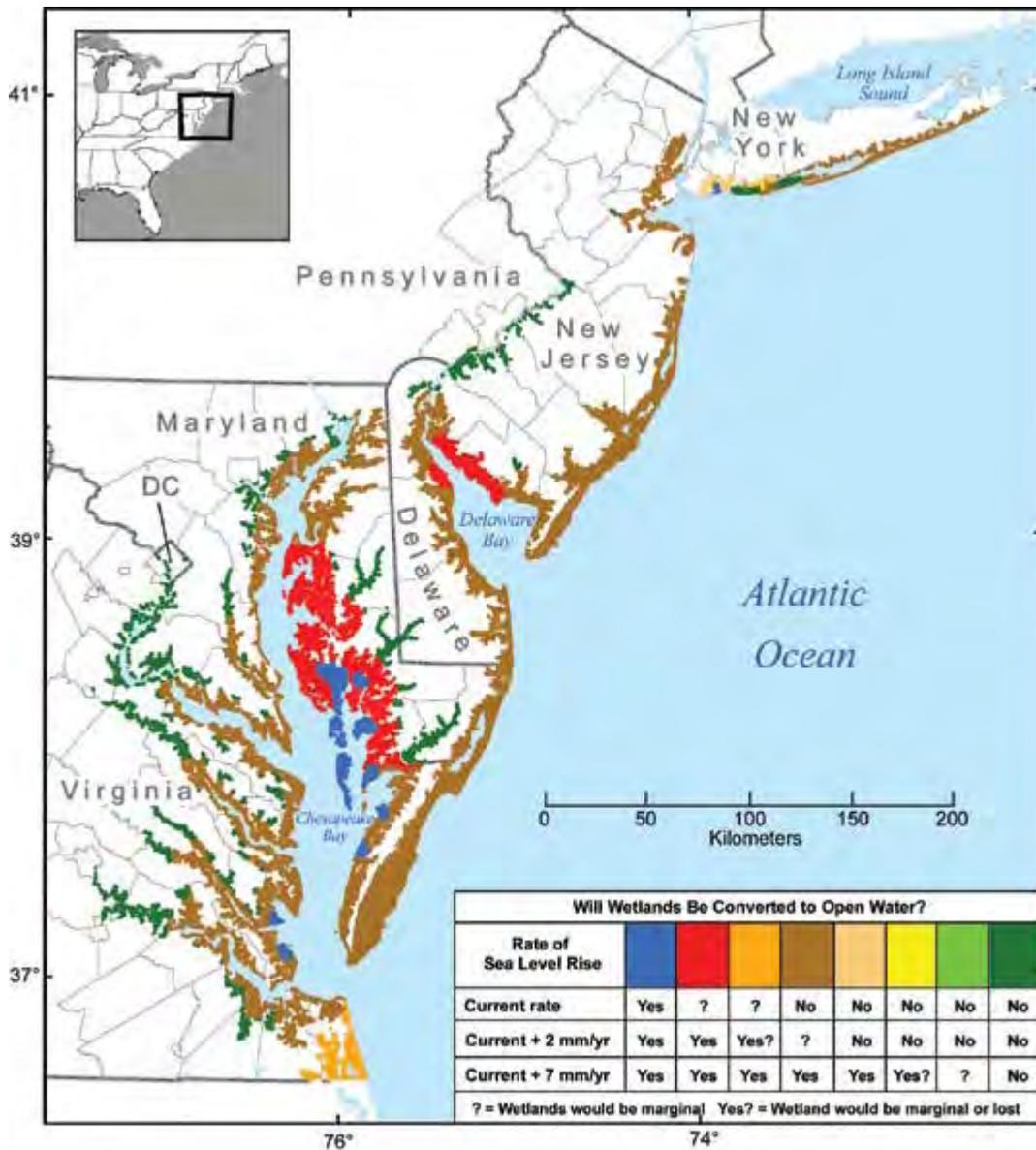


Figure 6. Map showing where tidal wetlands may be converted to open water at three rates of sea-level rise. A 2mm/year rise in the rate should continue the conversion of low marsh to tidal flat and may even transform these marshes to open water. (Source: Titus et al. 2009)

## References

Church, J.A. and N.J. White. 2006. A 20<sup>th</sup> century acceleration in global sea-level rise. *Geophysical Research Letters* 33:LO1602, doi 10.1029/2005GL024826.

Davis, D.E. 2006. *Southern United States – An Environmental History*. ABC-CLIO, Santa Barbara, CA.

Hansen, J. 2007. Huge sea level rises are coming – unless we act now. *NewScientist* 2614.

Harrington, C.R. 2008. The evolution of Arctic marine mammals. *Ecological Applications* 18(2) Supplement: S23-S40.

Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: The Physical Science Basis. Summary for Policymakers for Working Group I of the Intergovernmental Panel on Climate Change*.

[http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_wg1\\_report\\_the\\_physical\\_science\\_basis.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm)

Pew Center on Global Climate Change. 2007. *Sea level rise – the state of the science*. [http://www.pewclimate.org/docUploads/SLR\\_fact\\_sheet\\_020207.pdf](http://www.pewclimate.org/docUploads/SLR_fact_sheet_020207.pdf)

Rahmstorf, S. 2007. A semi-empirical approach to projecting future sea-level rise. *Science* 315:368-370.

Schyler, K. 2006. *Refuges at Risk. The Threat of Global Warming*. Defenders for Wildlife, Washington, DC.

[http://www.defendersofwildlife.org/resources/publications/programs\\_and\\_policy/habitat\\_conservation/federal\\_lands/refuges\\_at\\_risk\\_2006.pdf](http://www.defendersofwildlife.org/resources/publications/programs_and_policy/habitat_conservation/federal_lands/refuges_at_risk_2006.pdf)

Short, N.M. 2008. *Remote Sensing Tutorial*. National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, MD. [http://rst.gsfc.nasa.gov/Sect2/Sect2\\_1b.html](http://rst.gsfc.nasa.gov/Sect2/Sect2_1b.html)

Titus, J.G., K.E. Andersen, D.R. Cahoon, D.B. Gesch, S.K. Gill, B.T. Gutierrez, E.R. Thieler, and S.J. Williams. 2009. *Coastal Sensitivity to Sea-level Rise: A Focus on the Mid-Atlantic Region. Synthesis and Assessment Product 4.1. Report by the U.S. Climate Change Science Program and the Subcommittee for Global Change Research*. U.S. Environmental Protection Agency, Washington, DC.

<http://www.climatechange.gov/Library/sap/sap4-1/final-report/sap4-1-final-report-all.pdf>

## Appendix H

Mao Lin/USFWS



*View of Refuge*

# **Adapting Now to a Changing Climate: Wallops Flight Facility and the Eastern Shore**





climate risks

# Adapting Now to a Changing Climate

Wallops Flight Facility and the Eastern Shore



# the issue

Climate data collected over the past 60 years in the Wallops Flight Facility Area show a long-term pattern of sea level and temperature rise. Data from Salisbury, Maryland indicate that the average annual temperature has risen approximately 1.2 degrees over the past century. Data from Kiptopeke, Virginia show that sea level has risen about 7 inches during the past sixty years.

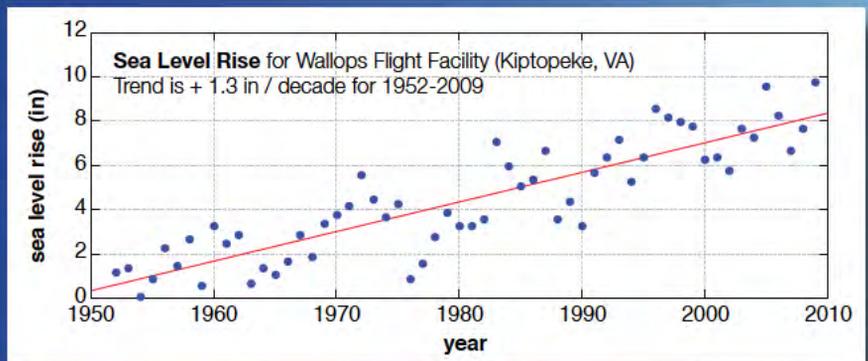
Climate models project continued sea level rise and warmer temperatures in the region. Along with sea level rise, storm surges from hurricanes and nor'easters may increasingly make natural and built systems vulnerable to disruption or damage. Government agencies and other organizations, including utilities, planning commissions, conservation groups, and research institutions are currently assessing the potential of climate hazards to affect the region and their operations.

This handout can help area leaders (NASA together with its tenants, neighbors, and area partners) understand what they may expect in the future, and plan accordingly.

## What's already happened *locally*?

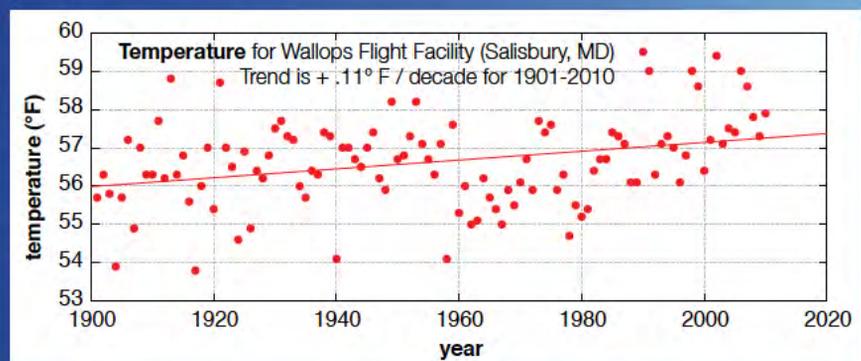
### Sea Level

has risen over decades, though individual years vary somewhat



### Temperature

has risen too, but values vary more year to year



*Local historical data tells us the climate is changing.*

# the setting

NASA Wallops Flight Facility (WFF) occupies nearly 6500 acres on the mainland of the Eastern Shore of Virginia and on Wallops Island, which is part of a long chain of barrier islands along the coastlines of Virginia and Maryland. The Virginia/Maryland border is about 6 miles north of WFF.



# what's at stake?

Wallops Flight Facility (WFF) is NASA's principal facility for suborbital and small orbital research missions. The professionals at Wallops enable relatively low-cost aerospace-based science and technology research critical to the nation. Over 16,000 rockets have launched from WFF since its establishment in 1945. WFF employs about 1,300 NASA civil servants, contractors, and partners, and contributes significantly to the local economy. WFF hosts internship and co-op programs, as well as education programs in local communities and schools.



WFF supports NASA and its partners from two sites. At its Main Base, a research airport, command centers, labs, rocket storage areas, and radars and telemetry facilities serve NASA, the Navy, and NOAA. Wallops Research Park, on adjacent non-federal property, will provide opportunities for public/private ventures with nearby NASA and Navy expertise. Seven miles to the south, Wallops Island is the location of six launch sites, supporting facilities, and a major Naval Surface Combat Systems Center, which serve NASA and academic, commercial space industry, and military partners. Wallops is irreplaceable for these missions; in addition to seclusion from incompatible land uses, it adjoins the Atlantic Warning Area, a secure airspace that enables sensitive launch activities with no commercial air traffic nearby. Constructed NASA and Navy assets at WFF are conservatively valued at over \$1B.

Beyond its importance to NASA and the military, Wallops Island is part of a largely undeveloped coastal ecosystem of 18 barrier islands. Several public and private entities steward the natural assets of these islands. The National Park Service's Assateague Island National Seashore is to the north; the U.S Fish and Wildlife Service's Chincoteague National Wildlife Refuge is on islands both immediately north and south of Wallops Island. The Nature Conservancy manages most of the barrier islands to the south. Undeveloped areas of Wallops Island consist largely of saltwater marsh, vegetated dunes, maritime forests, and beach habitat. Wallops Island supports two federally-protected species - the piping plover and loggerhead sea turtle. The other islands also support these species and all islands are important resting and feeding spots for many migratory bird species including the red knot, a candidate for listing under the Endangered Species Act. Other federally protected sea turtles and marine species can be found offshore.

# projected changes

## The Climate Science Context

Scientists have collected weather and climate data and indicators of longer-term climate patterns (such as ice cores and tree rings) from the entire globe. Based on analyses of these data, plus a growing understanding of physical processes that control climate, scientists have developed sophisticated models that project future climate changes. Many climate models project that climate change will accelerate this century. The US Global Climate Research Program's report summarizes these results at <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts>. NASA climate scientists are an important part of the international research effort. NASA is a key player in modeling climate variables and collecting both earth-based and space-based data used to develop and validate climate models and identify climate impacts.

## Eastern Shore Area Climate and Weather Today

The climate at WFF and its surrounding region is best described as humid subtropical. Average temperatures in the area range from about 36°F in January to about 76°F in July. Annual precipitation averages 40 inches and is relatively evenly distributed throughout the year. Local climate hazards that impact the center include nor'easters and hurricanes.

## Future Climate Projections

Based on local temperature and sea level records, scientists from NASA's Goddard Institute for Space Studies used local data to refine global climate model outputs, making the projections WFF-specific. This "downscaling" process can provide a more precise projection for a specific location (in this case the WFF area), than modeling for an entire region, such as the East Coast. Using these models,

## Climate Scenarios

The United Nations Intergovernmental Panel on Climate Change (IPCC) developed several greenhouse gas (GHG) emissions scenarios based on differing sets of assumptions about future economic growth, population growth, fossil fuel use, and other factors. The emissions scenarios range from "business-as-usual" (i.e., minimal change in the current emissions trends) to more progressive (i.e., international leaders implement aggressive emissions reductions policies). Each of these scenarios leads to a corresponding GHG concentration, which is then used in climate models to examine how the climate may react to varying levels of GHGs. Climate researchers use many global climate models to assess the potential changes in climate due to increased GHGs. In this case, 3 emissions scenarios were used in 16 different global climate models, to provide a range of possible outcomes and provide a sound basis for policy decisions and adaptation planning.

## Projected Changes in Climate Variables

|                                                                                     |                                            | 2020's         | 2050's         | 2080's         |
|-------------------------------------------------------------------------------------|--------------------------------------------|----------------|----------------|----------------|
|  | Average Annual Precipitation               | 0 to +10%      | 0 to +10%      | 0 to +15%      |
|  | Sea Level (inches)                         | +2 to +5       | +7 to +11      | +12 to +21     |
|  | Sea Level—Rapid Ice Melt Scenario (inches) | +5 to +9       | +19 to +28     | +42 to +56     |
|  | Average Annual Temperature (F°)            | +1.5° to +2.5° | +2.5° to +4.5° | +3.5° to +6.5° |

*Average sea levels and temperatures are projected to rise.*

*Temperature and precipitation projections reflect a 30-year average centered on the specified decade; sea levels are averages for the specific decade. Data for 1971-2000 from Wallops Flight Facility provide a baseline for Temperature (56.3°F) and for Annual Precipitation (40.0 inches). Sea level data are for Gloucester Point and Kiptopeke, VA and include the impacts of subsidence in the area. Temperatures are rounded to the nearest half degree, precipitation projections to the nearest 5%, and sea level rise to the nearest inch. Shown are the central range (middle 67% of values) across the GCMs and GHG emissions scenarios. Data are from the NOAA National Climatic Data Center.*

# projected changes

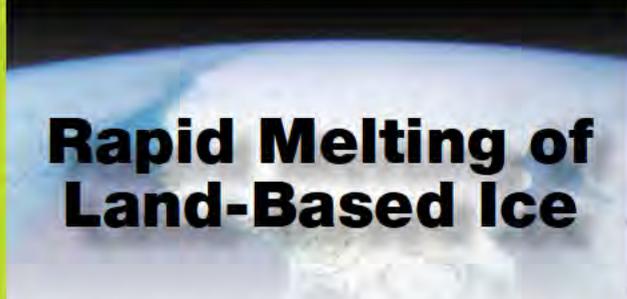
scientists project higher average annual temperatures and rising average sea levels for the Wallops area. While little change is expected in average annual precipitation, storms may be more intense, leading to increased risks of flooding.

## The Case for Adaptation

Because of its location on the Atlantic coast, sea level rise and storm surge may be the biggest threats to WFF. The area has always been subject to hurricanes and nor'easters, and the associated high winds and flooding. The combination of rising sea level and severe storms could produce catastrophic impacts on WFF and the surrounding high profile infrastructure assets, human capital, and natural resources. Projected changes in the frequency of some extreme events like hot and cold days (see tables below) may also lead to large impacts. Most people are more likely to notice the increased frequency of extreme events - more heat waves, more downpours, more flooding - than the gradual rise in average annual temperatures and sea levels. The Facility's future is intricately connected with broader social, economic, and environmental trends expected throughout the region; WFF and its partners in the region will collaborate to develop and implement adaptation strategies for a climate resilient Eastern Shore.

## A Note on Interpreting Climate Projections

Model projections indicate a progressive long-term warming trend for the Wallops area, but they cannot provide an exact temperature for a future date. For example, it cannot be stated that the average temperature at WFF will be 59.3°F in 2043; it is appropriate however to say that between 2040 and 2070, temperatures are projected to increase 2.5 to 4.5 degrees above the average baseline temperature.



## Rapid Melting of Land-Based Ice

Data collected over the past several years reveal that land-based ice, such as that on Greenland and the Western Antarctic Ice Sheet, is melting faster than most Global Climate Models project. Because this could change sea levels substantially, climate scientists developed an alternative projection that incorporates observed and longer-term historical land-based ice melt rates. This rapid ice melt scenario suggests that sea levels could rise three times as fast by the 2080s, resulting in up to 3 additional feet of sea level rise. (see Rapid Ice Melt data in the Climate Variables chart to the left.)

| Daily Temperatures         | Baseline | 2020s      | 2050s     | 2080s    |
|----------------------------|----------|------------|-----------|----------|
| Days/year at or above 95°F | 2        | 3 to 5     | 6 to 11   | 8 to 21  |
| Days/year at or above 90°F | 14       | 17 to 21   | 22 to 34  | 27 to 53 |
| Days/year at or below 40°F | 126      | 106 to 113 | 94 to 106 | 82 to 98 |
| Days/year at or below 32°F | 73       | 54 to 61   | 43 to 54  | 34 to 48 |

Baseline is from Wallops Flight Facility

## Extreme Event Changes This Century

| Event                 | Direction of Change | Likelihood           |
|-----------------------|---------------------|----------------------|
| Hot Days              | ↑                   | Very Likely          |
| Intense Precipitation | ↑                   | Likely               |
| River Flooding        | ↑                   | Likely               |
| Drought               | ↑                   | More likely than not |
| Intense Winds         | ↑                   | More likely than not |

Hot and Cold Day Projections

The number of days per year exceeding 90°F is projected to rise in the coming century, and the number of days with temperatures below 32°F is projected to decrease. More hot days (and fewer cold days) would affect outside work, energy use, agricultural practices, and habitats.

Based on global climate model simulations, published literature, and expert judgment

# our responsibility

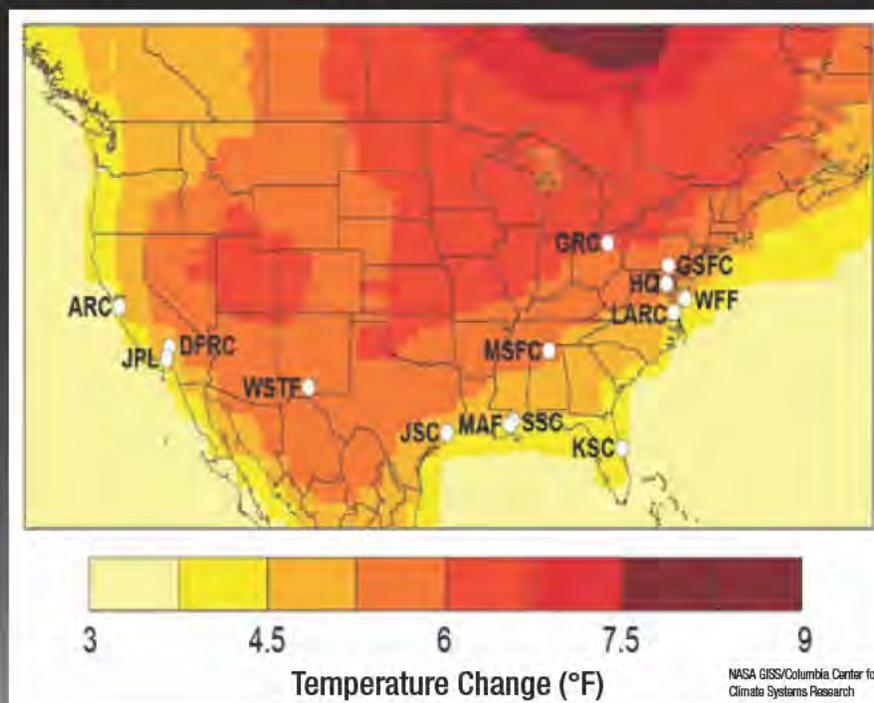
The time to develop and implement adaptation strategies is now. Executive Order 13514 directs federal agencies to assess and manage the effects of climate variables on operations and mission in both the short and long term. A changing climate in the Wallops area will affect facility operations (e.g., water and energy management), natural resources (e.g., new invasive species control), infrastructure that is vital to mission success (e.g., increased cost of protection against flooding), quality of life in the community (e.g., additional heat stress management), and the regions' economy (e.g., increased public expenditures on utilities). By considering these impacts during existing planning and decision-making cycles at Wallops Flight Facility and in collaboration with area partners, impacts to their missions may be abated or reduced. The recent construction of the new beach in front of the launch range, at considerable expense, provides an example of an adaptation measure taken to protect valuable national assets. Adaptation strategies developed for WFF may also prove beneficial to the local community as planners implement short-term tactical changes now, while simultaneously planning for longer-term strategic adaptation measures. Some potential impacts are listed in the chart below.



A new beach built by pumping sand from dredges offshore in 2012 will help protect more than \$1 billion in federal and state government assets located here. The Wallops Island facility is home to NASA, the US Navy Surface Combat Systems Center, and the Mid-Atlantic Regional Spaceport. (upper photo - U.S. Army photo/Patrick Bloodgood)

| Climate Trends                            | Potential Impacts                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rising Sea Level                          | Exacerbated flooding from storm surges; reduced emergency response capabilities. Increased salinity impacts to drinking water resources and habitats        |
| Increased Coastal Flooding                | Impacts to wastewater treatment plants on the coast; damage to infrastructure; changes in shoreline habitats; overloading of stormwater management systems  |
| Overall Increased Temperature             | Increased cooling costs in the summer; decreased heating costs in the winter. Changes in plant and animal cycles, including pest and disease vector species |
| Increased Number of High Temperature Days | Potential for damage to infrastructure materials; potential for limiting work and recreation outdoors; increased health problems related to heat stress     |
| Precipitation Changes                     | Increased flooding from extreme precipitation events; increased risk of drought as temperatures rise; habitats affected by fluctuating groundwater levels   |

## Projected Temperature Change (°F), 2080s minus 1980s, A1B Emissions Scenario\*



\*Average projected temperature change across sixteen global climate models for the A1B emissions scenario. The A1B scenario, one of several developed by the IPCC, assumes high CO<sub>2</sub> levels for first the half of the 21st century, followed by a gradual decrease after 2050. Each time period (the 2080s and 1980s) reflects a 30-year average, not a specific point in time. *The precise values shown in the map should not be interpreted as the most likely outcome. The patterns of future climate change will depend on a range of factors, including the climate system, population, economics, technology, and policy.*

### A Note about Downscaling Climate Data Specifically for Individual NASA Centers

The quantitative climate projections in this document are based on global climate model simulations conducted for the IPCC Fourth Assessment Report (2007) from the World Climate Research Programme's (WCRP's) Coupled Model Intercomparison Project Phase 3 (CMIP3) multi-model dataset. The simulations provide results from sixteen global climate models that were run using three emissions scenarios of future greenhouse gas concentrations. The outputs are statistically downscaled to 1/8 degree resolution (~12 km by 12 km) based on outputs from the bias-corrected (to accurately reflect observed climate data) and spatially-disaggregated climate projections derived from CMIP3 data. Results provide a more refined projection for a smaller geographic area. This information is maintained at: [http://gdo-dcp.ucllnl.org/downscaled\\_cmip3\\_projections](http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections) and described by Maurer, et al. (2007)<sup>1</sup>.

The **rapid ice melt scenario** and qualitative projections reflect a blend of climate model output, historical information, and expert knowledge. For more information about rapid ice melt, see a paper and references at <http://www.nature.com/climate/2010/1004/pdf/climate.2010.29.pdf>.

### Key Uncertainties Associated with Climate Projections

Climate projections and impacts, like other types of research about future conditions, are characterized by uncertainty. Climate projection uncertainties include but are not limited to:

- 1) Levels of future greenhouse gas concentrations and other radiatively important gases and aerosols,
- 2) Sensitivity of the climate system to greenhouse gas concentrations and other radiatively important gases and aerosols,
- 3) Climate variability, and
- 4) Changes in local physical processes (such as afternoon sea breezes) that are not captured by global climate models.

Even though precise quantitative climate projections at the local scale are characterized by uncertainties, the information provided here can guide resource stewards as they seek to identify and manage the risks and opportunities associated with climate variability/climate change and the assets in their care.

<sup>1</sup>Maurer, E.P., L. Brekke, T. Pruitt, and P.B. Duffy (2007), 'Fine-resolution climate projections enhance regional climate change impact studies', *Eos Trans. AGU*, 88(47), 504.

Authorization for NASA's climate risk management efforts, which began in 2005, includes:

- Federal Managers' Financial Integrity Act of 1982, supported by:
  - GAO (1999) Standards of Internal Control in the Federal Government
  - OMB Circular A-123 (2004) Management's Responsibility for Internal Control
- National Security Directive 51 and Homeland Security Presidential Directive 20: National Continuity Policy (9 May 2007) on localized acts of nature
- Presidential Policy Directive 8 – National Preparedness (30 March 2011) for catastrophic natural disasters
- Executive Order 13514 (8 October 2009) Leadership In Environmental, Energy and Economic Performance
- 2010 National Aeronautics and Space Act (51 USC Sec 20101 et seq)
- 2010 National Space Policy of the United States of America

Members of NASA's Climate Adaptation Science Investigator (CASI) Work Group contributed to this document.



## Appendix I



USFWS

*Refuge visitors at the beach*

# Summary Costs of Draft Alternatives and Comparison of Beach Access Costs



| Non-Beach Capital Cost Components                                                                           |                                       |               |                    |                    |                    |                               |
|-------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------|--------------------|--------------------|--------------------|-------------------------------|
| Project                                                                                                     | Units/Notes                           | Cost per unit | Alternative A Cost | Alternative B Cost | Alternative C Cost | Beach Nourishment Alternative |
| WCS - between Ragged Point & Assateague Channel                                                             | 90 LF                                 | \$ 12,250.00  | \$ 1,102,500       | \$ 1,102,500       | \$ 1,102,500       | -                             |
| WCS - between NWF & Assateague Channel                                                                      | 100 LF                                | \$ 3,500.00   | \$ 350,000         | \$ 350,000         | \$ 350,000         | -                             |
| WCS - between E Pool & Assateague Channel                                                                   | 100 LF                                | \$ 3,500.00   | \$ 350,000         | \$ 350,000         | \$ 350,000         | -                             |
| WCS - between Sow Pond & Assateague Channel                                                                 | 90 LF                                 | \$ 12,250.00  | \$ 1,102,500       | \$ 1,102,500       | \$ 1,102,500       | -                             |
| WCS between A & B South (36")                                                                               | 100 LF                                | \$ 3,500.00   | \$ 350,000         | \$ 350,000         | \$ 350,000         | -                             |
| WCS between F & B South (36")                                                                               | 100 LF                                | \$ 3,500.00   | \$ 350,000         | \$ 350,000         | \$ 350,000         | -                             |
| WCS between B South & B North (36") 2 structures                                                            | 90 LF                                 | \$ 3,500.00   | \$ 630,000         | \$ 630,000         | \$ 630,000         | -                             |
| WCS between C and B North (36") 2 structures                                                                | 90 LF                                 | \$ 3,500.00   | \$ 630,000         | \$ 630,000         | \$ 630,000         | -                             |
| WCS between C & D (36") 2 structures                                                                        | 90 LF                                 | \$ 3,500.00   | \$ 630,000         | \$ 630,000         | \$ 630,000         | -                             |
| New Hunt Areas                                                                                              | 8 blinds                              | \$ 5,000.00   | -                  | \$ 40,000          | \$ 40,000          | -                             |
| Restore Lightkeepers House                                                                                  | 1 restoration                         |               | -                  | \$ 1,000,000       | -                  | -                             |
| Wildlife Observation Tower (Wallops Island)                                                                 | 1 tower                               |               | -                  | \$ 80,000          | -                  | -                             |
| Boardwalk (Wallops Island)                                                                                  | Facilities will be shared with NASA   |               | -                  | *shared with NASA  | -                  | -                             |
| Construct additional office space for NPS at the existing Herbert H. Bateman Administrative Office Complex. | Funding will be coordinated with NPS. |               |                    | *shared with NPS   |                    |                               |
| <b>TOTAL COSTS</b>                                                                                          |                                       |               | <b>\$5,495,000</b> | <b>\$6,615,000</b> | <b>\$5,535,000</b> | <b>-</b>                      |

Note: This table covers major capital costs expected for each alternative; operational costs – including staffing – for each alternative is not captured.

## All Major Capital Costs and Operations and Maintenance for Beach Access

| Project                                                                                              | Units/Notes                                                                                                                                      | Cost per unit                                                                                                                              | Alternative A Cost  | Alternative B Cost  | Alternative C Cost  | Alternative A with Beach Nourishment Cost | Alternative B with Beach Nourishment Cost |
|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|-------------------------------------------|-------------------------------------------|
| <b>Non-Beach Capital Cost Component</b>                                                              |                                                                                                                                                  |                                                                                                                                            | <b>\$5,495,000</b>  | <b>\$6,615,000</b>  | <b>\$5,535,000</b>  | <b>\$5,495,000</b>                        | <b>\$6,615,000</b>                        |
| WCS - A Pool (84")                                                                                   | 90 LF                                                                                                                                            | \$12,250.00                                                                                                                                | \$1,102,500         | -                   | -                   | -                                         | -                                         |
| WCS - F Pool (84")                                                                                   | 90 LF                                                                                                                                            | \$12,250.00                                                                                                                                | \$1,102,500         | -                   | -                   | -                                         | -                                         |
| Bike Trail - Visitor's Center to Beach                                                               | 11,523 linear feet of trail                                                                                                                      | \$123.00                                                                                                                                   | \$1,417,329         | -                   | -                   | -                                         | -                                         |
| Bike Trail - WL Loop to C Dike                                                                       | 3,730 linear feet of trail                                                                                                                       | \$123.00                                                                                                                                   | -                   | \$458,790           | -                   | -                                         | -                                         |
| Turn Around - terminus Beach Rd.                                                                     | 3,023 square feet of pavement                                                                                                                    | \$35.00                                                                                                                                    | -                   | \$105,805           | \$105,805           | -                                         | -                                         |
| Crabbing Dock                                                                                        | 40 linear feet of docking                                                                                                                        | \$875.00                                                                                                                                   | -                   | \$35,000            | -                   | -                                         | -                                         |
| Wildlife Observation Tower (Beach Road)                                                              | 1 tower                                                                                                                                          |                                                                                                                                            | -                   | \$80,000            | -                   | -                                         | -                                         |
| Launch Area for kayak/canoe                                                                          | 438 linear feet of boardwalk                                                                                                                     | \$875.00                                                                                                                                   | -                   | \$383,250           | -                   | --                                        | -                                         |
| Shuttle Transit Service                                                                              | 3 shuttles purchased and maintained for seven years                                                                                              | Capital cost of \$900,000, Annual operating cost of \$179,000                                                                              | \$2,600,000         | -                   | \$2,600,000         | -                                         | -                                         |
| Proposed Access Road, Joint NPS/USFWS Visitor Contact Station, and Parking Areas for Relocated Beach | 2 way traffic, emergency lane and bike trail / 8.5 acre or 4.25 acre parking area / 3,000 sf building with public restrooms / small exhibit area | Includes construction, design, and construction management costs, estimated by FWS                                                         |                     | \$14,558,100        | \$11,739,900        | -                                         | -                                         |
| Army Corp of Engineers Beach Nourishment Assessment                                                  | Stabilization of the current recreational beach and parking lots, and recurring maintenance every 3-7 years                                      | \$24 million of initial costs, then three maintenance occurrences at \$8.3 million (3-7 years over 15 year CCP = average of every 5 years) | -                   | -                   | -                   | \$48,900,000                              | \$48,900,000                              |
| <b>Grand Total</b>                                                                                   |                                                                                                                                                  |                                                                                                                                            | <b>\$11,717,329</b> | <b>\$22,235,945</b> | <b>\$19,980,705</b> | <b>\$54,395,000</b>                       | <b>\$55,515,000</b>                       |

## Appendix J



USFWS

*Chincoteague NWR*

# **Chincoteague National Wildlife Refuge Beachfill: Abbreviated Analysis and Cost Opinion for Maintaining the Existing Parking Areas and Recreational Beach**



## Chincoteague National Wildlife Refuge Beachfill

### Abbreviated Analysis and Cost Opinion for Maintaining the Existing Parking Areas and Recreational Beach

#### **Purpose of this report:**

The intent of this report to convey a cost opinion of stabilizing (not protecting) the existing parking areas and recreational beaches based on a similar recent United States Army Corps of Engineers (USACE) beach-fill project at Wallops Island, Virginia. The term protection is used when armoring (for example, revetments and seawalls) the shoreline and protecting inland development. The term stabilization is used to decelerate shoreline erosion using breakwater systems and/or increase the longevity of a beach by beach fill and maintain a wide berm for damage reduction. The design is proposing an establishment of a dune position on the exiting beach berm and beach nourishment that would extend towards the ocean. The intent and objective is to stabilize the existing parking areas. This report is not an economic analysis, alternative analysis or detailed design analysis.

#### **Problem Statement:**

Beach erosion along the open ocean of the Assateague Island is well documented with average net long-term rates of -1.2 meters/year (USGS 2010). Federal resources are expended yearly to maintain the recreational beach and parking areas.

#### **Existing Conditions:**

Based on the historical map data, the sediment transport is traveling from Toms Cove to Fishing Point (North to South). The sand from the north will, over time, travel to the south. The shoreline will continue to transgress west; however, the beach-fill will slow down the transgression in the vicinity of placement. Historical Sea Level Rise along the Assateague and Chincoteague shoreline will be considered at a minimum for this concept. Both erosion and sea level change rates are anticipated to continue at the current (historic measured) rates. In addition to the sea level rise and sediment transport, the shoreline of Assateague Island will continue to transgress west; however, the beach-fill will slow down the transgression in the vicinity of the placement. The dune and beach berm project will not prevent tidal flooding from the interior or backside of the shoreline.

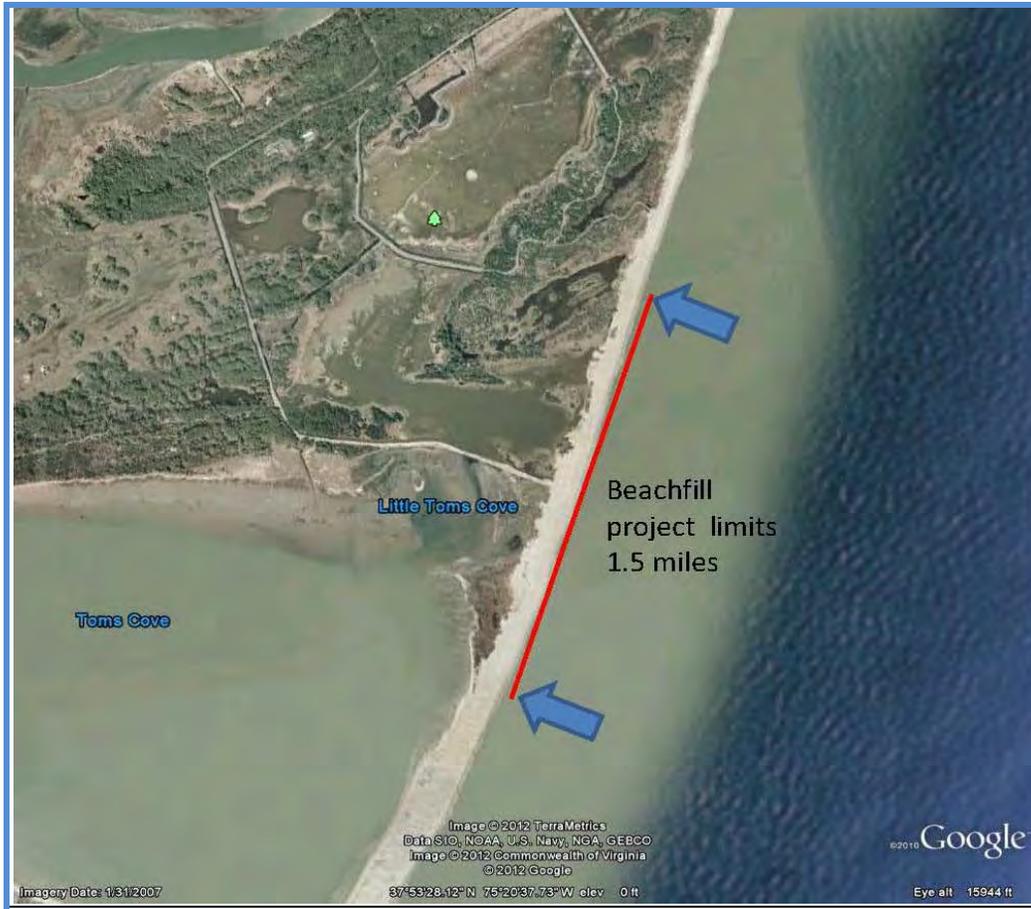
#### **Similar Projects:**

A recent (2012) project similar to a beachfill at Chincoteague includes the Wallops Island Shoreline Damage Reduction project with an initial cost of \$35M and a project length of 3.6 miles. Other similar projects within the Norfolk District include Virginia Beach, Sandbridge and Hampton Storm Damage Reduction Projects.

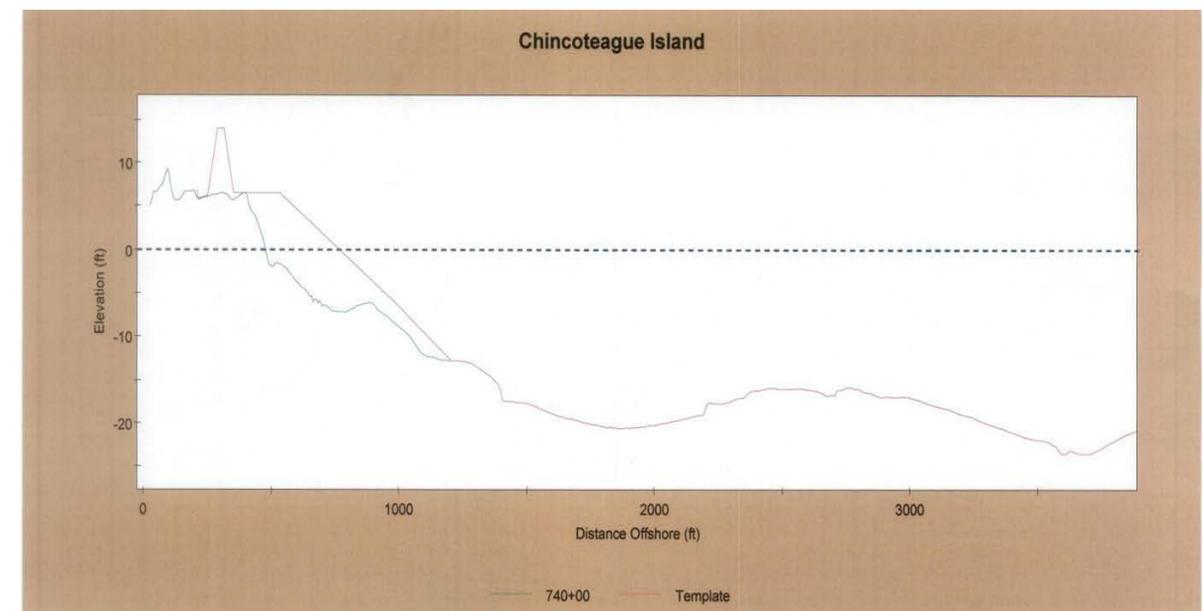
#### **Assumptions:**

- Natural beach berm elevation = 6.0 ft. NAVD '88
- Project length = 1.5 miles
- Dune height = 14 ft. NAVD '88
- Dune Crest width = 25 ft.
- Foreshore slope 20:1
- Borrow material is beach compatible i.e. 0.29 mm or greater
- Profile template = 160 CY/LF
- Total initial fill required = 1.5 MCY
- Dredging losses = 20%

**Project Limits**



**Beach-fill Template**



**Cost Opinions:**Initial  
Fill

|                                      |           |    |   |              |
|--------------------------------------|-----------|----|---|--------------|
| Hopper Dredging from offshore shoals |           |    |   |              |
| Mob                                  |           |    |   | \$2,750,000  |
| Dredge                               | 1,500,000 |    |   |              |
|                                      |           | CY | @ | \$11.50 /CY  |
| Standby Cost                         |           |    |   | \$17,250,000 |
| ST                                   |           |    |   | \$100,000    |
| Contingencies                        | 10%       |    |   | \$20,100,000 |
| Total Construction Cost              |           |    |   | \$2,010,000  |
|                                      |           |    |   | \$22,110,000 |
| S&A                                  | 5%        |    |   | \$1,105,500  |
| Total Construction plus S&A Cost     |           |    |   | \$23,215,500 |
| PED cost                             | 5%        |    |   | \$1,105,500  |
| TOTAL PROJECT COST                   |           |    |   | \$24,321,000 |

Renourishment cycle (3 to 7 years)

|                                  |         |    |   |             |
|----------------------------------|---------|----|---|-------------|
| Mob                              |         |    |   | \$2,750,000 |
| Dredge                           | 300,000 | CY | @ | \$11.50 /CY |
| Standby Cost                     |         |    |   | \$3,450,000 |
| ST                               |         |    |   | \$100,000   |
| Contingencies                    | 20%     |    |   | \$6,300,000 |
| Total Construction Cost          |         |    |   | \$1,260,000 |
|                                  |         |    |   | \$7,560,000 |
| S&A                              | 5%      |    |   | \$378,000   |
| Total Construction plus S&A Cost |         |    |   | \$7,938,000 |
| PED cost                         | 5%      |    |   | \$378,000   |
| TOTAL PROJECT COST               |         |    |   | \$8,316,000 |

- Wetland Mitigation Cost not included.

## Appendix K



USFWS

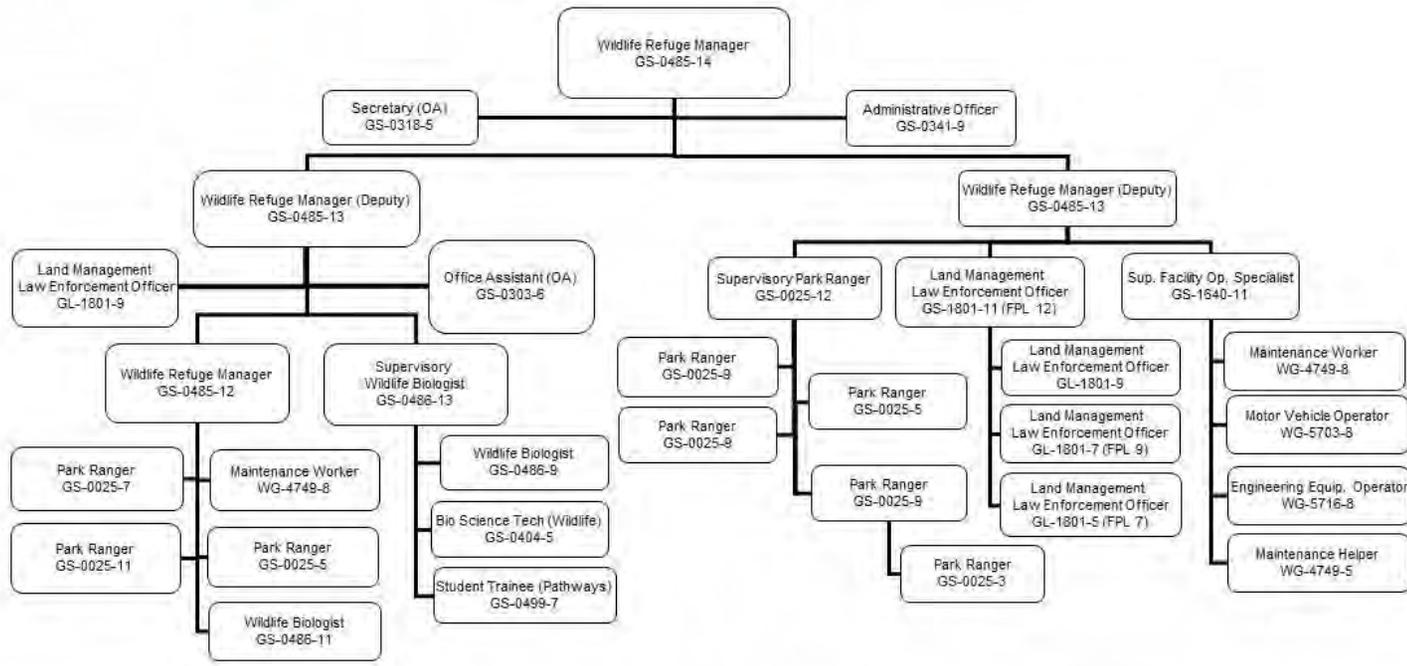
*View of Refuge*

# Staffing Charts for All Alternatives



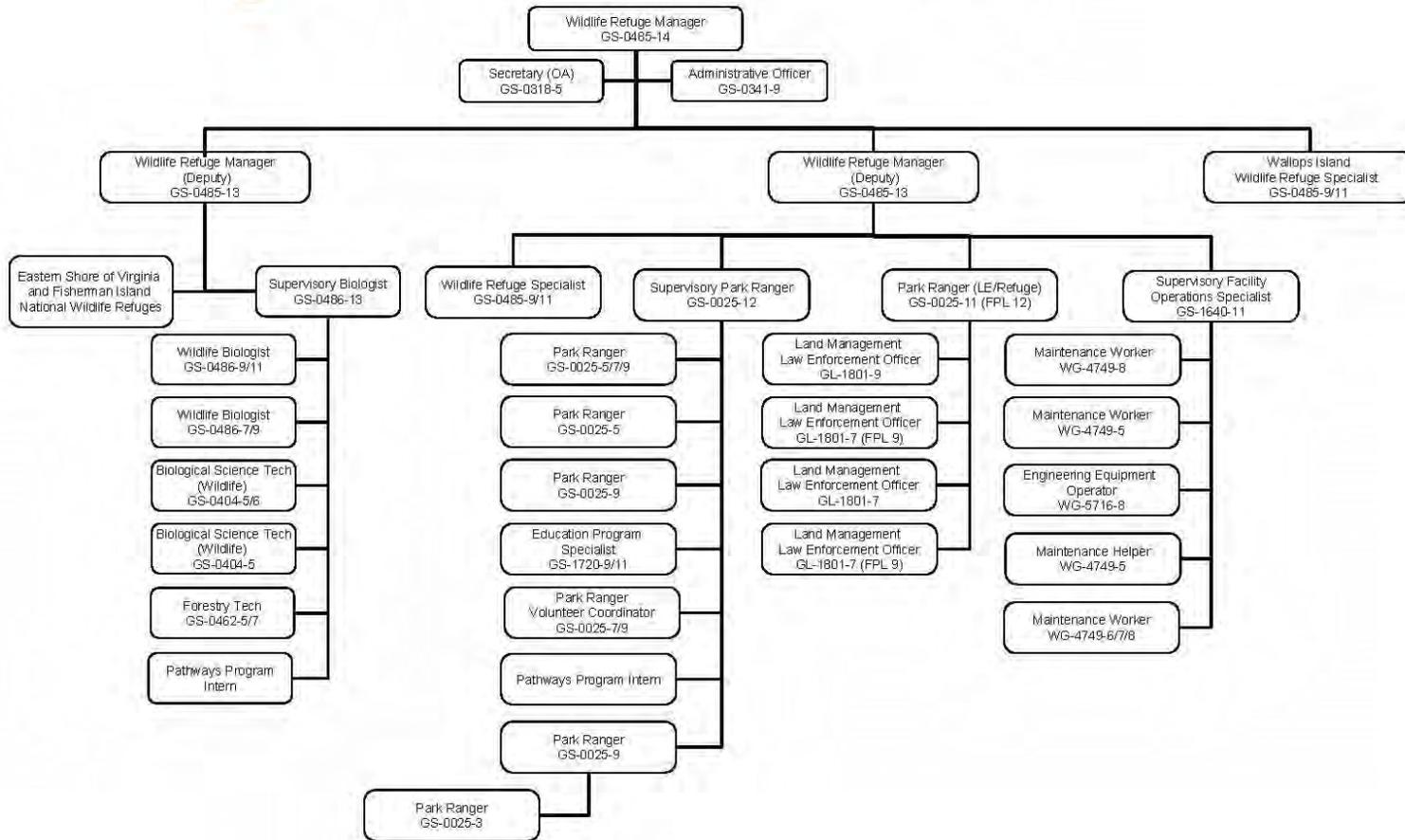


**Proposed Staff Plan  
Alternative A**  
Chincoteague and Wallops Island National Wildlife Refuges



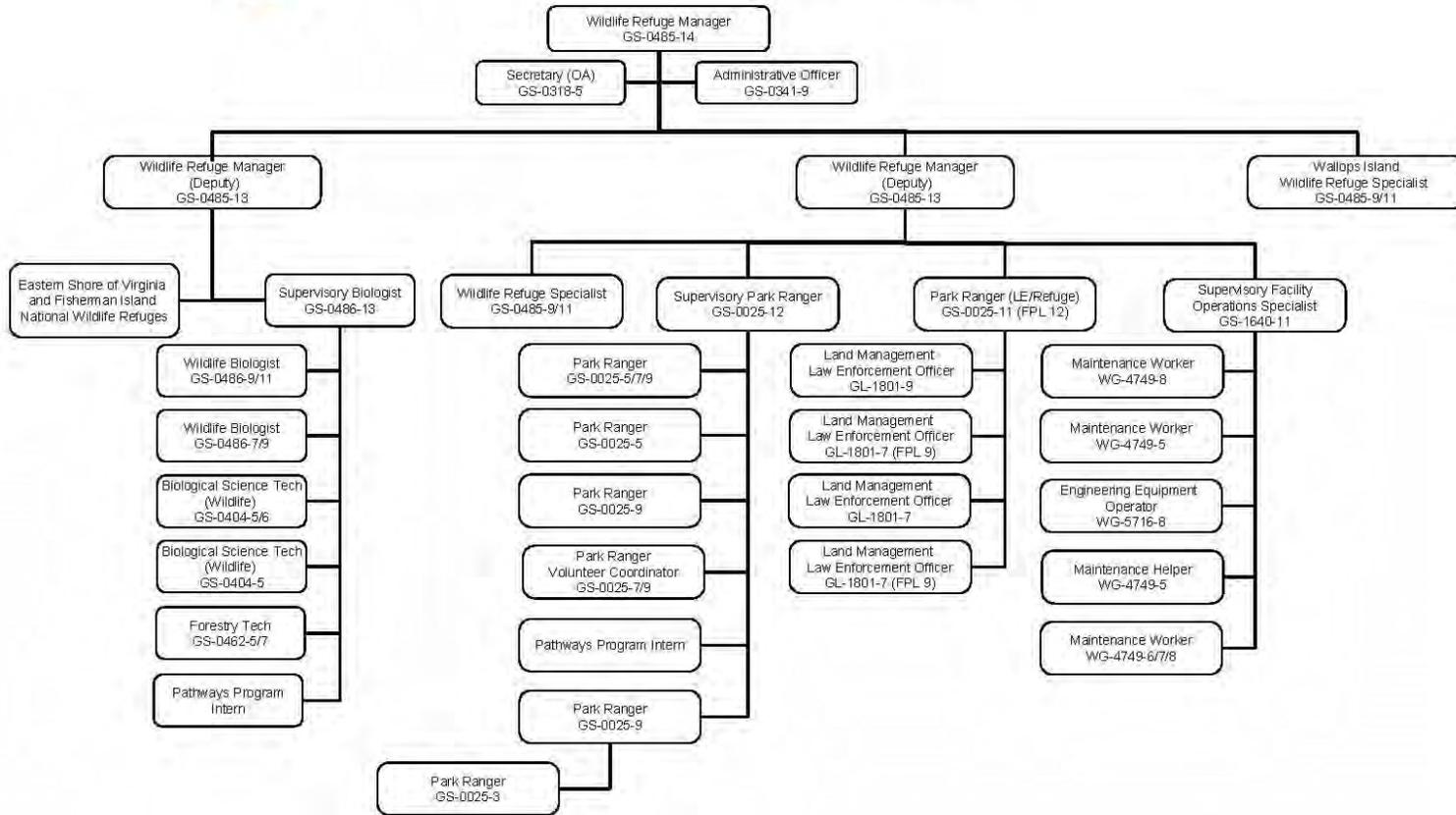


Proposed Staff Plan  
Alternative B  
Chincoteague and Wallops Island National Wildlife Refuges





Proposed Staff Plan  
Alternative C  
Chincoteague and Wallops Island National Wildlife Refuges



## Appendix L



USFWS

*Delmarva Fox Squirrel*

# Species Lists for Chincoteague and Wallops Island NWRs



|                                                                                                                                                                                                                                   |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Table A: Species Reference List for CCP/EIS – Common and Scientific Names.....                                                                                                                                                    | 1  |
| Table B: Bird Checklist for Chincoteague and Wallops Island National Wildlife Refuges .....                                                                                                                                       | 5  |
| Table C: Mammals – Working Species List Chincoteague and Wallops Island National Wildlife Refuges (USFWS refuge staff, National Parks Conservation Association 2007, USFWS 1992a and 1993a, USFWS 2007d).....                     | 13 |
| Table D: Reptiles and Amphibians – Working Species List Chincoteague and Wallops Island National Wildlife Refuges (USFWS refuge staff, National Parks Conservation Association 2007, USFWS 1992a and 1993a, USFWS 2007d) .....    | 15 |
| Table E: Aquatic Species – Working List Chincoteague and Wallops Island National Wildlife Refuges (USFWS refuge staff, National Parks Conservation Association 2007, USFWS 1992a and 1993a, USFWS 2007d).....                     | 18 |
| Table F: Threatened and Endangered Fauna and Flora in the Chincoteague and Wallops Island NWR's vicinity (Maryland Department of Natural Resources 2005 and n.d.a, Virginia Department of Conservation and Recreation n.d.) ..... | 20 |
| Table G: Potential Resources of Concern Table. Chincoteague & Wallops Island NWRs, Jan 2011 (USFWS refuge staff).....                                                                                                             | 22 |
| Table H: Fish Species Collected from Refuge Fish Surveys (USFWS 1997 and Mangold and Eyler 2006) .                                                                                                                                | 27 |
| Table I: Top Twenty Most Abundant Bird Species: Chincoteague NWR Landbird Surveys Listed in relative order of abundance (USFWS refuge staff, Chincoteague NWR 1996, Ailes and Ailes 2007, Roberts 2008).....                      | 28 |

Table A: Species Reference List for CCP/EIS – Common and Scientific Names

| Common Name                  | Scientific Name                |
|------------------------------|--------------------------------|
| <b>FLORA</b>                 |                                |
| American beach grass         | <i>Ammophila breviligulata</i> |
| American holly               | <i>Ilex opaca</i>              |
| American sea rocket          | <i>Cakile edentula</i>         |
| American three-square        | <i>Scirpus americanus</i>      |
| autumn olive                 | <i>Elaeagnus umbellata</i>     |
| Bacopa                       | <i>Bacopa monnieri</i>         |
| Bidens, bur-marigold         | <i>Bidens laevis</i>           |
| black cherry                 | <i>Prunus serotina</i>         |
| black gum                    | <i>Nyssa sylvatica</i>         |
| black willow                 | <i>Salix nigra</i>             |
| blackberry                   | <i>Rubus allegheniensis</i>    |
| broom-sedge                  | <i>Andropogon virginicus</i>   |
| carpetweed                   | <i>Mollugo verticillata</i>    |
| cattails                     | <i>Typha angustifolia L.</i>   |
| climbing fern                | <i>Lygodium palmatum</i>       |
| climbing hempweed            | <i>Mikania scandens</i>        |
| common chokecherry           | <i>Prunus virginiana</i>       |
| crested yellow orchid        | <i>Platanthera cristata</i>    |
| dead man's fingers           | <i>Codium fragile</i>          |
| devil's walkingstick         | <i>Aralias spinosa</i>         |
| dogwood                      | <i>Cornus florida</i>          |
| dune sandbur                 | <i>Cenchrus tribuloides</i>    |
| dwarf spike rush             | <i>Eleocharis parvula</i>      |
| false heather or beach-heath | <i>Hudsonia tomentosa</i>      |
| fox grape                    | <i>Vitis labrusca</i>          |
| greenbrier                   | <i>Smilax rotundifolia</i>     |
| groundsel tree               | <i>Baccharis halimifolia</i>   |
| high-blueberry bush          | <i>Vaccinium corymbosum</i>    |
| horsemint                    | <i>Monarda punctata</i>        |
| Indian pipe                  | <i>Monotropa uniflora</i>      |
| Japanese honeysuckle         | <i>Lonicera japonica</i>       |
| Japanese sedge               | <i>Carex kobomugi</i>          |
| Japanese silkgrass           | <i>Microstegium vimineum</i>   |
| Japanese wisteria            | <i>Wisteria floribunda</i>     |
| jointweed                    | <i>Polygonella articulata</i>  |
| loblolly pine                | <i>Pinus taeda</i>             |
| marsh elder                  | <i>Iva frutescens</i>          |
| northern bayberry            | <i>Myrica pensylvanica</i>     |
| partridgeberry               | <i>Mitchella repens</i>        |
| Phragmites, common reed      | <i>Phragmites australis</i>    |
| poison ivy                   | <i>Toxicodendron radicans</i>  |
| red cedar                    | <i>Juniperus virginiana</i>    |
| red maple                    | <i>Acer rubrum</i>             |
| red oak                      | <i>Quercus falcate</i>         |

|                           |                                     |
|---------------------------|-------------------------------------|
| rough buttonweed          | <i>Diodia radula</i>                |
| sago pondweed             | <i>Potamogeton pectinatus</i>       |
| salt marsh fleabane       | <i>Pluchea odorata</i>              |
| saltgrass                 | <i>Distichlis spicata</i>           |
| saltmeadow cordgrass      | <i>Spartina patens</i>              |
| saltwort                  | <i>Salicornia europaea</i>          |
| sassafras                 | <i>Sassafras albidum</i>            |
| sea lavender              | <i>Limonium<br/>carolinianum</i>    |
| sea oats                  | <i>Uniola paniculata</i>            |
| sea purslane              | <i>Sesuvium maritimum</i>           |
| seabeach evening primrose | <i>Oenothera humifusa</i>           |
| seabeach orach            | <i>Atriplex arenaria</i>            |
| seabeach sandwort         | <i>Honkenya peploides</i>           |
| seaside goldenrod         | <i>S. graminifolia</i>              |
| seaside goldenrod         | <i>S. tenuifolia</i>                |
| seaside goldenrod         | <i>Solidago sempervirens</i>        |
| serviceberry              | <i>Amelanchier canadensis</i>       |
| smartweed                 | <i>Polygonum spp.</i>               |
| smooth cordgrass          | <i>Spartina alterniflora</i>        |
| spicebrush                | <i>Lindera benzoin</i>              |
| spotted wintergreen       | <i>Pyrol L.</i>                     |
| swamp rose                | <i>Hibiscus palustris</i>           |
| sweet gum                 | <i>Liquidambar styraciflua</i>      |
| tulip poplar              | <i>Liriodendron tulipifera</i>      |
| umbrella grass            | <i>Fuirena pumila</i>               |
| water oak                 | <i>Quercus nigra</i>                |
| wax myrtle                | <i>Myrica cerifera</i>              |
| white oak                 | <i>Quercus alba</i>                 |
| widgeon grass             | <i>Ruppia maritima</i>              |
| <b>FUANA</b>              |                                     |
| American black duck       | <i>Anas rubripes</i>                |
| American kestrel          | <i>Falco sparverius</i>             |
| American oystercatcher    | <i>Haematopus palliatus</i>         |
| American widgeon          | <i>Anas americana</i>               |
| American woodcock         | <i>Scolopax minor</i>               |
| Asian shorecrabs          | <i>Hemigrapsus<br/>sanguineus</i>   |
| Atlantic brant            | <i>Branta bernicla</i>              |
| bald eagle                | <i>Haliaeetus<br/>leucocephalus</i> |
| beach vitex               | <i>Vitex rotundifolia</i>           |
| black skimmer             | <i>Rynchops niger</i>               |
| black vulture             | <i>Coragyps atratus</i>             |
| black-and-white warbler   | <i>Mniotilta varia</i>              |
| blackburnian warbler      | <i>Dendroica fusca</i>              |
| black-crowned night-heron | <i>Nycticorax nycticorax</i>        |
| brown thrasher            | <i>Toxostoma rufum</i>              |
| brown-headed nuthatch     | <i>Sitta pusilla</i>                |

|                                 |                                     |
|---------------------------------|-------------------------------------|
| bufflehead                      | <i>Bucephala albeola</i>            |
| Canada geese                    | <i>Branta canadensis</i>            |
| Canada warbler                  | <i>Wilsonia canadensis</i>          |
| Carolina wren                   | <i>Thryothorus<br/>ludovicianus</i> |
| cattle egret                    | <i>Bubulcus ibis</i>                |
| Chinese mitten crab             | <i>Eriocheir sinensis</i>           |
| common grackle                  | <i>Quiscalus quiscula</i>           |
| common terns                    | <i>Sterna hirundo</i>               |
| common yellowthroat             | <i>Geothlypis trichas</i>           |
| Delmarva Peninsula fox squirrel | <i>Sciurus niger cenerus</i>        |
| dunlin                          | <i>Calidris alpina</i>              |
| eastern kingbird                | <i>Tyrannus tyrannus</i>            |
| eastern towhee                  | <i>Pipilo erythrophthalmus</i>      |
| eastern wood-pewee              | <i>Contopus virens</i>              |
| eelgrass                        | <i>Zostera marina</i>               |
| field sparrow                   | <i>Spizella pusilla</i>             |
| Forster's tern                  | <i>Sterna forsteri</i>              |
| gadwall                         | <i>Anas strepera</i>                |
| glossy ibis                     | <i>Plegadis falinellus</i>          |
| gray catbird                    | <i>Dumetella carolinensis</i>       |
| great black-backed gull         | <i>Larus marinus</i>                |
| great crested flycatcher        | <i>Myiarchus crinitus</i>           |
| great egret                     | <i>Casmerodius albus</i>            |
| great horned owl                | <i>Bubo virginianus</i>             |
| green crab                      | <i>Carcinus maena</i>               |
| green heron                     | <i>Butorides virescens</i>          |
| green sea turtle                | <i>Chelonia mydas</i>               |
| green-winged teal               | <i>Anas crecca</i>                  |
| herring gull                    | <i>Larus argentatus</i>             |
| house wren                      | <i>Troglodytes aedon</i>            |
| isopods                         | <i>Philosa</i>                      |
| laughing gull                   | <i>Larus atricilla</i>              |
| little blue heron               | <i>Egretta caerulea</i>             |
| long-finned pilot whale         | <i>Glovicephala melaena</i>         |
| Louisiana waterthrush           | <i>Parkesia motacilla</i>           |
| mallards                        | <i>Anas platyrhynchos</i>           |
| mink                            | <i>Mustela vison</i>                |
| mole crab                       | <i>Emerita talpoida</i>             |
| monarch butterfly               | <i>Danaus plexippus</i>             |
| northern bobwhite               | <i>Colinus virginianus</i>          |
| northern flicker                | <i>Colaptes auratus</i>             |
| northern pintail                | <i>Anas acuta</i>                   |
| northern shoveler               | <i>Anas clypeata</i>                |
| nutria                          | <i>Myocastor coypus</i>             |
| opossum                         | <i>Didelphis marsupialis</i>        |
| osprey                          | <i>Pandion haliaetus</i>            |
| oystercatchers                  | <i>Haematopus palliatus</i>         |
| periwinkle                      | <i>Littorina spp.</i>               |

|                        |                                       |
|------------------------|---------------------------------------|
| prairie warbler        | <i>Dendroica discolor</i>             |
| raccoon                | <i>Procyon lotor</i>                  |
| red fox                | <i>Vulpes vulpes</i>                  |
| red knot               | <i>Calidris canutus rufa</i>          |
| red-breasted merganser | <i>Mergus serrator</i>                |
| red-headed woodpecker  | <i>Melanerpes<br/>erythrocephalus</i> |
| red-tailed hawk        | <i>Buteo jamaicensis</i>              |
| ring-billed gull       | <i>Larus delawarensis</i>             |
| ruddy duck             | <i>Oxyura jamaicensis</i>             |
| saltmarsh snail        | <i>Melampus bidentata</i>             |
| seabeach spurge        | <i>Chamaesyce<br/>polygonifolia</i>   |
| semipalmated sandpiper | <i>Calidris pusilla</i>               |
| sika                   | <i>Cervus caballus</i>                |
| short-billed dowitcher | <i>Limnodromus griseus</i>            |
| snow geese             | <i>Chen caerulescens</i>              |
| snowy egret            | <i>Egretta thula</i>                  |
| song sparrow           | <i>Melospiza melodia</i>              |
| southern leopard frog  | <i>Rana utricularia</i>               |
| tri-colored heron      | <i>Egretta tricolor</i>               |
| tundra swan            | <i>Cygnus columbianus</i>             |
| Virginia oyster        | <i>Crassostrea virginica</i>          |
| willet                 | <i>Tringa semipalmata</i>             |
| worm-eating warbler    | <i>Helmitheros vermivorus</i>         |
| yellow-breasted chat   | <i>Icteria virens</i>                 |
| yellow-rumped warbler  | <i>Dendroica coronata</i>             |

Table B: Bird Checklist for Chincoteague and Wallops Island National Wildlife Refuges

| Common Name                           |
|---------------------------------------|
| <b>LOONS - GREBES</b>                 |
| Red-throated Loon                     |
| Common Loon                           |
| Pied-billed Grebe                     |
| Horned Grebe                          |
| Red-necked Grebe                      |
| Eared Grebe                           |
| <b>SHEARWATERS - STORM-PETRELS</b>    |
| Cory's Shearwater                     |
| Greater Shearwater                    |
| Sooty Shearwater                      |
| Wilson's Storm-Petrel                 |
| <b>GANNET - PELICANS - CORMORANTS</b> |
| Northern Gannet                       |
| American White Pelican                |
| Brown Pelican                         |
| Great Cormorant                       |
| Double-crested Cormorant              |
| <b>BITTERNs - HERONS - IBISES</b>     |
| American Bittern                      |
| Least Bittern                         |
| Great Blue Heron                      |
| Great Egret                           |
| Snowy Egret                           |
| Little Blue Heron                     |
| Tricolored Heron                      |
| Cattle Egret                          |
| Green Heron                           |
| Black-crowned Night-Heron             |
| Yellow-crowned Night-Heron            |
| White Ibis                            |
| Glossy Ibis                           |
| <b>SWANS - GEESE - DUCKS</b>          |
| Tundra Swan                           |
| Mute Swan                             |
| Greater White-Fronted Goose           |
| Greater Snow Goose                    |

|                                   |
|-----------------------------------|
| Atlantic Brant                    |
| Canada Goose                      |
| Wood Duck                         |
| Green-winged Teal                 |
| American Black Duck               |
| Mallard                           |
| Northern Pintail                  |
| Blue-winged Teal                  |
| Northern Shoveler                 |
| Gadwall                           |
| Eurasian Wigeon                   |
| American Wigeon                   |
| Canvasback                        |
| Redhead                           |
| Ring-necked Duck                  |
| Greater Scaup                     |
| Lesser Scaup                      |
| Common Eider                      |
| Oldsquaw                          |
| Black Scoter                      |
| Surf Scoter                       |
| White-winged Scoter               |
| Common Goldeneye                  |
| Bufflehead                        |
| Hooded Merganser                  |
| Common Merganser                  |
| Red-breasted Merganser            |
| Ruddy Duck                        |
|                                   |
| <b>VULTURES - HAWKS - FALCONS</b> |
|                                   |
| Black Vulture                     |
| Turkey Vulture                    |
| Osprey                            |
| Bald Eagle                        |
| Northern Harrier                  |
| Sharp-shinned Hawk                |
| Cooper's Hawk                     |
| Red-shouldered Hawk               |
| Red-tailed Hawk                   |
| Rough-legged Hawk                 |
| American Kestrel                  |
| Merlin                            |
| Peregrine Falcon                  |
|                                   |
| <b>GROUSE - QUAIL - TURKEY</b>    |
|                                   |
| Northern Bobwhite                 |
|                                   |

| <b>RAILS - CRANES</b>          |
|--------------------------------|
|                                |
| <b>Yellow Rail</b>             |
| <b>Black Rail</b>              |
| <b>Clapper Rail</b>            |
| <b>King Rail</b>               |
| <b>Virginia Rail</b>           |
| <b>Sora</b>                    |
| <b>Purple Gallinule</b>        |
| <b>Common Moorhen</b>          |
| <b>American Coot</b>           |
|                                |
| <b>PLOVERS - SANDPIPERS</b>    |
|                                |
| <b>Black-bellied Plover</b>    |
| <b>American Golden Plover</b>  |
| <b>Wilson's Plover</b>         |
| <b>Semipalmated Plover</b>     |
| <b>Piping Plover</b>           |
| <b>Killdeer</b>                |
| <b>American Oystercatcher</b>  |
| <b>Black-necked Stilt</b>      |
| <b>American Avocet</b>         |
| <b>Greater Yellowlegs</b>      |
| <b>Lesser Yellowlegs</b>       |
| <b>Solitary Sandpiper</b>      |
| <b>Willet</b>                  |
| <b>Spotted Sandpiper</b>       |
| <b>Upland Sandpiper</b>        |
| <b>Whimbrel</b>                |
| <b>Hudsonian Godwit</b>        |
| <b>Marbled Godwit</b>          |
| <b>Ruddy Turnstone</b>         |
| <b>Red Knot</b>                |
| <b>Sanderling</b>              |
| <b>Semipalmated Sandpiper</b>  |
| <b>Western Sandpiper</b>       |
| <b>Least Sandpiper</b>         |
| <b>White-rumped Sandpiper</b>  |
| <b>Baird's Sandpiper</b>       |
| <b>Pectoral Sandpiper</b>      |
| <b>Dunlin</b>                  |
| <b>Curlew Sandpiper</b>        |
| <b>Stilt Sandpiper</b>         |
| <b>Buff-breasted Sandpiper</b> |
| <b>Ruff</b>                    |
| <b>Short-billed Dowitcher</b>  |
| <b>Long-billed Dowitcher</b>   |
| <b>Common Snipe</b>            |

|                                                          |
|----------------------------------------------------------|
| American Woodcock                                        |
| Wilson's Phalarope                                       |
| Red-necked Phalarope                                     |
|                                                          |
| <b>JAEGERS - GULLS - TERNS - AUKS</b>                    |
|                                                          |
| Laughing Gull                                            |
| Black-headed Gull                                        |
| Bonaparte's Gull                                         |
| Ring-billed Gull                                         |
| Herring Gull                                             |
| Lesser Black-backed Gull                                 |
| Great Black-backed Gull                                  |
| Gull-billed Tern                                         |
| Caspian Tern                                             |
| Royal Tern                                               |
| Sandwich Tern                                            |
| Roseate Tern                                             |
| Common Tern                                              |
| Arctic Tern                                              |
| Forster's Tern                                           |
| Least Tern                                               |
| Black Tern                                               |
| Black Skimmer                                            |
|                                                          |
| <b>DOVES - CUCKOOS - OWLS - SWIFTS -<br/>HUMMINGBIRD</b> |
|                                                          |
| Rock Dove                                                |
| Mourning Dove                                            |
| Black-billed Cuckoo                                      |
| Yellow-billed Cuckoo                                     |
| Barn Owl                                                 |
| Eastern Screech-Owl                                      |
| Great Horned Owl                                         |
| Snowy Owl                                                |
| Long-eared Owl                                           |
| Short-eared Owl                                          |
| Common Nighthawk                                         |
| Chuck-will's-widow                                       |
| Chimney Swift                                            |
| Ruby-throated Hummingbird                                |
| Belted Kingfisher                                        |
|                                                          |
| <b>WOODPECKERS - FLYCATCHERS</b>                         |
|                                                          |
| Red-headed Woodpecker                                    |
| Red-bellied Woodpecker                                   |
| Yellow-bellied Sapsucker                                 |

|                                        |
|----------------------------------------|
| <b>Downy Woodpecker</b>                |
| <b>Hairy Woodpecker</b>                |
| <b>Northern Flicker</b>                |
| <b>Pileated Woodpecker</b>             |
| <b>Olive-sided Flycatcher</b>          |
| <b>Eastern Wood-Pewee</b>              |
| <b>Yellow-bellied Flycatcher</b>       |
| <b>Acadian Flycatcher</b>              |
| <b>Willow Flycatcher</b>               |
| <b>Least Flycatcher</b>                |
| <b>Eastern Phoebe</b>                  |
| <b>Great Crested Flycatcher</b>        |
| <b>Western Kingbird</b>                |
| <b>Eastern Kingbird</b>                |
|                                        |
| <b>LARKS - SWALLOWS - JAYS - CROWS</b> |
|                                        |
| <b>Horned Lark</b>                     |
| <b>Purple Martin</b>                   |
| <b>Tree Swallow</b>                    |
| <b>Northern Rough-winged Swallow</b>   |
| <b>Bank Swallow</b>                    |
| <b>Barn Swallow</b>                    |
| <b>Blue Jay</b>                        |
| <b>American Crow</b>                   |
| <b>Fish Crow</b>                       |
|                                        |
| <b>TITMICE - NUTHATCHES - WRENS</b>    |
|                                        |
| <b>Carolina Chickadee</b>              |
| <b>Tufted Titmouse</b>                 |
| <b>Red-breasted Nuthatch</b>           |
| <b>White-breasted Nuthatch</b>         |
| <b>Brown-headed Nuthatch</b>           |
| <b>Brown Creeper</b>                   |
| <b>Carolina Wren</b>                   |
| <b>House Wren</b>                      |
| <b>Winter Wren</b>                     |
| <b>Sedge Wren</b>                      |
| <b>Marsh Wren</b>                      |
|                                        |
| <b>KINGLETS - THRUSHES - THRASHERS</b> |
|                                        |
| <b>Golden-crowned Kinglet</b>          |
| <b>Ruby-crowned Kinglet</b>            |
| <b>Blue-gray Gnatcatcher</b>           |
| <b>Eastern Bluebird</b>                |
| <b>Veery</b>                           |
| <b>Bicknell's Thrush</b>               |

|                                      |
|--------------------------------------|
| Swainson's Thrush                    |
| Hermit Thrush                        |
| Wood Thrush                          |
| American Robin                       |
| Gray Catbird                         |
| Northern Mockingbird                 |
| Brown Thrasher                       |
|                                      |
| <b>WAXWINGS - SHRIKES - STARLING</b> |
|                                      |
| American Pipit                       |
| Cedar Waxwing                        |
| European Starling                    |
|                                      |
| <b>VIREOS - WOOD WARBLERS</b>        |
|                                      |
| White-eyed Vireo                     |
| Solitary Vireo                       |
| Yellow-throated Vireo                |
| Warbling Vireo                       |
| Philadelphia Vireo                   |
| Red-eyed Vireo                       |
| Blue-winged Warbler                  |
| Golden-winged Warbler                |
| Tennessee Warbler                    |
| Orange-crowned Warbler               |
| Nashville Warbler                    |
| Northern Parula                      |
| Yellow Warbler                       |
| Chestnut-sided Warbler               |
| Magnolia Warbler                     |
| Cape May Warbler                     |
| Black-throated Blue Warbler          |
| Yellow-rumped Warbler                |
| Black-throated Green Warbler         |
| Blackburnian Warbler                 |
| Yellow-throated Warbler              |
| Pine Warbler                         |
| Prairie Warbler                      |
| Palm Warbler                         |
| Bay-breasted Warbler                 |
| Blackpoll Warbler                    |
| Cerulean Warbler                     |
| Black-and-white Warbler              |
| American Redstart                    |
| Prothonotary Warbler                 |
| Worm-eating Warbler                  |
| Swainson's Warbler                   |
| Ovenbird                             |

|                                |
|--------------------------------|
| Northern Waterthrush           |
| Louisiana Waterthrush          |
| Kentucky Warbler               |
| Connecticut Warbler            |
| Common Yellowthroat            |
| Hooded Warbler                 |
| Wilson's Warbler               |
| Canada Warbler                 |
| Yellow-breasted Chat           |
|                                |
| <b>TANAGERS - SPARROWS</b>     |
|                                |
| Summer Tanager                 |
| Scarlet Tanager                |
| Northern Cardinal              |
| Rose-breasted Grosbeak         |
| Blue Grosbeak                  |
| Indigo Bunting                 |
| Dickcissel                     |
| Eastern Towhee                 |
| American Tree Sparrow          |
| Chipping Sparrow               |
| Clay-colored Sparrow           |
| Field Sparrow                  |
| Vesper Sparrow                 |
| Lark Sparrow                   |
| Savannah Sparrow               |
| Grasshopper Sparrow            |
| Henslow's Sparrow              |
| Saltmarsh Sharp-tailed Sparrow |
| Nelson's Sharp-tailed Sparrow  |
| Seaside Sparrow                |
| Fox Sparrow                    |
| Song Sparrow                   |
| Lincoln's Sparrow              |
| Swamp Sparrow                  |
| White-throated Sparrow         |
| White-crowned Sparrow          |
| Dark-eyed Junco                |
| Lapland Longspur               |
| Snow Bunting                   |
|                                |
| <b>BLACKBIRDS - FINCHES</b>    |
|                                |
| Bobolink                       |
| Red-winged Blackbird           |
| Eastern Meadowlark             |
| Yellow-headed Blackbird        |
| Rusty Blackbird                |

|                             |
|-----------------------------|
| <b>Boat-tailed Grackle</b>  |
| <b>Common Grackle</b>       |
| <b>Brown-headed Cowbird</b> |
| <b>Orchard Oriole</b>       |
| <b>Baltimore</b>            |
| <b>Purple Finch</b>         |
| <b>House Finch</b>          |
| <b>Red Crossbill</b>        |
| <b>Common Redpoll</b>       |
| <b>Pine Siskin</b>          |
| <b>American Goldfinch</b>   |
| <b>Evening Grosbeak</b>     |

Table C: Mammals – Working Species List Chincoteague and Wallops Island National Wildlife Refuges (USFWS refuge staff, National Parks Conservation Association 2007, USFWS 1992a and 1993a, USFWS 2007d)

| Common Name                       | Scientific Name                   |
|-----------------------------------|-----------------------------------|
| <b>TERRESTRIAL MAMMALS</b>        |                                   |
| White-tailed Deer                 | <i>Odocoileus Virginianus</i>     |
| * Sika Elk                        | <i>Cervus Caballus</i>            |
| * Wild Ponies                     | <i>Equus Caballus</i>             |
| * Delmarva Peninsula Fox Squirrel | <i>Sciurus Niger Cenerus</i>      |
| * [Eastern Gray Squirrel]         | [ <i>Sciurus carolinensis</i> ]   |
| Muskrat                           | <i>Ondatra Zibethicus</i>         |
| * Virginia Opossum                | <i>Didelphis Virginiana</i>       |
| Raccoon                           | <i>Procyon Lotor</i>              |
| Red Fox                           | <i>Vulpes Vulpes</i>              |
| River Otter                       | <i>Lutra Canadensis</i>           |
| Eastern Cottontail                | <i>Sylvilagus Floridanus</i>      |
| Least Shrew                       | <i>Cryptotis parva</i>            |
| Little Brown Bat                  | <i>Myotis Lucifugus</i>           |
| Silver-haired Bat                 | <i>Lasionycteris Noctivagans</i>  |
| Red Bat                           | <i>Lasiurus Borealis</i>          |
| [Hoary Bat]                       | [ <i>Lasiurus cinereus</i> ]      |
| Meadow Jumping Mouse              | <i>Zapus Hudsonius</i>            |
| * White-footed Mouse              | <i>Peromyscus Leucopus</i>        |
| [Deer Mouse]                      | [ <i>Peromyscus maniculatus</i> ] |
| House Mouse                       | <i>Mus Musculus</i>               |
| * Meadow Vole                     | <i>Microyus Pennsylvanicus</i>    |
| Rice Rat                          | <i>Oryzomys Palustris</i>         |
| * Norway Rat                      | <i>Rattus norvegicus</i>          |
| * Feral Cat                       | <i>Felis catus</i>                |
| <b>MARINE MAMMALS</b>             |                                   |
| [West Indian Manatee]             | [ <i>Trichechus manatus</i> ]     |
| Gray Seal                         | <i>Halichoerus Gryphus</i>        |
| Harbor Seal                       | <i>Phoca Vitulina</i>             |
| Hooded Seal                       | <i>Cystophora Cristata</i>        |
| Atlantic Harbor Porpoise          | <i>Phocoena Phocoena</i>          |
| Risso's Dolphin                   | <i>Grampus Griseus</i>            |
| Bottlenose Dolphin                | <i>Tursiops Truncatus</i>         |
| Spotted Dolphin                   | <i>Stenella Plagiodon</i>         |
| Rough-toothed Dolphin             | <i>Steno Bredanensis</i>          |
| Common Dolphin                    | <i>Delphinus Delphis</i>          |

|                                     |                                          |
|-------------------------------------|------------------------------------------|
| <b>Atlantic White-sided Dolphin</b> | <i>Lagenorhynchus Acutus</i>             |
| <b>Long Finned Pilot Whale</b>      | <i>Globicephala melas</i>                |
| <b>True's Beaked Whale</b>          | <i>Mesoplodon Mirus</i>                  |
| <b>Goosebeak Whale</b>              | <i>Ziphius Cavirostris</i>               |
| <b>Pygmy Sperm Whale</b>            | <i>Kogia Breviceps</i>                   |
| <b>Sperm Whale</b>                  | <i>Physeter catodon (=macrocephalus)</i> |
| <b>Melon-headed Whale</b>           | <i>Peponocephala Electra</i>             |
| <b>Long-finned Pilot Whale</b>      | <i>Globicephala Melaena</i>              |
| <b>[Humpback Whale]</b>             | <i>[Megaptera Novaeangliae]</i>          |
| <b>Minke Whale</b>                  | <i>Balaenoptera Acutorostrata</i>        |
| <b>Fin Back Whale</b>               | <i>Balaenoptera Physalus</i>             |
| <b>Sei Whale</b>                    | <i>Balaenoptera Borealis</i>             |
| <b>Blue Whale</b>                   | <i>Balaenoptera Musculus</i>             |
| <b>Northern Right (Black) Whale</b> | <i>Balaena Glacialis</i>                 |

Note – Species shown in brackets [ ] need confirmation

\* Indicates a non-native species

Table D: Reptiles and Amphibians – Working Species List Chincoteague and Wallops Island National Wildlife Refuges (USFWS refuge staff, National Parks Conservation Association 2007, USFWS 1992a and 1993a, USFWS 2007d)

| Species                              | Scientific Name                            |
|--------------------------------------|--------------------------------------------|
| <b>TOADS AND FROGS</b>               |                                            |
| <b>Fowler's toad</b>                 | <i>Bufo woodhousii fowleri</i>             |
| <b>Green tree frog</b>               | <i>Hyla cinerea</i>                        |
| <b>Bullfrog</b>                      | <i>Rana catesbeiana</i>                    |
| <b>New Jersey Chorus frog</b>        | <i>Pseudacris triseriata kalmi</i>         |
| <b>Green frog</b>                    | <i>Rana clamitans melanota</i>             |
| <b>Southern Leopard frog</b>         | <i>Rana sphenoccephala</i>                 |
| <b>[Gray tree frogs]</b>             | <i>[Hyla versicolor]</i>                   |
| <b>SALAMANDERS</b>                   |                                            |
| <b>Red back Salamander</b>           | <i>Plethodon cinereus</i>                  |
| <b>SNAKES</b>                        |                                            |
| <b>Northern Black racer</b>          | <i>Coluber constrictor constrictor</i>     |
| <b>Black rat snake</b>               | <i>Elaphe obseleta obseleta</i>            |
| <b>Eastern Hognose snake</b>         | <i>Heterodon platirhinos</i>               |
| <b>Rough Green Snake</b>             | <i>Opheodrys aestivus</i>                  |
| <b>Northern Brown snake</b>          | <i>Storeria dekayi dekayi</i>              |
| <b>Northern Water snake</b>          | <i>Nerodia sipedon sipedon</i>             |
| <b>[Ringneck snake]</b>              | <i>[Diadophis punctatus]</i>               |
| <b>TURTLES</b>                       |                                            |
| <b>Spotted Turtle</b>                | <i>Clemmys guttata</i>                     |
| <b>Eastern Box turtle</b>            | <i>Terrapene carolina carolina</i>         |
| <b>Eastern Mud turtle</b>            | <i>Kinosternon subrubrum subrubrum</i>     |
| <b>Northern Diamondback Terrapin</b> | <i>Malaclemys terrapin terrapin</i>        |
| <b>Eastern Painted turtle</b>        | <i>Chrysemys picta picta</i>               |
| <b>Red-bellied turtle</b>            | <i>Pseudemys rubriventris</i>              |
| <b>Common Snapping turtle</b>        | <i>Chelydra serpentina serpentina</i>      |
| <b>SEA TURTLES</b>                   |                                            |
| <b>Loggerhead sea turtle</b>         | <i>Caretta caretta</i>                     |
| <b>Atlantic Green turtle</b>         | <i>Chelonia mydas mydas</i>                |
| <b>Atlantic Ridley turtle</b>        | <i>Leidochelys Kempi</i>                   |
| <b>Leatherback sea turtle</b>        | <i>Dermochelys coriacea</i>                |
| <b>Atlantic Hawksbill sea turtle</b> | <i>Eretmochelys imbricata</i>              |
| <b>LIZARDS</b>                       |                                            |
| <b>[Northern fence Lizard]</b>       | <i>[Sceloporus undulatus hyacinthinus]</i> |
| <b>Five-lined skink</b>              | <i>Eumeces fasciatus</i>                   |

Note – Species shown in brackets [ ] need confirmation

Amphibians and Reptiles Occurring on Chincoteague and Wallops Island NWR<sup>1</sup> (USFWS refuge staff)

| Common Name                   | Scientific Name                        | Most Recent Documented Occurrence   | Habitats and Habits                                                                                                                              |
|-------------------------------|----------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TURTLES</b>                |                                        |                                     |                                                                                                                                                  |
| <b>Spotted turtle</b>         | <i>Clemmys guttata</i>                 | Toadvine 2000                       | Freshwater ponds, ditches & impoundments. Shrub, maritime forest & freshwater marshes. Omnivorous.                                               |
| <b>Eastern box turtle</b>     | <i>Terraepene carolina</i>             | Toadvine 2000                       | Terrestrial in maritime forest, shrub, and dunegrass communities. Sometimes enter water. Omnivorous.                                             |
| <b>Eastern mud turtle</b>     | <i>Kinosternon subrubrum subrubrum</i> | Toadvine 2000                       | Freshwater ponds & impoundments; brackish pools & marshes. Seldom bask. Omnivorous.                                                              |
| <b>Diamondback terrapin</b>   | <i>Malaclemys terrapin terrapin</i>    | Toadvine 2000                       | Salt marsh, fresh marsh, creeks, ponds. Found on all barrier islands, where it lays eggs. Eats mollusks, crabs, marine worms, salt marsh plants. |
| <b>Eastern painted turtle</b> | <i>Chrysemys picta picta</i>           | Toadvine 2000                       | Freshwater ponds & impoundments. Frequently bask on logs. Shrub & woodlands. Omnivorous.                                                         |
| <b>Red-bellied turtle</b>     | <i>Pseudemys rubriventris</i>          | Toadvine 2000                       | Freshwater ponds & impoundments. Shrub, woodland & fresh marshes. Primarily herbivorous.                                                         |
| <b>Common snapping turtle</b> | <i>Chelydra serpentina serpentina</i>  | Toadvine 2000                       | Freshwater ponds & impoundments; brackish marshes. Occasionally bask, but mostly rest on bottom. Omnivorous                                      |
| <b>Loggerhead sea turtle</b>  | <i>Caretta caretta</i>                 | Most recent documented nest in 2012 | Nests on barrier island beaches between high tide and dune line                                                                                  |
| <b>SNAKES</b>                 |                                        |                                     |                                                                                                                                                  |
| <b>Northern black racer</b>   | <i>Coluber constrictor constrictor</i> | Toadvine 2000                       | Mostly in open dunegrass, shrub, or woodland community. Primarily feeds on rodents and frogs. Most abundant snake on Assateague                  |
| <b>Eastern hognose snake</b>  | <i>Heterodon platirhinos</i>           | Toadvine 2000                       | Found in sandy areas with sparse vegetation. Eats toads (mainly Fowler's on Assateague).                                                         |
| <b>Black rat snake</b>        | <i>Elaphe obselea obselea</i>          | Toadvine 2000                       | Hardwood forest or shrub/forest interface. Excellent climber; found in tree cavities. Eats small mammals & birds.                                |

|                               |                                    |                                                                    |                                                                                                                                                  |
|-------------------------------|------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Rough green snake</b>      | <i>Opheodrys aestivus</i>          | Toadvine 2000                                                      | Inhabit shrubs & low trees in all habitats on Assateague. Eats spiders and insects.                                                              |
| <b>Northern brown snake</b>   | <i>Storeria dekayi dekayi</i>      | Mitchell et al. 1993                                               | Completely terrestrial; shrub and woodland habitats. Often under logs & stumps. Eats earthworms & insects.                                       |
| <b>Northern water snake</b>   | <i>Nerodia sipedon</i>             | Toadvine 2000                                                      | In freshwater ponds & impoundments, or basking on logs on the water's edge. Eats amphibians and fish.                                            |
| <b>FROGS &amp; TOADS</b>      |                                    |                                                                    |                                                                                                                                                  |
| <b>Fowler's toad</b>          | <i>Bufo woodhousii fowleri</i>     | Toadvine 2000; Anuran call counts 2003-2005<br>WINWR: Hranitz 2010 | Inhabits all habitats on Assateague except open beach. Tolerates brackish water. Eats insects<br>Fowler's Toads are a prey item to many species. |
| <b>Green tree frog</b>        | <i>Hyla cinerea</i>                | Toadvine 2000; Anuran call counts 2003-2005<br>WINWR: Hranitz 2010 | Salt marsh & freshwater habitats; shrubs & woodland. Often found on tree branches. Eats insects & invertebrates.                                 |
| <b>Cope's gray tree frog</b>  | <i>Hyla chrysocelis</i>            | WINWR: Hranitz 2010                                                | In or near mixed deciduous-coniferous forests w/ ditches for breeding. Arboreal. Not on barrier islands.                                         |
| <b>Bullfrog</b>               | <i>Rana catesbeiana</i>            | Toadvine 2000; Anuran call counts 2003-2005                        | Freshwater ponds and impoundments. Requires permanent water for breeding<br>Feeds on small invertebrates.                                        |
| <b>Southern leopard frog</b>  | <i>Rana sphenoccephala</i>         | Toadvine 2000; Anuran call counts 2003-2005                        | Inhabits most habitats on Assateague except open beach. Feeds on insects.                                                                        |
| <b>New Jersey chorus frog</b> | <i>Pseudacris triseriata kalmi</i> | Lee 1972                                                           | Found only in NJ & Delmarva peninsula. 1 location record on Assateague (near lighthouse) in 1970s.                                               |
| <b>Green frog</b>             | <i>Rana clamitans melanota</i>     | Conant et al. 1990<br>Wallops Island NWR: Hranitz 2010             | Permanent bodies of freshwater, including impoundments. Not recorded on Assateague since 1990s.                                                  |
| <b>SALAMANDERS</b>            |                                    |                                                                    |                                                                                                                                                  |
| <b>Red-back salamander</b>    | <i>Plethodon cinereus</i>          | Toadvine 2000; 2008 Refuge survey                                  | Terrestrial in woodlands. Hides under debris such as fallen logs, and leaf litter. Feeds on small insects.                                       |

Table E: Aquatic Species – Working List Chincoteague and Wallops Island National Wildlife Refuges (USFWS refuge staff, National Parks Conservation Association 2007, USFWS 1992a and 1993a, USFWS 2007d)

| Species                         | Scientific Name                      |
|---------------------------------|--------------------------------------|
| <b>MOLLUSKS AND CRUSTACEANS</b> |                                      |
| Atlantic bay scallop            | <i>Aequipecten irradians</i>         |
| Quahogs (hard shell clam)       | <i>Mercenaria mercenaria</i>         |
| Virginia Oyster                 | <i>Crassostrea virginica</i>         |
| Ribbed mussel                   | <i>Guekensia demissa</i>             |
| Blue crab                       | <i>Callinectes sapidus</i>           |
| Ghost crab                      | <i>Ocypode quadrata</i>              |
| Horseshoe crab                  | <i>Limulus polyphemus</i>            |
| Fiddler Crab                    | <i>Uca</i> spp.                      |
| Mud Snail                       | <i>Nassarius</i> spp.                |
| <b>FINFISH (IMPOUNDMENTS)</b>   |                                      |
| Sheepshead minnow               | <i>Cyprinodon variegatus</i>         |
| Rainwater killifish             | <i>Luncania parva</i>                |
| Striped killifish               | <i>Fundulus majalis</i>              |
| Mummichog                       | <i>Fundulus heteroclitus</i>         |
| Banded killifish                | <i>Fundulus diaphanous</i>           |
| Tidewater silverside            | <i>Menidia beryllina</i>             |
| Threespine stickel-back         | <i>Gasterosteus aculeatus</i>        |
| Fourspine stickel-back          | <i>Apeltes quadracus</i>             |
| White perch                     | <i>Morone americana</i>              |
| Yellow perch                    | <i>Perca flavescens</i>              |
| American eel                    | <i>Anguilla rostrata</i>             |
| <b>FINFISH (MARINE WATERS)</b>  |                                      |
| Black drum                      | <i>Pogonias cromis</i>               |
| Red drum or channel bass        | <i>Sciaenops ocellatus</i>           |
| Bluefish                        | <i>Pomatomus saltatrix</i>           |
| Winter flounder                 | <i>Pseudopleuronectes americanus</i> |
| Summer flounder                 | <i>Paralichthys dentatus</i>         |
| Menhaden                        | <i>Brevoortia tyrannus</i>           |
| Spot                            | <i>Leiostomus xanthurus</i>          |
| Atlantic croaker                | <i>Micropogonias undulates</i>       |
| Weakfish                        | <i>Cynoscion regalis</i>             |
| Mullet                          | <i>Mugil</i> spp.                    |
| Spotted sea trout               | <i>Cynoscion nebulosus</i>           |
| Puffer                          | <i>Sphoeroides maculatus</i>         |
| Rockfish                        | <i>Sebastes</i> spp.                 |
| Spotfin killifish,              | <i>Fundulus luciae</i>               |

|                            |                                |
|----------------------------|--------------------------------|
| <b>King fish</b>           | <i>Scomberomorus commerson</i> |
| <b>Sand tiger shark</b>    | <i>Odontaspis taurus</i>       |
| <b>Bay anchovy</b>         | <i>Anchoa mitchilli</i>        |
| <b>Atlantic silverside</b> | <i>Menidia menidia</i>         |

**Table F: Threatened and Endangered Fauna and Flora in the Chincoteague and Wallops Island NWR's vicinity (Maryland Department of Natural Resources 2005 and n.d.a, Virginia Department of Conservation and Recreation n.d.)**

| Scientific Name                                      | Common Name                       | MD Status  | VA Status       | Federal Status |
|------------------------------------------------------|-----------------------------------|------------|-----------------|----------------|
| <b>FAUNA</b>                                         |                                   |            |                 |                |
| <b>BIRDS</b>                                         |                                   |            |                 |                |
| <i>Charadrius melodus</i>                            | Piping Plover                     | Endangered | Threatened      | Threatened     |
| <i>Charadrius wilsonia</i>                           | Wilson's Plover                   | Endangered | Endangered      |                |
| <i>Falco peregrinus</i>                              | Peregrine Falcon                  |            | Threatened      |                |
| <i>Gelochelidon nilotica</i>                         | Gull-billed Tern                  | Endangered | Threatened      |                |
| <i>Haliaeetus leucocephalus</i>                      | Bald Eagle                        | Threatened | Threatened      |                |
| <i>Sterna antillarum</i>                             | Least Tern                        | Threatened | Special Concern |                |
| <b>MAMMALS</b>                                       |                                   |            |                 |                |
| <i>Balaena Glacialis</i>                             | Northern Right (Black) Whale      | Endangered | Endangered      | Endangered     |
| <i>Balaenoptera Borealis</i>                         | Sei Whale                         | Endangered | Endangered      | Endangered     |
| <i>Balaenoptera Musculus</i>                         | Blue Whale                        | Endangered | Endangered      | Endangered     |
| <i>Balaenoptera Physalus</i>                         | Fin Back Whale                    | Endangered | Endangered      | Endangered     |
| <i>Megaptera Novaeangliae</i>                        | Humpback Whale                    | Endangered | Endangered      | Endangered     |
| <i>Physeter catodon</i><br>(= <i>macrocephalus</i> ) | Sperm Whale                       | Endangered | Endangered      | Endangered     |
| <i>Sciurus niger cinereus</i>                        | Delmarva Fox Squirrel             | Endangered | Endangered      | Endangered     |
| <i>Trichechus manatus</i>                            | West Indian Manatee               |            | Endangered      | Endangered     |
| <b>REPTILES</b>                                      |                                   |            |                 |                |
| <i>Caretta caretta</i>                               | Loggerhead Sea Turtle             | Threatened | Threatened      | Threatened     |
| <i>Chelonia mydas</i>                                | Atlantic Green Turtle             | Threatened | Threatened      | Threatened     |
| <i>Dermochelys coriacea</i>                          | Atlantic Leatherback Turtle       | Endangered | Endangered      | Endangered     |
| <i>Eretmochelys imbricate</i>                        | Atlantic Hawksbill                | Endangered | Endangered      | Endangered     |
| <i>Lepidochelys kempii</i>                           | Atlantic Ridley Turtle            | Endangered | Endangered      | Endangered     |
| <b>INSECTS</b>                                       |                                   |            |                 |                |
| <i>[Cicindela dorsalis dorsalis]</i>                 | [Northeastern Beach Tiger Beetle] |            | Threatened      | Threatened     |
| <i>Cicindela dorsalis media</i>                      | White Tiger Beetle                | Endangered |                 |                |
| <i>Cicindela lepida</i>                              | Little White (Ghost) Tiger Beetle | Endangered |                 |                |
| <b>FLORA</b>                                         |                                   |            |                 |                |

| Vascular Plants               |                         |            |            |            |
|-------------------------------|-------------------------|------------|------------|------------|
| <i>Amaranthus pumilus</i>     | Seabeach Amaranth       | Endangered | Threatened | Threatened |
| <i>Carex silicea</i>          | Sea-beach Sedge         | Endangered |            |            |
| <i>Gymnopogon brevifolius</i> | Broad-leaved Beardgrass | Endangered |            |            |
| <i>Polygonum glaucum</i>      | Seaside Knotweed        | Endangered |            |            |
| <i>Prunus maritime</i>        | Beach Plum              | Endangered |            |            |
| <i>Scleria verticillata</i>   | Whorled Nutrush         | Endangered |            |            |

Table G: Potential Resources of Concern Table. Chincoteague & Wallops Island NWRs, Jan 2011  
(USFWS refuge staff)

| Species                            | Seasons on Refuge <sup>1</sup> | Federal T&E for VA <sup>2</sup> | State T&E <sup>3</sup> |
|------------------------------------|--------------------------------|---------------------------------|------------------------|
| <b>WATERBIRDS</b>                  |                                |                                 |                        |
| American bittern                   | YR                             |                                 |                        |
| Black skimmer                      | B                              |                                 |                        |
| Black tern                         | M                              |                                 |                        |
| Black-headed gull                  | M                              |                                 |                        |
| Black-crowned night heron          | YR                             |                                 |                        |
| Caspian tern                       | M                              |                                 |                        |
| Clapper rail                       | B                              |                                 |                        |
| Common tern                        | B/YR                           |                                 |                        |
| Forster's tern                     | B                              |                                 |                        |
| Glossy ibis                        | YR                             |                                 |                        |
| Green heron                        | B                              |                                 |                        |
| Gull-billed tern                   | B                              |                                 | T                      |
| Herring gull                       | YR                             |                                 |                        |
| Horned grebe                       | W/M                            |                                 |                        |
| Least bittern                      | B                              |                                 |                        |
| Least tern                         | B                              |                                 |                        |
| Little blue heron                  | YR                             |                                 |                        |
| Northern gannet                    | M                              |                                 |                        |
| Red-throated loon                  | W/M                            |                                 |                        |
| Roseate tern                       | M                              | E                               | E                      |
| Royal tern                         | YR                             |                                 |                        |
| Snowy egret                        | YR                             |                                 |                        |
| Sora                               | M                              |                                 |                        |
| Tricolored heron                   | YR                             |                                 |                        |
| Virginia rail                      | B/YR                           |                                 |                        |
| Yellow rail                        | M                              |                                 |                        |
| Yellow-crowned night heron         | YR                             |                                 |                        |
|                                    |                                |                                 |                        |
| <b>WATERFOWL</b>                   |                                |                                 |                        |
| American black duck                | B/YR                           |                                 |                        |
| American wigeon                    | W/M                            |                                 |                        |
| Atlantic brant                     | W/M                            |                                 |                        |
| Black scoter                       | W/M                            |                                 |                        |
| Blue-winged teal                   | B/YR                           |                                 |                        |
| Bufflehead                         | W/M                            |                                 |                        |
| Canada goose – Atlantic Population |                                |                                 |                        |
| Canada goose – North Atlantic      |                                |                                 |                        |
| Canvasback                         | W/M                            |                                 |                        |

|                         |      |   |   |
|-------------------------|------|---|---|
| Common eider            | W/M  |   |   |
| Common goldeneye        | W/M  |   |   |
| Gadwall                 | N/YR |   |   |
| Greater scaup           | W/M  |   |   |
| Greater snow goose      | W/M  |   |   |
| Green-winged teal       | W/M  |   |   |
| Hooded merganser        | W/M  |   |   |
| Lesser scaup            | W/M  |   |   |
| Long-tailed duck        | W/M  |   |   |
| Mallard                 | B/YR |   |   |
| Northern pintail        | W/M  |   |   |
| Red-breasted merganser  | W/M  |   |   |
| Redhead                 | W/M  |   |   |
| Ruddy duck              | W/M  |   |   |
| Surf scoter             | W/M  |   |   |
| Tundra swan – Eastern   | W/M  |   |   |
| White-winged scoter     | W/M  |   |   |
| Wood duck – Eastern     | B/YR |   |   |
|                         |      |   |   |
| <b>SHOREBIRDS</b>       |      |   |   |
| American avocet         | M    |   |   |
| American golden plover  | M    |   |   |
| American oystercatcher  | B/YR |   |   |
| American woodcock       | B/YR |   |   |
| Baird's sandpiper       | M    |   |   |
| Black-bellied plover    | YR   |   |   |
| Buff-breasted sandpiper | M    |   |   |
| Dunlin                  | M/W  |   |   |
| Greater yellowlegs      | YR   |   |   |
| Hudsonian godwit        | M    |   |   |
| Killdeer                | B/YR |   |   |
| Least sandpiper         | YR   |   |   |
| Lesser yellowlegs       | YR   |   |   |
| Long-billed dowitcher   | M/W  |   |   |
| Marbled godwit          | M    |   |   |
| Pectoral sandpiper      | M    |   |   |
| Piping Plover           | B/M  | T | T |
| Red knot                | M    | C |   |
| Red-necked phalarope    | M    |   |   |
| Ruddy turnstone         | M/W  |   |   |
| Sanderling              | M/W  |   |   |
| Semipalmated plover     | M    |   |   |
| Semipalmated sandpiper  | M    |   |   |
| Short-billed dowitcher  | M/W  |   |   |
| Solitary sandpiper      | M    |   |   |
| Spotted sandpiper       | M    |   |   |
| Stilt sandpiper         | M    |   |   |
| Upland sandpiper        | M    |   | T |

|                               |      |  |   |
|-------------------------------|------|--|---|
| Western sandpiper             | M/W  |  |   |
| Whimbrel                      | M/W  |  |   |
| White-rumped sandpiper        | M    |  |   |
| Willet                        | B/YR |  |   |
| Wilson's phalarope            | M    |  |   |
| Wilson's plover               | B/M  |  | E |
| Wilson's snipe                | YR   |  |   |
|                               |      |  |   |
| <b>LANDBIRDS</b>              |      |  |   |
| Bald eagle                    | YR/B |  | T |
| Baltimore oriole              | M    |  |   |
| Barn owl                      | YR   |  |   |
| Black-and-white warbler       | M    |  |   |
| Blue-winged warbler           | M    |  |   |
| Broad-winged hawk             | M    |  |   |
| Brown creeper                 | W/M  |  |   |
| Brown thrasher                | B/YR |  |   |
| Brown-headed nuthatch         | B/YR |  |   |
| Canada warbler                | M    |  |   |
| Chimney swift                 | B    |  |   |
| Chuck-will's-widow            | B    |  |   |
| Eastern kingbird              | B    |  |   |
| Eastern meadowlark            | B    |  |   |
| Eastern towhee                | B/YR |  |   |
| Eastern wood-pewee            | B    |  |   |
| Field sparrow                 | B/YR |  |   |
| Grasshopper sparrow           | B    |  |   |
| Gray catbird                  | B/YR |  |   |
| Great crested flycatcher      | B    |  |   |
| Ipswich savannah sparrow      | W    |  |   |
| Louisiana waterthrush         | M    |  |   |
| Marsh wren                    |      |  |   |
| Nelson's sparrow              | W    |  |   |
| Northern bobwhite             | B/YR |  |   |
| Northern flicker              | B/YR |  |   |
| Northern harrier              | B/YR |  |   |
| Northern parula               | M    |  |   |
| Northern rough-winged swallow | M    |  |   |
| Northern saw-whet owl         | W    |  |   |
| Ovenbird                      | B    |  |   |
| Peregrine falcon              | YR   |  | T |
| Prairie warbler               | B    |  |   |
| Red crossbill                 | W    |  |   |
| Red-headed woodpecker         | B/M  |  |   |
| Rose-breasted grosbeak        | M    |  |   |
| Rusty blackbird               | W    |  |   |

|                               |      |   |   |
|-------------------------------|------|---|---|
| Saltmarsh sparrow             | B/YR |   |   |
| Scarlet tanager               | M    |   |   |
| Seaside Sparrow               | B/YR |   |   |
| Sedge wren                    | W/M  |   |   |
| Short-eared owl               | W    |   |   |
| Willow flycatcher             | M    |   |   |
| Wood thrush                   | M    |   |   |
| Worm-eating warbler           | M    |   |   |
| Yellow warbler                | B    |   |   |
| Yellow-billed cuckoo          | B    |   |   |
| Yellow-breasted chat          | B/YR |   |   |
| Yellow-throated vireo         | M    |   |   |
|                               |      |   |   |
| <b>MAMMALS</b>                |      |   |   |
| Delmarva fox squirrel         | YR   | E | E |
|                               |      |   |   |
| <b>AMPHIBIANS</b>             |      |   |   |
| Eastern spadefoot toad        |      |   |   |
| Eastern tiger salamander      |      |   | E |
| New Jersey chorus frog        |      |   |   |
|                               |      |   |   |
| <b>REPTILES</b>               |      |   |   |
| Eastern box turtle            | YR   |   |   |
| Eastern hognose snake         | YR   |   |   |
| Green sea turtle              |      | T |   |
| Hawksbill sea turtle          |      | E |   |
| Kemp's ridley sea turtle      |      | E |   |
| Leatherback sea turtle        |      | E | E |
| Loggerhead sea turtle         | B    | T | T |
| Northern diamondback terrapin | YR   |   |   |
| Spotted turtle                | YR   |   |   |
|                               |      |   |   |
| <b>FISH</b>                   |      |   |   |
| Alewife                       |      |   |   |
| American eel                  |      |   |   |
| American shad                 |      |   |   |
|                               |      |   |   |
| <b>INVERTEBRATES</b>          |      |   |   |
| Monarch butterfly             | M/B  |   |   |
|                               |      |   |   |
| <b>PLANTS</b>                 |      |   |   |
| Brown-fruited rush            | YR   |   |   |
| Few-flowered beakrush         | YR   |   |   |
| Seabeach amaranth             | YR   | T |   |

|                              |    |  |  |
|------------------------------|----|--|--|
| <b>Southern bladderwort</b>  | YR |  |  |
| <b>Ten-angle pipewort</b>    | YR |  |  |
| <b>White beakrush</b>        | YR |  |  |
| <b>White-topped fleabane</b> | YR |  |  |

1 Seasons on the Refuge: B = Breeding; M = Migrant; W = Winter; YR = Year-Round

2 USFWS: Threatened and Endangered Species System (TESS). Report for the Commonwealth of Virginia.

T = threatened; E = endangered

3 Virginia Comprehensive Wildlife Conservation Strategy. 2005. Data from the Excel file developed by the Federal Aid office of USFWS, Hadley, MA. Sept. 2006

E = endangered; T = threatened

Does not include state listed plants.

**Table H: Fish Species Collected from Refuge Fish Surveys (USFWS 1997 and Mangold and Eyer 2006)**

| Common Name          | Scientific Name                 | 1996 Survey | 2005/06 Survey |
|----------------------|---------------------------------|-------------|----------------|
| Alewife*             | <i>Alosa pseudoharengus</i>     | X           |                |
| American eel*        | <i>Anguillia rostrata</i>       | X           | X              |
| Atlantic menhaden    | <i>Brevoortia tyrannus</i>      | X           | X              |
| Atlantic needlefish  | <i>Stronglura manna</i>         | X           | X              |
| Atlantic silverside  | <i>Menidia menidia</i>          | X           | X              |
| Bay anchovy          | <i>Anchoa mitchilli</i>         | X           | X              |
| Black drum           | <i>Pogonias cromis</i>          | X           |                |
| Black seabass        | <i>Centropristis stiata</i>     | X           | X              |
| Bluefish             | <i>Pomatomus saltatrix</i>      | X           |                |
| Green goby           | <i>Microgobius thalassinus</i>  |             | X              |
| Inland silverside    | <i>Minidia beryllina</i>        |             | X              |
| Marsh killifish      | <i>Fundulus confluentus</i>     | X           |                |
| Ladyfish             | <i>Elops saurus</i>             | X           |                |
| Mosquitofish         | <i>Gambusia affinis</i>         |             | X              |
| Mummichog            | <i>Fundulus heteroclitus</i>    | X           | X              |
| Northern puffer      | <i>Sphoeroides maculatus</i>    | X           |                |
| Northern kingfish    | <i>Menticirrhus saxatilis</i>   | X           | X              |
| Oyster toadfish      | <i>Opsanus tau</i>              | X           | X              |
| Permit               | <i>Chilomycterus schoepfi</i>   | X           |                |
| Pigfish              | <i>Orthopristis chrysoptera</i> | X           | X              |
| Rainwater killifish  | <i>Lucania parva</i>            | X           | X              |
| Reef butterflyfish   | <i>Cheatoodon sedentarius</i>   |             | X              |
| Sheepshead minnow    | <i>Cyprinodon variegatus</i>    | X           | X              |
| Silver jenny         | <i>Eucinostomus gula</i>        | X           |                |
| Silver perch         | <i>Bairdiella chrysoura</i>     | X           | X              |
| Skilletfish          | <i>Gobiosox strumosus</i>       | X           |                |
| Small mouth flounder | <i>Etropus cyclosquamus</i>     | X           |                |
| Spiny butterfly ray  | <i>Gymnura altavela</i>         | X           |                |
| Spot                 | <i>Leiostomus xanthurus</i>     | X           | X              |
| Striped Anchovy      | <i>Anchoa hepsetus</i>          | X           |                |
| Striped blenny       | <i>Meiacanthus glammistes</i>   | X           | X              |
| Striped burrfish     | <i>Chilomycterus schoepfi</i>   | X           | X              |
| Striped killifish    | <i>Fundulus majalis</i>         | X           | X              |
| Striped mullet       | <i>Mugil cephalus</i>           | X           |                |
| Summer flounder      | <i>Paralichthys dentatus</i>    | X           |                |
| Tautog               | <i>Tautoga onitis</i>           | X           |                |
| Weakfish             | <i>Cynoscion regalis</i>        | X           |                |
| White mullet         | <i>Mugil curema</i>             | X           | X              |
| White perch          | <i>Morone Americana</i>         | X           | X              |
| Winter flounder      | <i>Pleuronectes americanus</i>  | X           |                |

X in column indicates the species was encountered during that survey

\* Alewife & American Eel are State Conservation Priorities and Federal Trust Species

**Table I: Top Twenty Most Abundant Bird Species: Chincoteague NWR Landbird Surveys Listed in relative order of abundance (USFWS refuge staff, Chincoteague NWR 1996, Ailes and Ailes 2007, Roberts 2008)**

| Order of Abundance | BBS Route 1996-2006<br>Myrtle Shrub | BBS Route 1996-2006<br>Loblolly Forest | Mist Net Study 1999-2007<br>All Sites |
|--------------------|-------------------------------------|----------------------------------------|---------------------------------------|
| 1                  | Common yellowthroat*                | House wren***                          | Yellow-rumped warbler                 |
| 2                  | Eastern towhee**                    | Eastern wood-peewee                    | #Gray catbird*                        |
| 3                  | #Field sparrow***                   | Pine warbler                           | Common yellowthroat*                  |
| 4                  | #Northern bobwhite**                | #Eastern towhee**                      | White-throated sparrow                |
| 5                  | Song sparrow***                     | Northern cardinal*                     | Song sparrow***                       |
| 6                  | Red-winged blackbird**              | #Gray catbird*                         | House wren***                         |
| 7                  | Yellow warbler                      | #Northern bobwhite**                   | Northern cardinal*                    |
| 8                  | Yellow-breasted chat***             | American robin                         | Swamp sparrow                         |
| 9                  | #Gray catbird*                      | Carolina wren***                       | Common grackle*                       |
| 10                 | Boat-tailed grackle                 | #Great-crested flycatcher              | Carolina wren***                      |
| 11                 | Eastern kingbird                    | Common grackle*                        | Golden-crowned kinglet                |
| 12                 | Common grackle*                     | American crow                          | #Field sparrow***                     |
| 13                 | #Brown thrasher**                   | Common yellowthroat*                   | Western palm warbler                  |
| 14                 | Brown-headed cowbird**              | Red-winged blackbird**                 | Slate-colored junco                   |
| 15                 | Eastern meadowlark                  | Brown-headed cowbird**                 | Yellow-breasted chat***               |
| 16                 | Yellow-billed cuckoo                | #Brown thrasher**                      | Ruby-crowned kinglet                  |
| 17                 | Fish Crow                           | Mourning dove                          | American redstart                     |
| 18                 | Northern cardinal*                  | #Yellow-shafted flicker                | White-eyed vireo                      |
| 19                 | #Prairie warbler                    | #Brown-headed nuthatch                 | Magnolia warbler                      |
| 20                 | Tree Swallow                        | Ovenbird                               | Carolina chickadee                    |

#Listed as a Bird of Conservation Concern in BCR 30 (New England/Mid-Atlantic Coast)

\*Top 20 most abundant on all three studies

\*\*Top 20 most abundant on two BBS routes

\*\*\*Top 20 most abundant on one BBS route and Robert's Mist Net Study (Roberts 2009)

## Appendix M



USFWS

*Egret at Nightfall*

# **Chincoteague National Wildlife Refuge Economic Analysis in Support of Comprehensive Conservation Plan**



# Division of Economics

## US Fish and Wildlife Service

January 2013

### Public Review Draft

### Chincoteague National Wildlife Refuge Economic Analysis In Support of Comprehensive Conservation Plan

Prepared by:  
Division of Economics  
US Fish and Wildlife Service  
4401 N. Fairfax Drive  
MS 7081-43  
Arlington, VA 22203

## Table of Contents

|                                                                                                           |           |
|-----------------------------------------------------------------------------------------------------------|-----------|
| <b>1.0. Introduction</b> .....                                                                            | <b>2</b>  |
| 1.1. Refuge Profile.....                                                                                  | 4         |
| <b>2.0. Socio-demographics of Chincoteague and Accomack County</b> .....                                  | <b>6</b>  |
| 2.1. Population .....                                                                                     | 6         |
| 2.2 Demographics .....                                                                                    | 8         |
| 2.3 Households and Housing.....                                                                           | 8         |
| 2.4 Education and Earnings.....                                                                           | 9         |
| 2.5 Employment and Earnings by Industry .....                                                             | 11        |
| <b>3.0. Economic Characteristics of Chincoteague and Accomack County</b> .....                            | <b>14</b> |
| 3.1. Establishments and Employment.....                                                                   | 14        |
| 3.2 Town Revenues.....                                                                                    | 19        |
| 3.3 Commercial Shell and Finishing .....                                                                  | 22        |
| 3.3 NASA Wallops Flight Facility and Mid-Atlantic Regional Spaceport .....                                | 25        |
| 3.4 Accomack County.....                                                                                  | 25        |
| <b>4.0. Chincoteague National Wildlife Refuge Recreation Visits and Associated Economic Impacts</b> ..... | <b>27</b> |
| 4.1. Chincoteague NWR Visitor Use.....                                                                    | 28        |
| 4.2. Economic Impact on Refuge Visitation .....                                                           | 31        |
| 4.2.1. Major Assumptions .....                                                                            | 32        |
| 4.2.2. Economic Impact measures .....                                                                     | 33        |
| 4.2.3. Accomack and Worcester Counties Economic Impacts.....                                              | 34        |
| 4.2.4. Chincoteague Economic Impacts from Refuge Visitation.....                                          | 35        |
| <b>5.0. Chincoteague National Wildlife Refuge Budget Expenditures</b> .....                               | <b>38</b> |
| 5.1. Refuge Expenditures .....                                                                            | 38        |
| 5.2. Refuge Revenue Sharing and Payments in Lieu of taxes .....                                           | 40        |
| <b>6.0. Analysis of Alternatives</b> .....                                                                | <b>41</b> |
| 6.1 Alternative A.....                                                                                    | 41        |
| 6.2 Alternative C.....                                                                                    | 47        |
| <b>7.0. References</b> .....                                                                              | <b>49</b> |

## 1.0 Introduction

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a refuge and provide long-range guidance and management direction to achieve refuge purposes. The U.S. Fish and Wildlife Service is in the process of developing a range of management goals, objectives, and strategies for the Chincoteague and NASA Wallops Island National Wildlife Refuges CCP. The CCP for the refuge must contain an analysis of expected effects associated with current and proposed refuge management strategies.

Chincoteague NWR (CNWR) was established on May 13, 1943 through acquisition of 8,808 acres under authority of the Migratory Bird Conservation Act. The Assistant Secretary of the Interior determined that FWS ownership of this land was necessary for protection during nesting and migration seasons of all those species of wildlife determined as being of great value as a source of food, or in destroying of injurious insects, or nevertheless in danger of extermination through lack of adequate protection (U.S. District Court 1943). The Migratory Bird Conservation Commission (MBCC) initially approved the Refuge at a meeting on March 25, 1941, acknowledging the importance of Assateague Island important wintering habitat for migrating greater snow goose, and nesting habitat for black ducks, shorebirds, and migratory birds (MBCC 1941). At that time they also approved acquisition of Jerico and Hebron Islands, two small marshes adjacent to Assateague Island, just north of the Virginia boundary in Maryland.

Since 1943, numerous tracts of land have been added to CNWR. All lands have been purchased with money from either the Migratory Bird Conservation Fund or the Land and Water Conservation Fund. Federal title of these lands is acquired to the mean low water line. In 1990 Assawoman and portions of Metompkin Island (1,608.5 acres total) were purchased with Land and Water Conservation Funds, which come from royalties on off-shore oil drilling.

Refuge purposes are taken from enabling legislation and acquisition authorities for a particular refuge and from Congressional legislation affecting the refuge system as a whole. CNWR purposes include: preserving and enhancing endangered species; protecting and enhancing habitat for migratory and non-migratory species; maintaining indigenous species; and, providing opportunities for wildlife-dependent recreation (CNWR 1993). The Service database (<http://refugedata.fws.gov/databases/purposes>) lists the following Refuge Purposes for CNWR:

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” (16 U.S.C. 715d) (Migratory Bird Conservation Act).

“...suitable for B (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species...( 16 U.S.C. 460k-1) “...the Secretary ... may accept and use real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” (16 U.S.C. 460k-2) Refuge Receptions Act (16 U.S.C. 460k-460k-4), as amended.

“... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ...”(16 U.S.C. 3901(b), 100 Stat. 3583 Emergency Wetlands Resources Act of 1986)

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources ...” ( 16 U.S.C. 742f(a)(4) “... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ...”( 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)

"... for conservation purposes ..." (7 U.S.C. 2002 (Consolidated Farm and Rural Development Act)

In 1997, Congress passed the landmark National Wildlife Refuge System Improvement Act (NWRISA) establishing a unifying mission and a wildlife-first mandate for the Refuge System. The NWRISA affirmed that: refuges are anchors for biodiversity and ecosystem-level conservation; lands and waters of the System are biologically healthy; and refuge lands reflect national and international leadership in habitat management and wildlife conservation.

The NWRISA also declares that all existing and proposed public uses must be compatible with each refuge's purposes, and highlights six priority public uses that each Refuge should evaluate for compatibility. These are wildlife observation, photography, interpretation, environmental education, hunting and fishing. Recreational activities allowed on CNWR are also influenced by portions of Assateague Island being within the Assateague Island National Seashore (ASIS).

Recreational use and related development on Assateague Island were authorized under Public Law 85 57, Chincoteague National Wildlife Refuge, Virginia – Bridge and Road, approved on June 17, 1957, that provided for construction of a bridge and road to the Refuge beach as well as recreational facilities “to permit the controlled development of a portion of the seashore of the Chincoteague National Wildlife Refuge, Virginia for recreational purposes.” These “easements and other rights” are subject to “such terms and conditions as the Secretary deems appropriate for the adequate protection of the wildlife refuge and other interests of United States.”

The 1962 Refuge Recreation Act (16U.S.C. 460K – 460K – 4) expanded the purpose of all refuges to include “... (1) incidental fish and wildlife-oriented recreation development, (2) the protection of natural resources, (3) the conservation of endangered species and threatened species...”

On September 21, 1965, the Assateague Island Seashore Act authorized establishment of the Assateague Island National Seashore (ASIS). The ASIS encompasses the Maryland side of Assateague Island and certain beach portions of the Virginia side of Assateague Island. The Act provided that the National Park Service (NPS) manage the Virginia portion for general purposes of public outdoor recreation with the qualification that land and water within the Refuge be administered for purposes under laws and regulations applicable to national wildlife refuges, including administration for public recreation use in accordance with the provisions of the Refuge Recreation Act (P.L. 87-714 (USFWS 1993).

NASA Wallops Island National Wildlife Refuge (WINWR) was created on July 10, 1975 with the transfer of 373 acres of land to the Service from the National Aeronautics and Space Administration (NASA/Goddard Space Flight Center/Wallops Flight Facility). NASA Wallops Island NWR is located entirely in Accomack County, Virginia. The primary purpose for this land transfer was for wildlife conservation and the “... particular value in carrying out the national migratory bird management program.” (16 U.S.C. 667b-667d).

The Chincoteague NWR is open to the public for recreational uses centered around wildlife and wildland activities. Access to the Refuge is primarily through the town of Chincoteague, which has become a town

whose economy is increasingly dependent on the tourism dollars brought into their community by Refuge visitors.

The purpose of this analysis is to provide a better understanding of the economic relationship between the Refuge and the community. For CCP planning, a regional economic assessment provides a means of estimating how current management (no action alternative) and proposed management activities (alternatives) could affect the local economy. This type of analysis provides two critical pieces of information. First it illustrates a refuge's contribution to the local community. Second, it can help in determining whether local economic effects are or are not a real concern in choosing among management alternatives.

This report is organized as follows: (1) a general summary of demographic characteristics of Accomack County and the Town of Chincoteague (Chincoteague); (2) a discussion of the economic characteristics of Accomack County and Chincoteague, with the focus on Chincoteague; (3) a discussion of Chincoteague National Wildlife Refuge visitation and the associated economic impacts; (4) estimates of how the economies of Chincoteague and Accomack County are impacted by Refuge visitors; and (5) an estimate of the economic impacts to the local and regional area of Refuge budget expenditures.

### 1.1 Refuge Profile

The original purpose for the establishment of Chincoteague NWR was "...for use as an inviolate sanctuary or for any other management purpose, for migratory birds" (16 U.S.C. § 715d, Migratory Bird Conservation Act), especially migrating and wintering waterfowl. Approximately 2,600 acres of fresh and brackish water impoundments on Chincoteague NWR have been created and managed for migrating and wintering waterfowl and other migratory birds. Chincoteague NWR also provides and manages habitat for the American black ducks, as part of a long-term effort, in compliance with the North American Waterfowl Management Plan, to reverse significant drops in this species' populations. These efforts also benefit other wildlife, especially shore and wading birds.

Today, wildlife management strategies at Chincoteague NWR continue to provide quality habitat for migrating and wintering waterfowl but also include a greater variety of wildlife, such as wading birds, shorebirds, and neotropical migrants. For example, Chincoteague NWR supports breeding populations of the endangered Delmarva fox squirrel and the threatened piping plover. The American peregrine falcon (a recently delisted threatened and endangered species) is seen quite frequently during its annual autumn migration. Additionally, the Atlantic loggerhead sea turtle is a threatened species that nests occasionally on Chincoteague NWR. Refuge management programs are targeted to provide feeding and resting areas for birds in migration, and nesting and brood-rearing habitat for those birds that find Chincoteague NWR suitable for reproduction. To this end, Chincoteague NWR continues efforts toward acquiring land and water for increased conservation of migratory bird resources and to protect important wildlife habitat from the impacts of development.

Chincoteague NWR has been designated as a Globally Important Bird Area by the American Bird Conservancy, designated as one of the top ten birding Hotspots by the National Audubon Society, and a Site of International Importance within the Western Hemisphere Shorebird Reserve Network, a conservation partnership of stewards and landowners led by the Manomet Center for Conservation Sciences. This coastal barrier island/lagoon system has been designated a World Biosphere Reserve by the United Nations Educational, Scientific, and Cultural Organization in recognition of its great

ecological value. Moreover, the Department of the Interior designated the area a National Natural Landmark in recognition of its outstanding natural values.

Chincoteague NWR is also an important recreational destination, particularly for people living in the Washington D.C., Baltimore, Philadelphia, and New York City areas. With approximately 1.25 million visits annually, Chincoteague NWR is one of the most visited refuges in the United States, providing visitors with the six wildlife-dependent recreation opportunities (hunting, fishing, wildlife observation and photography, environmental education and interpretation), as well as other public uses that have been deemed appropriate and compatible, including a recreational beach, which is managed by the NPS under an agreement with USFWS. Visitation to Chincoteague NWR supports the tourism economy of the Town of Chincoteague, which is the refuge's gateway community and is located on Chincoteague Island, and through which visitors must travel to access Chincoteague NWR.

A bridge spanning Assateague Channel separates Refuge headquarters from the Town of Chincoteague. Chincoteague, the largest community in Accomack County (population 33,164), had approximately 2,941 permanent residents in 2009 (Chincoteague 2009). Numerous small rural communities and towns surround the Refuge. The Refuge headquarters and visitor center are located about two miles from the Chincoteague town center.

The Refuge has a single entry point for vehicle traffic, which is accessed via the Town of Chincoteague. Visitors come to the Refuge to participate in a variety of activities including wildlife watching, surf fishing, and general beach recreation. The Refuge is well known for its wild pony population, popularized by the bestselling children's book, Misty of Chincoteague by Marguerite Henry first published in 1947. This book popularized the annual roundup of the Assateague Island ponies that are located on the Refuge. These animals are herded to the Assateague Channel where they then swim across to Chincoteague Island where the foals are then auctioned off to benefit the Chincoteague Volunteer Fire Company. The event attracts tens of thousands of tourists every year to witness the pony swim.

The first European explorer to record landing in the Assateague Island vicinity was Giovanni da Verrazano, sailing for the King of France in 1524 (Bearss, 1968). During the next one-hundred years, many explorers investigated the area but colonists preferred the better soils and protected environments of the mainland. In the mid-1600's Chincoteague and Assateague Islands were used to graze livestock by landowners wanting to avoid fencing ordinances on the mainland. Camps for livestock herders were established (Bearss, 1968 and Wroten, 1972); salt extraction and shell-fishing brought more seasonal inhabitants. These activities remain currently popular on the Refuge.

Chincoteague NWR (CNWR) was established on May 13, 1943 through acquisition of 8,808 acres under authority of the Migratory Bird Conservation Act. The Assistant Secretary of the Interior determined that FWS ownership of this land was necessary for protection during nesting and migration seasons of all those species of wildlife determined as being of great value as a source of food, or in destroying of injurious insects, or nevertheless in danger of extermination through lack of adequate protection (U.S. District Court 1943). The Migratory Bird Conservation Commission (MBCC) initially approved the Refuge at a meeting on March 25, 1941, acknowledging the importance of Assateague Island important wintering habitat for migrating greater snow goose, and nesting habitat for black ducks, shorebirds, and migratory birds (MBCC 1941). At that time they also approved acquisition of Jerico and Hebron Islands, two small marshes adjacent to Assateague Island, just north of the Virginia boundary in Maryland.

Today, the Refuge is well known for its population of wild ponies. The Chincoteague ponies are most likely descendants of colonial horses brought to Assateague Island in the 17<sup>th</sup> century by Eastern Shore planters (AINS, 1986 and Bearss, 1968) when crop damage caused by free roaming animals led colonial legislatures to enact laws requiring fencing and taxes on livestock (AINS, no date). The modern day descendants of those domestic horses are wild and have adapted to their environment. Today, the ponies found on the Refuge are owned by the Chincoteague Volunteer Fire Company (CVFC). The Refuge permits the CVFC to graze their ponies within two designated areas on the Refuge. Following tradition, the Fire Company rounds up the entire herd (approximately 150 adult ponies plus foals) for the Annual Pony Penning and Auction held on the last Wednesday and Thursday of July; all foals and yearlings are sold at auction to benefit the town's ambulance and fire services.

## 2.0. Socio-Demographics of Accomack County and Chincoteague

This section provides an overview of basic socio-demographic information for the Town of Chincoteague as well as for Accomack County, the State of Virginia, and the United States for comparative purposes. This information is being provided so that both current and future refuge managers and workers who base decisions on this CCP will have a better appreciation for the nearby communities that surround the refuge. This information should help the refuge better understand how their management decisions may impact Town residents and their livelihood. This information may also help Refuge management better communicate to local officials and residents rationales behind their decisions.

In October 2011, the U.S. Fish and Wildlife Service released “Conserving the Future, Wildlife Refuges and the Next Generation.” The document reflects the Service’s vision that will guide the management of the Refuge System during the next decade and beyond. The Service recognizes in this document that successful conservation will require strategic, collaborative, science-based landscape conservation – along with effective public outreach, education, and environmental awareness. The Service recognizes that forming partnerships with other federal, State, and local government agencies as well as conservation-oriented non-profits is a necessary step for success. Themes that are adopted in the document include: relevance to a changing America, the impact of a changing climate, the need for conservation at the landscape scale, the necessity of partnership and collaboration, and the absolute importance of scientific excellence.

The socio-demographic information contained in this document will hopefully serve as a basis for both current and future Refuge managers to better understand the basic characteristics of the people and communities that surround the Refuge, which hopefully will be used to improve outreach and collaborative projects that will benefit both the Refuge and its trust species as well as the communities economic well-being.

### 2.1 Population

According to the U.S. Census Bureau the population of Chincoteague grew 21 percent from 3,572 to 4,317 individuals between 1990 and 2000 but declined to 2,941 residents in 2010.<sup>1</sup> The population in

<sup>1</sup> U.S. Census Bureau, 2010 Demographic Profile Data, DP-1. Accessed at [www.factfinder2.census.gov](http://www.factfinder2.census.gov) on March 20, 2012.

2010 reflects a 32 percent decline from the 2000 Census count.<sup>2</sup> In comparison, Accomack County's population declined by 13.4 percent in contrast to the change in total population for the State, which increased by 13 percent an amount greater than the nation's<sup>7</sup>. Table 1 shows the comparison between these geographical entities.

**Table 1**  
**Change in Population, 2010 and 2000**

| Year  | Chincoteague Town | Accomack County | Virginia  | U.S.        |
|-------|-------------------|-----------------|-----------|-------------|
| 2010  | 2,941             | 33,164          | 8,001,024 | 308,745,538 |
| 2000  | 4,317             | 38,305          | 7,078,515 | 281,421,906 |
| % chg | -31.9%            | -13.4%          | 13.0%     | 9.7%        |

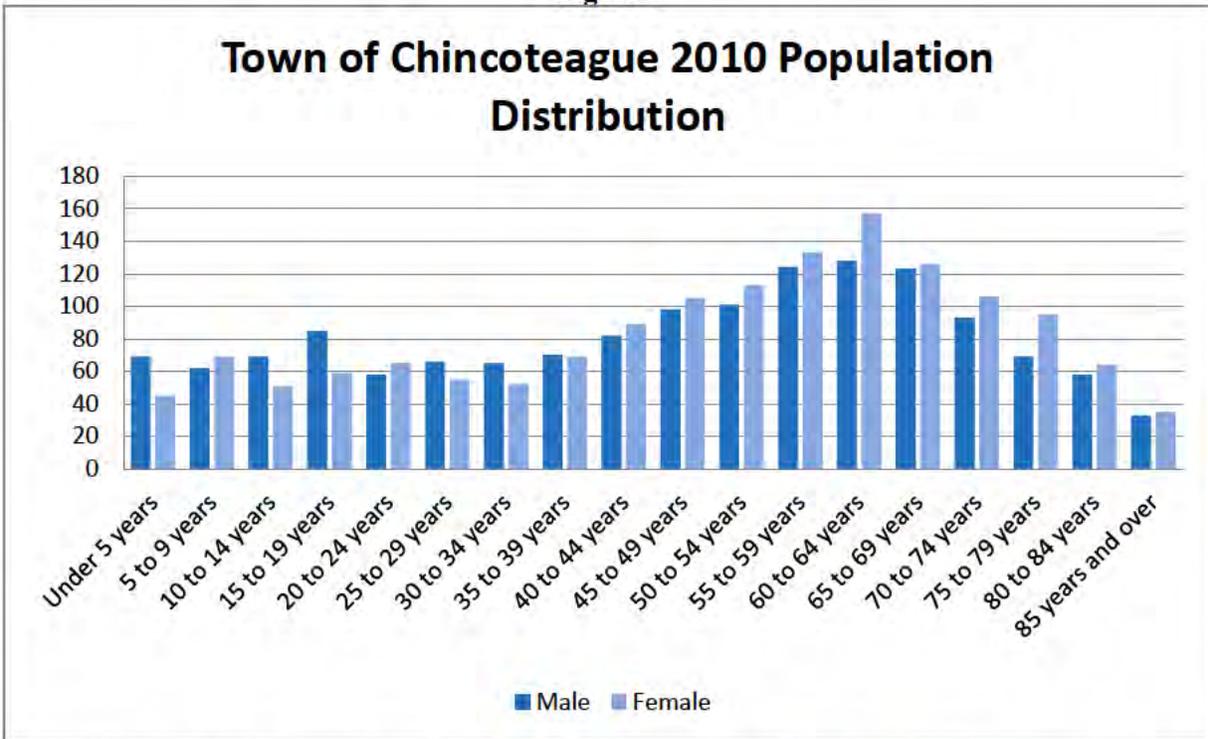
U.S. Census Bureau, 2010 and 2000 Demographic Profile Data, DP-1. Accessed at [www.factfinder2.census.gov](http://www.factfinder2.census.gov) on March 20, 2012

Figure 1 shows the breakdown of population by sex and age group category for the Town of Chincoteague. The table shows that the Town's residents skew towards the elderly. Individuals between 60 and 64 years constitute the greatest number of residents. The table also shows a decline in residents for the years 20 through 40, which likely reflects an outward migration of individuals after completing high school as they continue their educations or look for employment elsewhere.

Figure 2 compares the percentage of all residents by age category between the Town of Chincoteague and the U.S. The table shows that up until the age of 50, the Town of Chincoteague has significantly fewer children, young adults and middle aged adults than the national average. Beyond age 50 the Town has proportionally more adults in every age-group than the national averages, reflecting the Town's desirability as a retirement destination.

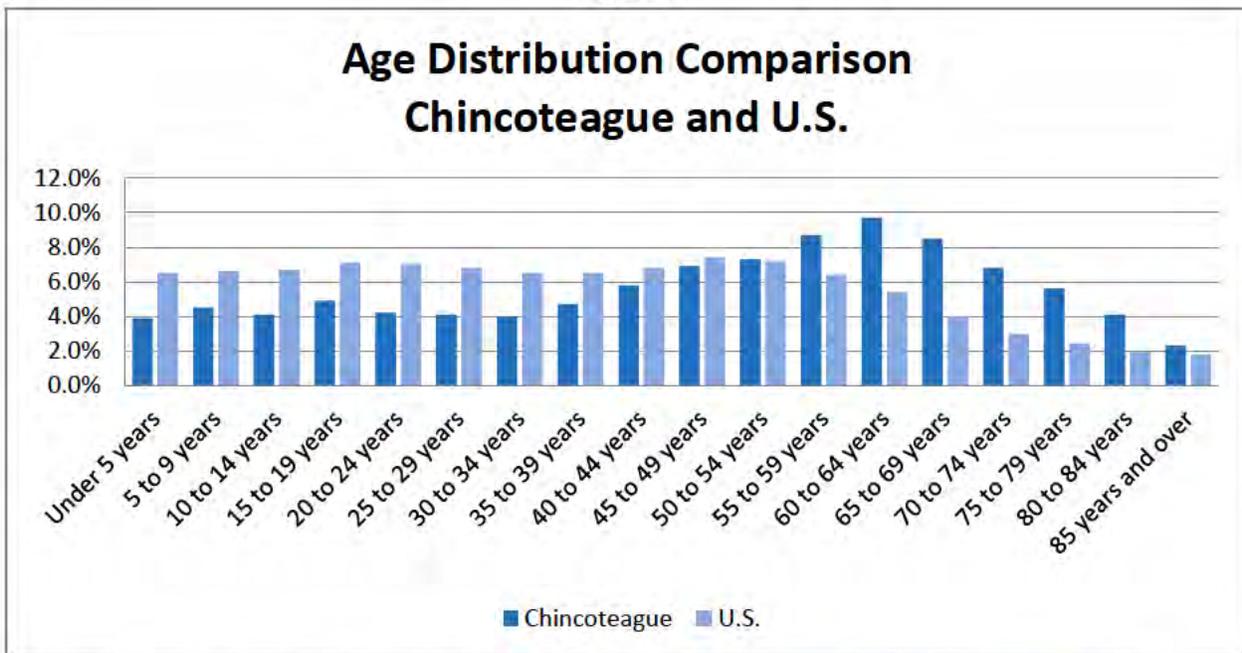
<sup>2</sup> It is noted that the Town of Chincoteague disagrees with the Census findings and believes that the resident population is approximately 3,974. Town Resolution, April 6, 2011.

Figure 1



Source: U.S. Census Bureau, 2010 Demographic Profile Data, DP-1. Accessed at [www.factfinder2.census.gov](http://www.factfinder2.census.gov) on March 20, 2012.

Figure 2



Source: U.S. Census Bureau, 2010 Demographic Profile Data, DP-1. Accessed at [www.factfinder2.census.gov](http://www.factfinder2.census.gov) on March 20, 2012.

## 2.2 Demographics

The Town of Chincoteague is not as racially or ethnically diversified as the rest of the County, State, or nation. The 2010 Census reports that over 95 percent of the Town residents are white compared to 65 percent for Accomack County, 68 percent for Virginia, and 72 percent for the nation as a whole. Hispanics also constitute a small percentage of the ethnic composition of the Town (1.7 percent) compared to the county (8.6 percent), State (7.9 percent), or nation (16.3 percent). Table 2 provides a breakdown of the racial and ethnic composition of the Town along with the corresponding data for the county, State, and nation for comparative purposes.

**Table 2**  
**Racial and Ethnic Characteristics**

| Race and Ethnicity                | Chincoteague Town    | Accomack County | Virginia  | U.S.        |
|-----------------------------------|----------------------|-----------------|-----------|-------------|
| Total population                  | 2,941 <sup>(1)</sup> | 33,164          | 8,001,024 | 308,745,538 |
| One race                          | 97.2%                | 98.4%           | 97.1%     | 97.1%       |
| White                             | 95.3%                | 65.3%           | 68.6%     | 72.4%       |
| Black or African American         | 0.8%                 | 28.1%           | 19.4%     | 12.6%       |
| American Indian and Alaska Native | 0.3%                 | 0.4%            | 0.4%      | 0.9%        |
| Asian                             | 0.6%                 | 0.6%            | 5.5%      | 4.8%        |
| Other                             | 3.0%                 | 5.7%            | 6.2%      | 9.3%        |
| Hispanic or Latino (of any race)  | 1.7%                 | 8.6%            | 7.9%      | 16.3%       |

(1) The Town of Chincoteague officially disagrees with the Census findings and believes that the correct population count is 3,974. April 7, 2011 Resolution.  
Source: U.S. Census; 2010 Census Data, Summary File 1.

## 2.3 Households and Housing

There are 1,417 households living in the Town of Chincoteague, according to the 2010 U.S. Census. Census defines a household as all the people who occupy a housing unit. A housing unit is a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied. The average household size was 2.06 persons, which if multiplied by the total number of households corresponds to the Town's population.

Family households constituted 61.2 percent of the total number of Chincoteague households, which is about five percent less than the county, State, or national percentages. A family household is defined by Census as a householder living with one or more individuals related to him or her by birth, marriage, or adoption. Census data shows that Chincoteague family sizes were slightly smaller than the county, State,

or national percentages, likely reflecting the fact that Chincoteague draws proportionally more elderly married couples, without kids, due to its desirability as a retirement community. In fact, over 40 percent of the total number of Chincoteague households consisted of individuals 65 years and over. Table 3 presents the household characteristics for the Town, county, State, and nation.

**Table 3**  
**Household Characteristics**

|                                               | Chincoteague | Accomack | Virginia  | US          |
|-----------------------------------------------|--------------|----------|-----------|-------------|
| Total households                              | 1,417        | 13,798   | 3,056,058 | 116,716,292 |
| Family households (families)                  | 61.2%        | 66.1%    | 67.0%     | 66.4%       |
| With own children under 18 years              | 17.7%        | 22.9%    | 29.9%     | 29.8%       |
| Households with individuals under 18 years    | 20.1%        | 27.7%    | 33.4%     | 33.4%       |
| Households with individuals 65 years and over | 41.4%        | 33.8%    | 23.3%     | 24.9%       |
| Average household size                        | 2.06         | 2.37     | 2.54      | 2.58        |
| Average family size                           | 2.58         | 2.88     | 3.06      | 3.14        |

Source: U.S. Census, DP-1: Profile of General Population and Housing Characteristics: 2010.

Chincoteague has nearly three times the number of housing units as total households, reflecting the town's linkages to the tourism-based industry. Census reports that nearly 60 percent of all vacant housing units were built for seasonal, recreational, or occasional use, compared to the State average of 2.4 percent. Table 4 shows some of the key housing characteristics for the Town, along with those for the county, State, and nation.

**Table 4**  
**Housing Characteristics**

|                                               | Chincoteague | Accomack | Virginia  | US          |
|-----------------------------------------------|--------------|----------|-----------|-------------|
| Total housing units                           | 4,517        | 21,002   | 3,364,939 | 131,704,730 |
| Occupied housing units                        | 31.4%        | 65.7%    | 90.8%     | 88.6%       |
| Vacant housing units                          | 68.6%        | 34.3%    | 9.2%      | 11.4%       |
| For rent                                      | 4.4%         | 2.7%     | 2.5%      | 3.1%        |
| Rented, not occupied                          | 0.2%         | 0.2%     | 0.2%      | 0.2%        |
| For sale only                                 | 2.5%         | 2.1%     | 1.3%      | 1.4%        |
| Sold, not occupied                            | 0.2%         | 0.4%     | 0.3%      | 0.3%        |
| For seasonal, recreational, or occasional use | 59.5%        | 23.0%    | 2.4%      | 3.5%        |
| All other vacants                             | 1.8%         | 5.9%     | 2.6%      | 2.8%        |
| Homeowner vacancy rate                        | 9.5%         | 4.1%     | 2.1%      | 2.4%        |
| Rental vacancy rate                           | 36.0%        | 12.9%    | 7.6%      | 9.2%        |

Source: U.S. Census, DP-1: Profile of General Population and Housing Characteristics: 2010.

## 2.4 Education and Earnings

Over 83 percent of Chincoteague residents have a high school degree or higher, which is near the national average of 85 percent. Compared to the county, Chincoteague has a higher percentage of residents with a bachelor's, graduate, or professional degree (13.7 percent vs. 10.3 percent). Only 16.6 percent of Chincoteague residents have not achieved a high school diploma, which is less than the county but more than the State average (13.9 percent) and nation (14.9 percent). Table 5 provides an overview of education attainment for the Town, county, State, and nation.

**Table 5**  
**Educational Attainment for Population 25 years and Over**

|                                             | <b>Chincoteague town,<br/>Virginia</b> | <b>Accomack County,<br/>Virginia</b> | <b>Virginia</b> | <b>United<br/>States</b> |
|---------------------------------------------|----------------------------------------|--------------------------------------|-----------------|--------------------------|
|                                             | Total                                  | Total                                | Total           | Total                    |
|                                             | Estimate                               | Estimate                             | Estimate        | Estimate                 |
| Population 25 years and over                | 2,529                                  | 24,217                               | 5,208,536       | 199,726,659              |
| Less than 9th grade                         | 6.6%                                   | 7.9%                                 | 5.5%            | 6.2%                     |
| 9th to 12th grade, no diploma               | 10.0%                                  | 13.2%                                | 8.4%            | 8.7%                     |
| High school graduate (includes equivalency) | 37.0%                                  | 37.9%                                | 26.0%           | 29.0%                    |
| Some college, no degree                     | 15.1%                                  | 17.4%                                | 19.6%           | 20.6%                    |
| Associate's degree                          | 5.5%                                   | 5.5%                                 | 6.7%            | 7.5%                     |
| Bachelor's degree                           | 12.1%                                  | 10.3%                                | 19.9%           | 17.6%                    |
| Graduate or professional degree             | 13.7%                                  | 7.7%                                 | 13.9%           | 10.3%                    |
| Percent high school graduate or higher      | 83.4%                                  | 78.9%                                | 86.1%           | 85.0%                    |
| Percent bachelor's degree or higher         | 25.8%                                  | 18.0%                                | 33.8%           | 27.9%                    |

Source: U.S. Census, American Community Survey 5 year estimates, 2006 - 2010.

In general, the average earnings for people 25 years and over is less in Chincoteague than other areas. Specifically, the average earnings for a Town resident is \$23,000 compared to \$27,406 for a county resident, \$39,409 for a State resident, and \$34,665 for an average national resident. However, these estimates are heavily influenced by the lower earnings power of Town residents with only a high school diploma or less. Town residents with a bachelor's degree or higher earn more on average than a resident of the county or nation (but not the State). Regardless of educational attainment, however, Chincoteague residents have a higher percentage of residents experiencing poverty than State or national residents. Table 6 presents an overview of poverty status and earnings.

**Table 6**  
**Poverty Status and Earnings**

|                                                                                                                         | Chincoteague town, Virginia | Accomack County, Virginia | Virginia | United States |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------|----------|---------------|
|                                                                                                                         | Total                       | Total                     | Total    | Total         |
|                                                                                                                         | Estimate                    | Estimate                  | Estimate | Estimate      |
| POVERTY RATE FOR THE POPULATION 25 YEARS AND OVER FOR WHOM POVERTY STATUS IS DETERMINED BY EDUCATIONAL ATTAINMENT LEVEL |                             |                           |          |               |
| Less than high school graduate                                                                                          | 30.7%                       | 28.0%                     | 21.3%    | 24.7%         |
| High school graduate (includes equivalency)                                                                             | 22.8%                       | 13.2%                     | 9.6%     | 12.0%         |
| Some college or associate's degree                                                                                      | 9.4%                        | 12.2%                     | 6.2%     | 8.4%          |
| Bachelor's degree or higher                                                                                             | 5.4%                        | 3.6%                      | 2.5%     | 3.8%          |
| MEDIAN EARNINGS IN THE PAST 12 MONTHS (IN 2010 INFLATION-ADJUSTED DOLLARS)                                              |                             |                           |          |               |
| Population 25 years and over with earnings                                                                              | 23,000                      | 27,406                    | 39,409   | 34,665        |
| Less than high school graduate                                                                                          | 12,852                      | 16,634                    | 21,001   | 19,492        |
| High school graduate (includes equivalency)                                                                             | 15,729                      | 25,979                    | 29,064   | 27,281        |
| Some college or associate's degree                                                                                      | 28,495                      | 27,535                    | 36,137   | 33,593        |
| Bachelor's degree                                                                                                       | 52,417                      | 40,809                    | 53,522   | 48,485        |
| Graduate or professional degree                                                                                         | 66,563                      | 50,898                    | 75,613   | 63,612        |

Source: U.S. Census, American Community Survey 5 year estimates, 2006 - 2010.

## 2.5 Employment and Earnings by Industry

Census estimates that throughout the year 2010 there were a total of 1,363 people employed in the Town of Chincoteague. 908 of these people were employed year-round with the remainder primarily seasonal. Accordingly, median salaries were greater for the year-round workers (\$39,028) than the total, which included seasonal workers (\$27,702). The difference between the number of year-round employment and total employment, which included seasonal workers, were in the fields of retail trade, real estate and rental leasing, and accommodations and food services. Median earnings were estimated to be highest for year-round manufacturing jobs (\$93,529) and lowest in the field of Other Services (\$6,467).

The greatest number of year-round jobs were in public administration (148), accommodations and food services (117), and professional, scientific, and technical services (112). Total jobs, which includes seasonal work, were greatest in the fields of accommodations and food services (213), public administration (173) and health care and social assistance (146). Table 7 provides a detailed breakdown of estimated employment and median earnings by industry for total employment and year-round employment.

**Table 7**  
**Total Employment by Industry and Full-Time, Year-Round Employment by Industry, 2010**

| Chincoteague Town, Virginia                                                                 | Total Civilian employed population 16 years and over |                           | Full-time, year-round civilian employed population 16 years and over |                           |
|---------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------|----------------------------------------------------------------------|---------------------------|
|                                                                                             | Total                                                | Median earnings (dollars) | Total                                                                | Median earnings (dollars) |
|                                                                                             | Estimate                                             | Estimate                  | Estimate                                                             | Estimate                  |
| Total                                                                                       | 1,363                                                | 27,702                    | 908                                                                  | 39,028                    |
| Agriculture, forestry, fishing and hunting, and mining:                                     | 72                                                   | 9,136                     | 35                                                                   | 9,931                     |
| Agriculture, forestry, fishing and hunting                                                  | 72                                                   | 9,136                     | 35                                                                   | 9,931                     |
| Mining, quarrying, and oil and gas extraction                                               | 0                                                    | -                         | 0                                                                    | -                         |
| Construction                                                                                | 62                                                   | 16,364                    | 49                                                                   | 16,856                    |
| Manufacturing                                                                               | 64                                                   | 93,529                    | 64                                                                   | 93,529                    |
| Wholesale trade                                                                             | 30                                                   | 40,294                    | 30                                                                   | 40,294                    |
| Retail trade                                                                                | 56                                                   | 17,976                    | 0                                                                    | -                         |
| Transportation and warehousing, and utilities:                                              | 17                                                   | -                         | 17                                                                   | -                         |
| Transportation and warehousing                                                              | 17                                                   | -                         | 17                                                                   | -                         |
| Utilities                                                                                   | 0                                                    | -                         | 0                                                                    | -                         |
| Information                                                                                 | 0                                                    | -                         | 0                                                                    | -                         |
| Finance and insurance, and real estate and rental and leasing:                              | 103                                                  | 15,852                    | 61                                                                   | 27,688                    |
| Finance and insurance                                                                       | 37                                                   | 29,188                    | 32                                                                   | 29,500                    |
| Real estate and rental and leasing                                                          | 66                                                   | 14,052                    | 29                                                                   | -                         |
| Professional, scientific, and management, and administrative and waste management services: | 187                                                  | 32,202                    | 140                                                                  | 41,000                    |
| Professional, scientific, and technical services                                            | 140                                                  | 56,250                    | 112                                                                  | 56,042                    |
| Management of companies and enterprises                                                     | 0                                                    | -                         | 0                                                                    | -                         |
| Administrative and support and waste management services                                    | 47                                                   | 20,625                    | 28                                                                   | 21,944                    |
| Educational services, and health care and social assistance:                                | 277                                                  | 39,688                    | 187                                                                  | 50,605                    |
| Educational services                                                                        | 131                                                  | 51,573                    | 90                                                                   | 52,258                    |
| Health care and social assistance                                                           | 146                                                  | 31,607                    | 97                                                                   | 32,232                    |
| Arts, entertainment, and recreation, and accommodation and food services:                   | 251                                                  | 13,695                    | 155                                                                  | 14,629                    |
| Arts, entertainment, and recreation                                                         | 38                                                   | 14,083                    | 38                                                                   | 14,083                    |
| Accommodation and food services                                                             | 213                                                  | 13,504                    | 117                                                                  | 14,898                    |
| Other services, except public administration                                                | 71                                                   | 6,467                     | 22                                                                   | 7,708                     |
| Public administration                                                                       | 173                                                  | 65,353                    | 148                                                                  | 66,154                    |

Source: 2006-2010 American Community Survey 5-Year Estimates

### 3.0. Economic Characteristics of Chincoteague and Accomack County

The Town of Chincoteague has several sources of economic activity, including tourism, both Refuge-related and other outdoor-based recreation opportunities, commercial fishing and seafood manufacturing, and impacts from the nearby National Aeronautics and Space Administration (NASA) Wallops Island Flight Facility. This section will summarize some general economic characteristics for Chincoteague and discuss tourist-related characteristics of the economy, the commercial and seafood manufacturing sectors and the impacts of the NASA Wallops Island Flight Facility.

#### 3.1 Establishments and Employment

Table 8 shows Chincoteague employment by business sector for the years 2007 and 2010. Total employment in 2007 was 908, which increased by 74 jobs to 982 in 2010. In 2010, the three largest employment sectors, accommodation and food services, retail trade and health care and social assistance, accounted for almost 75 percent of total wage and salary employment. This compares with 2007, where the three largest sectors, accommodation and food services, retail trade and public administration, also accounted for about 75 percent of employment. The largest gain in jobs came from the health care sector, which showed a net gain of 62 jobs. Other sectors which showed significant gains include the retail trade sector, which showed a gain of 25 jobs, and the agriculture, forestry, fishing and hunting sector, which added 28 jobs.

Note that the above figures are wage and salary employment and do not include the self-employed. Chincoteague has a substantial number of self-employed, as evidenced by the number of business licenses issued in 2011 compared with the number of businesses which employed at least one person during the year (Table 8). In 2011, 1,269 business licenses issues. Table 9 shows 149 businesses which employed at least one person during 2010. Over 700 of the business licenses issued were for tourist rental homes, leaving 565 licenses covering the rest of the business sectors in town. Consequently, about 416 licenses are for the self-employed aside from the tourist rental home business.

For businesses that did employ people, the accommodation and food service sector accounted for 47 businesses, the retail trade sector accounted for 31 businesses, the construction sector for 15 and the real estate, rental and leasing sector for 11. These four sectors accounted for 70 percent of all businesses which hired workers in 2010.

**Table 8**  
**Chincoteague Town Employment by Business Sector: 2010 - 2007 Comparison**

| Industry Sector                                            | 2010       |             | 2007       |             | Change    |
|------------------------------------------------------------|------------|-------------|------------|-------------|-----------|
|                                                            | Count      | Share       | Count      | Share       |           |
| Agriculture, Forestry, Fishing and Hunting                 | 29         | 3.0%        | 1          | 0.1%        | 28        |
| Mining, Quarrying, and Oil and Gas Extraction              | 0          | 0.0%        | -          | 0.0%        | -         |
| Utilities                                                  | 0          | 0.0%        | -          | 0.0%        | -         |
| Construction                                               | 33         | 3.4%        | 40         | 4.4%        | (7)       |
| Manufacturing                                              | 2          | 0.2%        | 4          | 0.4%        | (2)       |
| Wholesale Trade                                            | 10         | 1.0%        | 9          | 1.0%        | 1         |
| Retail Trade                                               | 163        | 16.6%       | 138        | 15.2%       | 25        |
| Transportation and Warehousing                             | 4          | 0.4%        | 10         | 1.1%        | (6)       |
| Information                                                | 14         | 1.4%        | 17         | 1.9%        | (3)       |
| Finance and Insurance                                      | 11         | 1.1%        | 19         | 2.1%        | (8)       |
| Real Estate and Rental and Leasing                         | 26         | 2.6%        | 34         | 3.7%        | (8)       |
| Professional, Scientific, and Technical Services           | 9          | 0.9%        | 14         | 1.5%        | (5)       |
| Management of Companies and Enterprises                    | 0          | 0.0%        | -          | 0.0%        | -         |
| Administration & Support, Waste Management and Remediation | 11         | 1.1%        | 19         | 2.1%        | (8)       |
| Educational Services                                       | 3          | 0.3%        | 3          | 0.3%        | -         |
| Health Care and Social Assistance                          | 104        | 10.6%       | 42         | 4.6%        | 62        |
| Arts, Entertainment, and Recreation                        | 7          | 0.7%        | 1          | 0.1%        | 6         |
| Accommodation and Food Services                            | 454        | 46.2%       | 462        | 50.9%       | (8)       |
| Other Services (excluding Public Administration)           | 23         | 2.3%        | 19         | 2.1%        | 4         |
| Public Administration                                      | 79         | 8.0%        | 76         | 8.4%        | 3         |
| <b>Total</b>                                               | <b>982</b> | <b>100%</b> | <b>908</b> | <b>100%</b> | <b>74</b> |

Source: U.S. Census Bureau 2012. OnTheMap Application. <http://onthemap.ces.census.gov/>. Accessed July 2012.

Table 9 breaks down the total number of businesses employing workers by industry for the year 2010. In that year there were 149 business employing workers. Businesses in the Accommodation and Food Service sectors accounted for over one-third of the local businesses employing workers. Retail Trade and Construction businesses combined accounted for another one-third of the business sectors employing workers.

Table 10 shows business sectors which are typically associated with tourism (and which employed people during the year). This does not imply that all the revenue generated by these sectors comes from tourism, only that, under typical circumstances, most of tourist spending occurs in these categories. The sectors in Table 10 are sub-sectors of the more general sector categories in Table 9. Hotels, motels, bed and breakfast inns, RV parks and campgrounds, and other accommodations account for 27 businesses, or 33 percent of the total.<sup>3</sup> Food services also account for 27 businesses.<sup>4</sup> For all 82 businesses, about one-third provide accommodations, one-third are food-related and one-third are other retail purchases.

**Table 9**  
**Chincoteague Business Sectors Employing Workers by Major Category, 2010**

| Sector                                                                          | Number of Businesses |
|---------------------------------------------------------------------------------|----------------------|
| Accommodation and Food services Total                                           | 47                   |
| Retail Trade Total                                                              | 31                   |
| Construction Total                                                              | 15                   |
| Real Estate, Rental and Leasing Total                                           | 11                   |
| Health care and social assistance Total                                         | 8                    |
| Other services Total                                                            | 8                    |
| Arts, entertainment and recreation Total                                        | 6                    |
| Professional, scientific and Tech services Total                                | 5                    |
| Wholesale trade Total                                                           | 3                    |
| Transportation and warehousing Total                                            | 3                    |
| Information Total                                                               | 3                    |
| Finance and Insurance Total                                                     | 3                    |
| Administrative and support, and waste management and remediation services Total | 3                    |
| Agriculture, Forestry, Fishing, Hunting Total                                   | 2                    |
| Educational Services Total                                                      | 2                    |
| Manufacturing Total                                                             | 1                    |
| Public administration Total                                                     | 1                    |
| Total Businesses employing workers                                              | 149                  |

Source: Virginia Employment Commission 2011

<sup>3</sup> NAICS codes for Accommodations include: 721110,721191, 721211, and 721199.

<sup>4</sup> NAICS codes for Food Services include: 722110,722211,722213, 445110, 445120, 445299, 445310, 722212.

**Table 10**  
**Tourism Related Businesses Employing Workers in Chincoteague, 2010**

| NAICS Code | Sector                                                     | Number |
|------------|------------------------------------------------------------|--------|
| 721110     | Hotels (except Casino Hotels) and Motels                   | 16     |
| 722110     | Full-Service Restaurants                                   | 11     |
| 453220     | Gift, Novelty, and Souvenir Stores                         | 7      |
| 721191     | Bed-and-Breakfast Inns                                     | 5      |
| 722211     | Limited-Service Restaurants                                | 5      |
| 721211     | RV (Recreational Vehicle) Parks and Campgrounds            | 4      |
| 448190     | Other Clothing Stores                                      | 3      |
| 713990     | All Other Amusement and Recreation Industries              | 3      |
| 722213     | Snack and Nonalcoholic Beverage Bars                       | 3      |
| 445110     | Supermarkets and Other Grocery (except Convenience) Stores | 2      |
| 447110     | Gasoline Stations with Convenience Stores                  | 2      |
| 452990     | All Other General Merchandise Stores                       | 2      |
| 721199     | All Other Traveler Accommodation                           | 2      |
| 445120     | Convenience Stores                                         | 1      |
| 445299     | All Other Specialty Food Stores                            | 1      |
| 445310     | Beer, Wine, and Liquor Stores                              | 1      |
| 446110     | Pharmacies and Drug Stores                                 | 1      |
| 447190     | Other Gasoline Stations                                    | 1      |
| 448120     | Women's Clothing Stores                                    | 1      |
| 448140     | Family Clothing Stores                                     | 1      |
| 451110     | Sporting Goods Stores                                      | 1      |
| 487210     | Scenic and Sightseeing Transportation, Water               | 1      |
| 488490     | Other Support Activities for Road Transportation           | 1      |
| 491110     | Postal Service                                             | 1      |
| 532292     | Recreational Goods Rental                                  | 1      |
| 712190     | Nature Parks and Other Similar Institutions                | 1      |
| 713930     | Marinas                                                    | 1      |
| 722212     | Cafeterias, Grill Buffets, and Buffets                     | 1      |
| Total      |                                                            | 82     |

Source: Virginia Employment Commission 2011

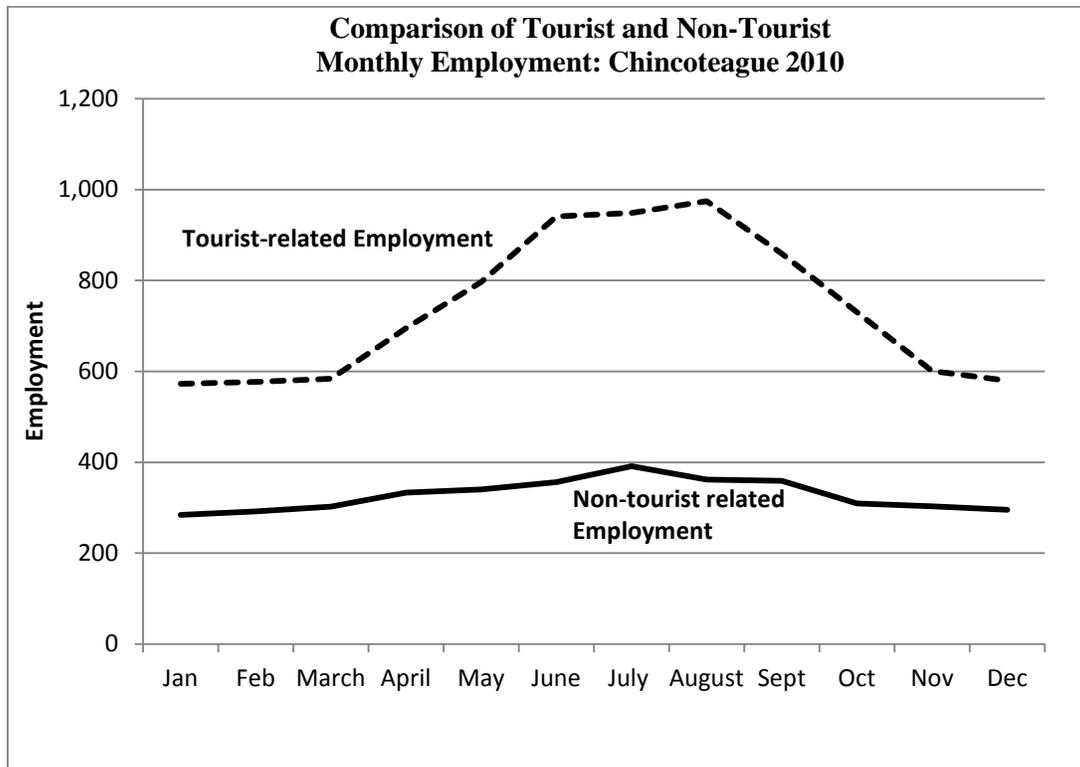
Chincoteague relies to a significant degree on tourism for town income. Tourism is not constant throughout the year, the summer months showing the highest concentration of visitors and the winter months the lowest. Consequently, much of the employment in Chincoteague follows a similar pattern. Table 11 shows Chincoteague 2010 employment by month categorized by tourist and non-tourist related businesses. Total employment is lowest in January and highest in July, ranging from 857 to 1,340. Tourist-related employment ranges from 573 in January to 975 in August, an increase of 70 percent from January. In contrast, non-tourist related employment ranges from 284 in January to 391 in July, an increase of 38 percent. Figure 3 shows a monthly graph of tourist and non-tourist employment in 2010.

**Table 11**  
**Chincoteague Town Tourist and Non-Tourist Employment by Month, 2010**

| Month        | Tourist-related Businesses | Non-Tourist related Businesses | Total       |
|--------------|----------------------------|--------------------------------|-------------|
| Jan          | 573                        | 284                            | 857         |
| Feb          | 577                        | 292                            | 869         |
| March        | 584                        | 302                            | 886         |
| April        | 695                        | 333                            | 1,028       |
| May          | 797                        | 340                            | 1,137       |
| June         | 941                        | 356                            | 1,297       |
| July         | 949                        | 391                            | 1,340       |
| August       | 975                        | 362                            | 1,337       |
| September    | 859                        | 359                            | 1,218       |
| October      | 730                        | 309                            | 1,039       |
| November     | 601                        | 303                            | 904         |
| December     | 580                        | 295                            | 875         |
| Annual range | 573 - 975                  | 284 - 391                      | 857 - 1,340 |

Source: Virginia Employment Commission 2011

**Figure 3**



Source: Virginia Employment Commission 2011

Table 12 shows the total number of establishments providing lodging in the Town of Chincoteague by type. In total, in the year 2010 there were 2,775 combined rooms, spaces, and sites provided by 707 establishments. Ninety percent of these establishments were vacation rental homes. Chincoteague had 21 hotels/motels that offered 849 rooms, six bed and breakfasts offering 33 rooms and six cottages offering 80 rooms. Four campsites offered 1,143 spaces. The rental of these places to tourists not only generates revenue for the owners but also generates revenue for the town in the form of food and lodging excise taxes.

**Table 12**  
**Available Lodging in Chincoteague by Type, 2010**

| Lodging Type          | Number of Establishments | Number of rooms/spaces/sites |
|-----------------------|--------------------------|------------------------------|
| Hotels/motels         | 21                       | 849                          |
| Bed and breakfast     | 6                        | 33                           |
| Cottages              | 6                        | 80                           |
| Campgrounds           | 4                        | 1,143                        |
| Vacation Rental Homes | 670                      | 670                          |
| Total                 | 707                      | 2,775                        |

Source: Town of Chincoteague 2011

### 3.2 Town Revenues

The town levies taxes on many of the tourist-related business to help pay for the provision of many public goods. In particular, taxes are levied on real estate, business licenses, occupancy, and meals.

Real estate is assessed by the Accomack County Assessor. Real estate within the Town of Chincoteague is taxed by both the Town and Accomack County with each having different rates. Real estate taxes for the Town are billed in early November of each year and are due on or before December 5th of the same year. The current Town real estate tax rate is \$0.06 per \$100 of assessed value.<sup>5</sup>

<sup>5</sup> The Town offers tax relief on real estate for certain elderly or handicapped individuals. The relief may be 50 percent or 100 percent. There are eligibility criteria, such as: income and amount of real estate owned. The contact is the Accomack County Commissioner of Revenue. The Commissioner of Revenue will notify the Town of those eligible for this relief.

Personal property taxes are assessed by the Accomack County Commissioner of Revenue on such items as automobiles, motorcycles, travel trailers, boats and mobile homes. Personal property is also taxed by the Town and Accomack County with different rates. Personal property bills are mailed the same time as real estate and have the same due date. The current Town personal property tax rate is \$0.85 per \$100 of assessed value. However, mobile homes are billed at the real estate rate.

The Town of Chincoteague levies an annual business license tax on all persons conducting business within the Town. The tax is due on April 30th of each year. For most business categories, the current rate for this tax is \$0.13 per \$100 of gross receipts of the previous year, with a minimum tax of \$50.00 and a maximum of tax \$500.00 per year.

Transient occupancy tax is charged by providers of lodging of less than 30 days. The current Town transient occupancy tax rate is 3 percent. Meals tax is charged on all prepared meals including beverages within the Town. The current meals tax rate is 5 percent.

Table 13 shows gross receipts derived from the transient occupancy tax (lodging excise tax) from 2001 to 2010. Over the 10-year period, hotels and motels account for 60.5 percent of average annual gross receipts, tourist homes 31.3 percent, campgrounds 4.7 percent and bed and breakfasts 3.5 percent. Annual receipts averaged \$17.6 million over the 10 year period. Table 14 shows the tax receipts derived from the lodging tax for both Chincoteague and Accomack County. Chincoteague tax receipts ranged from \$339,000 in 2005 to \$602,800 in 2010, an increase of 78 percent.

**Table 13**  
**Chincoteague Transient Occupancy Tax; Gross Receipts Reported, 2001 – 2010**  
**(dollars in millions)**

|                    | 2001    | 2002    | 2003    | 2004    | 2005    | 2006    | 2007    | 2008    | 2009    | 2010    |
|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Tourist Homes      | \$4.6   | \$4.9   | \$5.2   | \$5.4   | \$5.2   | \$5.4   | \$5.9   | \$5.9   | \$6.3   | \$6.3   |
| Hotels /motels     | \$8.8   | \$9.4   | \$10.2  | \$10.4  | \$10.6  | \$11.8  | \$11.7  | \$12.7  | \$12.0  | \$9.1   |
| Campgrounds        | \$0.899 | \$0.904 | \$0.724 | \$0.733 | \$0.758 | \$0.846 | \$0.929 | \$0.769 | \$0.991 | \$0.781 |
| Bed and Breakfasts | \$0.702 | \$0.648 | \$0.584 | \$0.583 | \$0.635 | \$0.694 | \$0.705 | \$0.587 | \$0.594 | \$0.378 |
| Total              | \$15.0  | \$15.9  | \$16.7  | \$17.1  | \$17.2  | \$18.7  | \$19.2  | \$20.0  | \$19.9  | \$16.6  |

Source: Town of Chincoteague 2011

**Table 14**  
**Chincoteague Lodging tax receipts as percentage of Accomack County Lodging Tax Receipts**  
**(dollars in thousands)**

|                                           | 2005    | 2006    | 2007    | 2008    | 2009      | 2010      |
|-------------------------------------------|---------|---------|---------|---------|-----------|-----------|
| Chincoteague excise tax collected         | \$339.0 | \$358.4 | \$384.0 | \$573.4 | \$620.0   | \$602.8   |
| Accomack County Tax collected             | \$670.4 | \$724.5 | \$791.3 | \$991.9 | \$1,047.5 | \$1,017.7 |
| Chincoteague portion of County Excise Tax | 50.6%   | 49.5%   | 48.5%   | 57.8%   | 59.2%     | 59.2%     |
| Source: Town of Chincoteague 2011         |         |         |         |         |           |           |

In addition to the lodging tax, Chincoteague also has a food excise tax, which applies to restaurants and other establishments which prepare food for consumption (as opposed to grocery stores). Table 15 shows both food and lodging excise tax revenue for the years 2004 to 2010. The food service excise tax revenue has been fairly constant, ranging from \$433,100 in 2004 to \$487,100 in 2010, a 12.5 % increase. Total excise tax collections ranged from \$761,500 in 2004 to \$1,089,900 in 2010, a 43.1 % increase.

**Table 15**  
**Town of Chincoteague: Lodging and Food Excise Tax Collected: 2004-2010**  
**(dollars in thousands)**

|                                           | 2004    | 2005    | 2006    | 2007    | 2008      | 2009      | 2010      |
|-------------------------------------------|---------|---------|---------|---------|-----------|-----------|-----------|
| Lodging Excise tax Collected              | \$328.4 | \$339.0 | \$358.4 | \$384.0 | \$573.4   | \$620.0   | \$602.8   |
| Food Service Excise tax Collected         | \$433.1 | \$434.3 | \$435.0 | \$451.0 | \$452.2   | \$480.7   | \$487.1   |
| Total Excise Tax collected                | \$761.5 | \$773.3 | \$793.4 | \$835.0 | \$1,025.6 | \$1,100.7 | \$1,089.9 |
| Source: Virginia Tourism Corporation 2011 |         |         |         |         |           |           |           |

### 3.3 Commercial Shell and Finfishing

The waters surrounding the Town of Chincoteague and the national wildlife refuge support a great diversity of fin and shellfish that have been harvested for centuries for commercial purposes. In 2010 the total value of commercial finfish and shellfish harvested from the area waters was estimated to be in excess of \$3.3 million. In recent years, the bulk of the commercial harvest and associated value has been the result of private shellfish farms that are forming in the area waters. In 2010 the sales from these ventures accounted for over one-half of the total value of the harvest.

To assess the economic importance of the shell and finfish industries, data was collected from the Virginia Marine Resources Commission. The Commission works to protect the resources for current and future generations. As part of its duties, the Commission collects data on the amount and types of shell and finfish species harvested in State waters. For the purposes of this analysis, the Commission was approached for all of the readily available historical the data that they have collected for water areas in the vicinity of Chincoteague. Table 16 shows the specific water bodies in Accomack County where data was requested.

**Table 16**  
**Water Areas Proximal to Accomack County**

| <b>Bogue Bay</b>                                                              | <b>Gargathy Bay</b> | <b>Upshur Bay</b> |
|-------------------------------------------------------------------------------|---------------------|-------------------|
| Bradford Bay                                                                  | Kegotank Bay        | Watts Bay         |
| Burton's Bay                                                                  | Metomkin Bay        | Unclassified      |
| Chincoteague Bay                                                              | Outlet Bay          |                   |
|                                                                               | Oyster Bay          |                   |
| Source: Virginia Marine Resources Commission, Plans and Statistics. May 2012. |                     |                   |

Data provided by the Commission show that since 1993, Blue crab harvests are the greatest of all marine species both in total amount and value. Also of significant economic importance is the harvesting of private quahogs. Table 17 shows the total amount and value of every species harvested in the waters surrounding Chincoteague since 1993. Annual and average values are not reported because not every species is harvested in every year. For example, the harvesting of private quahogs is a relatively new business and reporting did not begin until 2007.

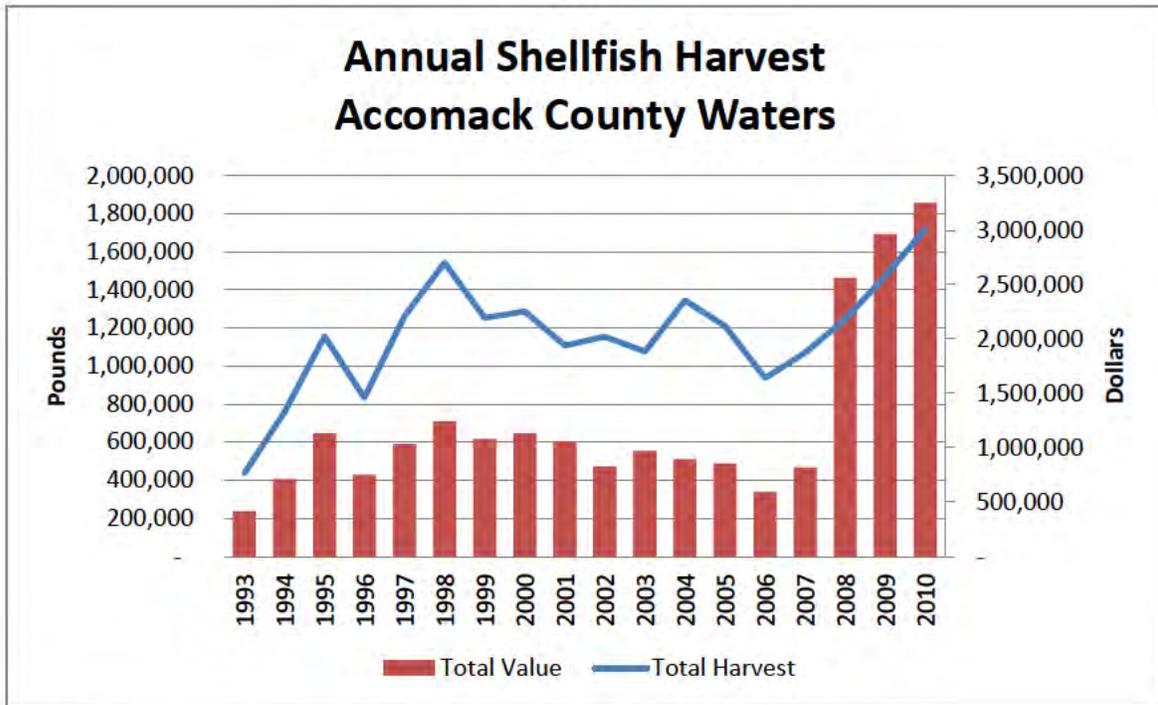
**Table 17**  
**Total Shellfish and Finfish Harvest (pounds) and Value (dollars)**  
**1993 through 2010 (Accomack County Waters)**

| Species                                                                                                                                                                                                                                        | Total Pounds | Total Value   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------|
| SHELLFISH                                                                                                                                                                                                                                      |              |               |
| CONCHS                                                                                                                                                                                                                                         | 13,334       | \$ 10,718     |
| CRAB, BLUE                                                                                                                                                                                                                                     | 18,263,850   | \$ 13,280,263 |
| CRAB, HORSESHOE <sup>1</sup>                                                                                                                                                                                                                   | 361,072      | \$ 208,407    |
| OYSTERS, PRIVATE                                                                                                                                                                                                                               | 58,192       | \$ 237,009    |
| QUAHOG, PRIVATE                                                                                                                                                                                                                                | 1,386,670    | \$ 6,066,194  |
| QUAHOG, PUBLIC                                                                                                                                                                                                                                 | 792,733      | \$ 2,477,834  |
| FINFISH                                                                                                                                                                                                                                        |              |               |
| ALEWIFE                                                                                                                                                                                                                                        | 32,160       | \$ 3,729      |
| BASS, STRIPED                                                                                                                                                                                                                                  | 97,145       | \$ 189,584    |
| BLUEFISH                                                                                                                                                                                                                                       | 227,587      | \$ 82,069     |
| CROAKER, ATLANTIC                                                                                                                                                                                                                              | 1,617,701    | \$ 747,540    |
| DOGFISH                                                                                                                                                                                                                                        | 196,909      | \$ 34,252     |
| FISH, OTHER INDUSTRY                                                                                                                                                                                                                           | 35,660       | \$ 2,205      |
| FLOUNDER, SUMMER                                                                                                                                                                                                                               | 26,546       | \$ 68,068     |
| PUFFER, NORTHERN                                                                                                                                                                                                                               | 32,763       | \$ 86,083     |
| SEATROUT, GREY                                                                                                                                                                                                                                 | 349,812      | \$ 244,837    |
| SHAD, AMERICAN                                                                                                                                                                                                                                 | 101,977      | \$ 87,124     |
| SPOT                                                                                                                                                                                                                                           | 1,968,817    | \$ 992,654    |
| <sup>1</sup> For purposes of the economic analysis, the horseshoe crab is included with other shellfish even though it is official classified as an arachnid.<br>Source: Virginia Marine Resources Commission, Plans and Statistics. May 2012. |              |               |

Figures 4 and 5 show the aggregated total harvests for shellfish and finfish for each of the years 1993 through 2010. These data reflect the harvests from all of the waters in Accomack County that are within the vicinity of the Town of Chincoteague. The data were compiled by the Virginia Marine Resources Commission based on the specific water bodies shown in Table 16.

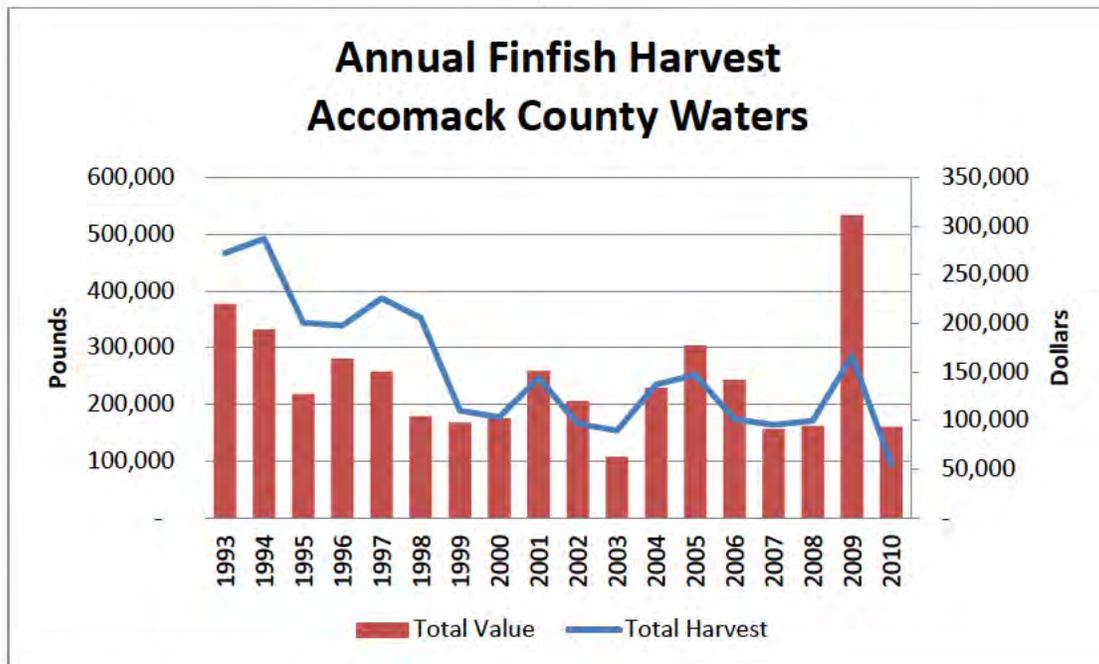
The data show that the annual total amount of the finfish harvest is declining over the years, while the amount of the shellfish harvest has been increasing. In 1993, Accomack County waters produced nearly 400,000 pounds of finfish and 400,000 pounds of shellfish. By 2010, shellfish harvests increased to nearly 1.8 million pounds, while finfish harvests declined to less than 100,000 pounds.

Figure 4



Source: Virginia Marine Resources Commission, Plans and Statistics. May 2012.

Figure 5



Source: Virginia Marine Resources Commission, Plans and Statistics. May 2012.

### 3.4 NASA Wallops Flight Facility and Mid-Atlantic Regional Spaceport

The NASA Wallops Flight Facility, just a few miles northwest of Chincoteague, is a source of economic activity for the town. This facility, which also includes the Mid-Atlantic Regional Spaceport administered by the Virginia Commercial Space Flight Authority, generates economic activity in several ways: (1) the annual impacts from operations of the various businesses at the site; (2) the employment impact generated by the percentage of the employees' payroll spent locally; and (3) the annual impact from the additional tourism generated in Accomack County (and Chincoteague) by the Flight Facility.<sup>6</sup> Table 17 shows that Accomack County accounted for \$77.8 million in economic impacts, the rest of the Lower Eastern Shore in Virginia \$110.5 million, for a total of \$188.3 million. Accomack County accounted for 1,206 jobs, Lower Eastern Shore 1,141 for a total of 2,347 jobs. The portion of these impacts which occur in Chincoteague is not known, but it is reasonable to assume that Chincoteague derives significant economic activity from the Flight Facility.

**Table 17**  
**Estimated Annual Economic, Employment and Fiscal Impacts of Activities at NASA Wallops Island**  
**(dollars in millions)**

|                                | Accomack<br>County | Lower Eastern<br>Shore | Total   | Outside of<br>Region | Total Impacts |
|--------------------------------|--------------------|------------------------|---------|----------------------|---------------|
| Total Economic<br>Impacts      | \$77.8             | \$110.5                | \$188.3 | \$207.2              | \$395.5       |
| Employment<br>Impacts          | 1,206              | 1,141                  | 2,347   | 704                  | 3,051         |
| State and Local<br>Tax Revenue | \$2.7              | \$4.5                  | \$7.1   | \$6.3                | \$13.4        |
| Federal Tax<br>Revenue         | \$2.3              | \$3.5                  | \$5.8   | \$7.5                | \$13.3        |
| Source: Bunch 2011, p.2        |                    |                        |         |                      |               |

### 3.5 Accomack County

Table 18 shows taxable sales by business sector for Accomack County in 2010. Taxable sales totaled \$286.4 million with retail trade accounting for \$179.5 million, 62.7 percent of the total, and accommodation and food services accounting for \$47.1 million, 16.5 % of total taxable sales.

Table 19 shows estimates of travel-related expenditure impacts in Accomack County. These are expenditures by travelers going to or through Accomack County. In 2010, travel-related expenditures totaled \$145.1 million, a 14.3 percent increase from 2006. These expenditures resulted in \$31.4 million in payroll and 1,847 jobs. State tax receipts totaled \$6.9 million and local tax receipts totaled \$4.5 million.

<sup>6</sup> Bunch 2011, p.4.

**Table 18**  
**Accomack County Taxable Sales by Business Sector, 2010**

| <b>Business Sector</b>                          | <b>Taxable Sales</b>    | <b>Percent of Total</b> |
|-------------------------------------------------|-------------------------|-------------------------|
| No Sector Name Information                      | \$5,089,123             | 1.8%                    |
| Construction                                    | \$2,399,516             | 0.8%                    |
| Manufacturing                                   | \$1,975,603             | 0.7%                    |
| Wholesale Trade                                 | \$16,204,731            | 5.7%                    |
| Retail Trade                                    | \$179,502,391           | 62.7%                   |
| Real Estate Rental and Leasing                  | \$10,551,698            | 3.7%                    |
| Professional, Scientific and Technical Services | \$2,723,241             | 1.0%                    |
| Administrative and Support Services             | \$309,500               | 0.1%                    |
| Arts, Entertainment and Recreation              | \$1,674,294             | 0.6%                    |
| Accommodation and Food Services                 | \$47,125,069            | 16.5%                   |
| Other Services                                  | \$5,568,627             | 1.9%                    |
| Sub-Total                                       | \$273,123,793           | 95.3%                   |
| Misc. and unidentifiable                        | \$13,340,460            | 4.7%                    |
| <b>Total</b>                                    | <b>\$286,454,253.35</b> | <b>100.0%</b>           |

Source: University of Virginia 2011

**Table 19**  
**Accomack County Travel Related Economic Impacts: 2006 - 2010**  
**(Dollars in millions)**

| <b>Impacts</b>     | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>Percent Change 2006 - 2010</b> |
|--------------------|-------------|-------------|-------------|-------------|-------------|-----------------------------------|
| Expenditures       | \$127.0     | \$134.3     | \$140.4     | \$137.5     | \$145.1     | +14.3%                            |
| Payroll            | \$28.5      | \$28.8      | \$30.0      | \$30.6      | \$31.4      | +10.2%                            |
| Employment         | 1,780       | 1,795       | 1,827       | 1,852       | 1,847       | +3.8%                             |
| State tax receipts | \$6.1       | \$6.4       | \$6.5       | \$6.8       | \$6.9       | +13.1%                            |
| Local tax Receipts | \$4.0       | \$4.2       | \$4.4       | \$4.4       | \$4.5       | +12.5%                            |

Source: Virginia Tourism Corporation 2011

#### 4.0. Chincoteague National Wildlife Refuge Recreation Visits and Associated Economic Impacts

In 1997, President William Jefferson Clinton signed into law the Refuge Improvement Act which establishes a unifying mission for the Refuge System. The mission of the Refuge System is:

*To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. — Refuge Improvement Act; Public Law 105-57*

The Refuge Improvement Act also establishes a new process for determining compatibility of public uses on refuges, and requires the Service to prepare a CCP for each refuge. The Act states that the Refuge System must focus on wildlife conservation. It also requires that the mission of the Refuge System, coupled with the purposes for which each refuge was established, will provide the principal management direction on that refuge. The Refuge Improvement Act identifies six wildlife-dependent public uses—hunting, fishing, wildlife observation and photography, and environmental education and interpretation—that will receive priority consideration on refuges and, therefore, in CCPs. Furthermore, the Act declares that all existing or proposed public or commercial uses must be “compatible” with the refuge’s purpose and consistent with public safety. The refuge manager determines if an existing or proposed use is “compatible” by evaluating its potential impact on refuge resources, insuring that the use supports the System mission, and does not materially interfere with or detract from the purpose for which the refuge was established.

Chincoteague National Wildlife Refuge is one of the most heavily visited refuges in the national system. Visitors come to Chincoteague for a variety of reasons. Many come in the summer months to access the beach. The beaches of Assateague Island offer a unique experience in the mid-Atlantic area as they exist primarily in an undeveloped setting unlike other beaches like Virginia Beach or Ocean City Maryland that are heavily developed. This natural setting draws many families seeking out a more traditional beach going experience.

Many summer beach visitors also take time to enjoy the wildlife found on the Refuge as they pass through on their way to or from the beach. While the Refuge is famous for its Chincoteague ponies, which families delight in watching, visitors will also see many different types of migratory birds and waterfowl, and animals thus exposing them to other types of wildlife that they may not normally see on a more traditional beach visit and hopefully leaving the visitor with a greater appreciation of the importance of conservation and the ability to participate and enjoy low-impact activities.

During the fall and spring seasons the many visitors come to the beach for surf fishing opportunities. In the fall, the Refuge opens up lower part of the beach from the southern-most parking lot to Toms Cove Hook to off-road vehicles. While some of these users are primarily engaged in wildlife watching, traditionally, most users are engaged in surf fishing activities.

The fall is also prime time for waterfowl hunting. Chincoteague NWR allows the hunting of waterfowl during the State season. Hunters must obtain a Migratory Game Bird Hunting permit from the Refuge for five dollars in order to hunt on the Refuge. Hunters must also possess valid State permits as well as a

federal Migratory Duck Stamp in order to hunt waterfowl. During the hunting season, hunters may target ducks, geese, swans, coots, and rails. The Refuge allows hunting during the days of Thursday, Fridays, and Saturdays. The Refuge allows hunting only within the designated areas of Wildcat Marsh, Morris Island, Assawoman Island, and Metompkin Islands. The harvesting of waterfowl on the Refuge is conducted in an environmentally friendly and sustainable manner, helping to ensure that the resources will be available to future generations for their enjoyment.

There is also limited big game hunting on the Refuge for Sika and White-tailed deer. Hunting occurs during the months of December and January. Hunting on the Refuge is controlled through a lottery process. Once selected by the lottery system, hunters must attend a firearms orientation session prior to hunting on the Refuge. The Refuge is divided into eleven primary hunting zones, with a few of those zones that are located closer to developed portions of the Refuge for use by mobility-impaired hunters.

#### 4.1. Chincoteague NWR Visitor Use

Table 20 shows Chincoteague NWR visitor use for 2010. A “visitor” is one person visiting the Refuge for all or part of one day. “Visits” are the number of activities a visitor engages in; for example, a person who goes bird watching and engages in nature photography is counted as two visits. Most of the activities on the Refuge are wildlife observation, hiking, nature walks, photography and beach use. Table 21 shows the number of Refuge visitors for the months June through August from 2005 to 2010. Well over half of total annual visitation occurs during these three months, ranging from 55 percent in 2010 to 58 percent in 2005.

Beach use is an important component of Chincoteague NWR visitor use. Table 22 shows one measure of visitor use (traffic counts) measured at the National Park Service visitor center near the beach. While most of the beach use occurs from June through August, a considerable amount of use occurs before and after this period, ranging from about 40 to 45 percent of total annual use. Figure 6 shows a graph of the traffic count for the months June through August for the years 1997 to 2011 as well as the total annual traffic count for the same years. On average, the Refuge receives 56 percent of its total visitors during the summer season.

Several times during the summer, the beach parking lot is filled to capacity and closes.

|                       |           |
|-----------------------|-----------|
| Parking lot closures: | 2007- 8   |
|                       | 2008 - 4  |
|                       | 2009 - 12 |
|                       | 2010 – 5  |
|                       | 2011 – 8  |
|                       | 2012 - 1  |

**Table 20**  
**Chincoteague NWR 2010 Visitation**

| <b>Total number of visitors</b> |                                                                | <b>1,359,553</b> |
|---------------------------------|----------------------------------------------------------------|------------------|
| <b>Visits<sup>1</sup></b>       | Special events on site                                         | 8,568            |
|                                 | Visitor Center or Contact Station                              | 364,568          |
|                                 | Upland game hunt                                               | 0                |
|                                 | Big game hunt                                                  | 2,097            |
|                                 | Total hunting                                                  | 2,304            |
|                                 | Fishing                                                        | 129,885          |
|                                 | Foot Trail/Pedestrian                                          | 1,019,664        |
|                                 | Auto Tour                                                      | 1,359,553        |
|                                 | Boat Trail/Launches                                            | 0                |
|                                 | Bicycle                                                        | 352,740          |
|                                 | Wildlife Observation                                           | 2,731,957        |
|                                 | Photography                                                    | 815,731          |
|                                 | Environmental education programs.                              | 8,948            |
|                                 | Interpretation participants in on- and off-site talks/programs | 60,226           |
| Other recreation                | 2,719,106                                                      |                  |

<sup>1</sup> The term "visits" represents the number of activities a visitor participated in during their visit to the refuge.  
Source: USFWS 2011

**Table 21**  
**Chincoteague National Wildlife Refuge: June - August and Annual Visitors, 2005 – 2010**

| <b>Month</b>                             | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> |
|------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| June                                     | 181,724     | 162,293     | 172,760     | 145,904     | 162,572     | 160,581     |
| July                                     | 375,862     | 307,132     | 297,697     | 291,281     | 314,110     | 304,248     |
| August                                   | 289,398     | 311,846     | 317,484     | 311,367     | 328,783     | 282,916     |
| 3 month total                            | 846,984     | 781,271     | 787,941     | 748,552     | 805,465     | 747,745     |
| Annual Total                             | 1,454,371   | 1,401,862   | 1,386,842   | 1,296,285   | 1,400,254   | 1,359,553   |
| June - August total as % of annual total | 58.2 %      | 55.7 %      | 56.8 %      | 57.7 %      | 57.5 %      | 55.0 %      |

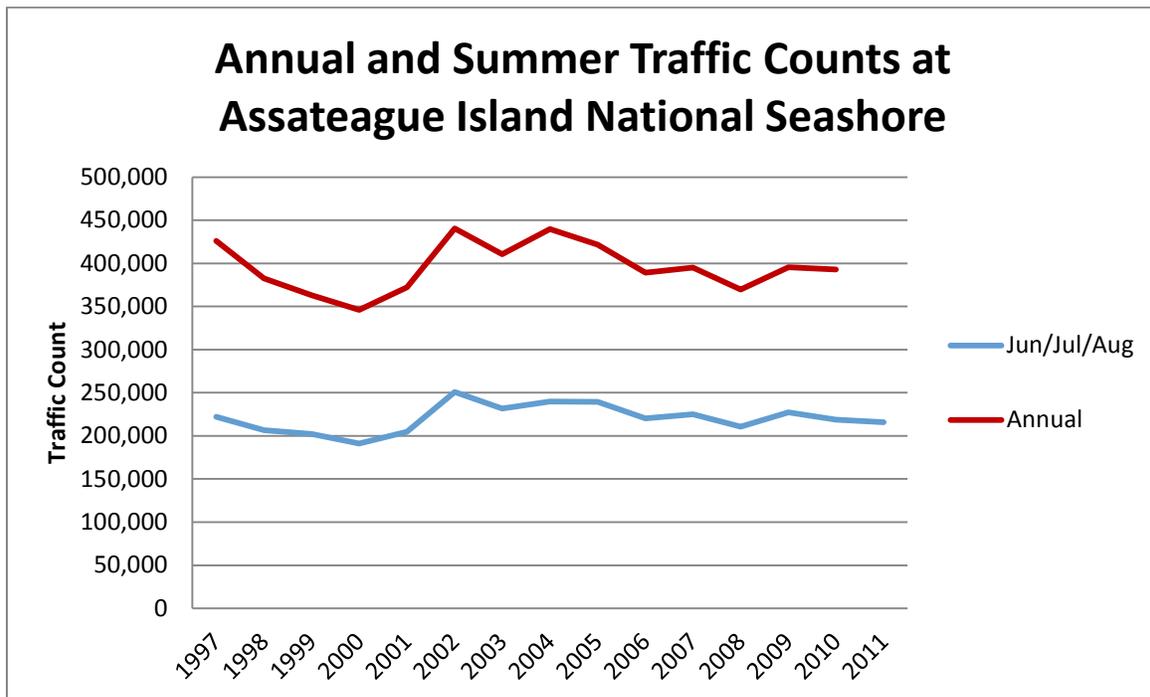
Source: USFWS 2011

**Table 22**  
**Assateague Island National Seashore: Traffic Counts At Chincoteague NWR**  
**July - August and Annual Counts**

| Year | JUN    | JUL     | AUG    | Total   | Annual  |
|------|--------|---------|--------|---------|---------|
| 1997 | 56,005 | 76,957  | 89,035 | 221,997 | 426,162 |
| 1998 | 45,160 | 81,378  | 80,021 | 206,559 | 382,650 |
| 1999 | 42,140 | 78,541  | 81,349 | 202,030 | 363,118 |
| 2000 | 44,041 | 77,717  | 69,399 | 191,157 | 346,181 |
| 2001 | 47,166 | 82,783  | 74,797 | 204,746 | 372,385 |
| 2002 | 63,893 | 94,053  | 93,011 | 250,957 | 440,341 |
| 2003 | 49,836 | 86,568  | 95,346 | 231,750 | 410,768 |
| 2004 | 48,391 | 108,164 | 83,179 | 239,734 | 439,679 |
| 2005 | 51,765 | 106,164 | 81,358 | 239,287 | 421,819 |
| 2006 | 45,999 | 86,357  | 87,827 | 220,183 | 389,107 |
| 2007 | 49,105 | 86,638  | 89,452 | 225,195 | 395,067 |
| 2008 | 41,136 | 81,789  | 87,689 | 210,614 | 369,548 |
| 2009 | 46,082 | 88,368  | 92,708 | 227,158 | 395,648 |
| 2010 | 45,821 | 91,884  | 81,155 | 218,860 | 392,804 |
| 2011 | 51,765 | 91,987  | 72,038 | 215,790 | na      |

Source: National Park Service 2011

**Figure 6**



Source: U.S. Fish and Wildlife Service, Chincoteague National Wildlife Refuge.

## 4.2. Economic Impact of Refuge Visitation

Spending associated with recreational use of the Refuge can generate a substantial amount of economic activity in both local and regional economies. Refuge visitors spend money on a wide variety of goods and services. Trip-related expenditures may include expenses for food, lodging and transportation. Anglers, hunters, boaters and wildlife watchers also buy equipment and supplies for their particular activity. Because this spending directly affects towns and communities where these purchases are made, recreational visitation can have a significant impact on local economies, especially in small towns and rural areas. These direct expenditures are only part of the total picture, however. Businesses and industries that supply the local retailers where the purchases are made also benefit from recreation spending. For example, a family may decide to purchase a set of fishing rods for an upcoming vacation. Part of the total purchase price will go to the local retailer, say a sporting goods store. The sporting goods store in turn pays a wholesaler who in turn pays the manufacturer of the rods. The manufacturer then spends a portion of this income to cover manufacturing expenses. In this fashion, each dollar of local retail expenditures can affect a variety of businesses at the local, regional and national level. Consequently, consumer spending associated with Refuge recreation can have a significant impact on economic activity, employment, household earnings and local, state and Federal tax revenue.

Ideally, information would be available on Refuge-specific expenditures, how much visitors spend and what they spend it on, and where they spend it. This information is not currently available, consequently in order to derive quantitative estimates of Refuge recreation impacts on Chincoteague and Accomack County, a number of assumptions will have to be made. While any estimates based on these assumptions will lack the precision of estimates based on site-specific information, these estimates may work as reasonable, reconnaissance-level estimates.

### 4.2.1. Major assumptions

Several assumptions are used to enable estimates of the economic impact of Refuge visitation.

1. The estimate of Refuge visitors is essentially “visitor days”, in the sense that a visitor is one person on the Refuge for at least part of one day. A visitor who spends two days visiting the Refuge counts as two visitors.
2. Refuge-specific spending information is not available. Regional spending averages are available from the National Survey of Fishing, Hunting and Wildlife-Associated Recreation (2007). Table 23 shows average per day per person expenditures based on survey information for Fish and Wildlife Service Region 5 Northeast Region (including Virginia). In the present context, local non-consumptive expenditures are expenditures by local residents for day trips to the Refuge; non-local non-consumptive expenditures are for visitors from out of the local area which include both day trips and overnight visits averaged together. It is assumed that these expenditures are reasonably reflective of actual expenditures for Refuge visitors.

**Table 23**  
**Average Per Person Per Day Expenditures: FWS Northeast Region**

| Sector             | Local Non-consumptive Expenditures | Non-local Non-consumptive Expenditures |
|--------------------|------------------------------------|----------------------------------------|
| Lodging            | \$3.19                             | \$26.18                                |
| Food/Drink         | \$6.76                             | \$39.40                                |
| Transportation     | \$7.54                             | \$24.06                                |
| Other Retail       | \$1.58                             | \$1.98                                 |
| Total              | \$19.07                            | \$91.62                                |
| Source: USDOJ 2007 |                                    |                                        |

- Information is not currently available as to where Refuge visitors make their purchases. While it reasonable to assume that Chincoteague receives a significant portion of these expenditures, it is not know precisely what portion is spent in Chincoteague. For example, a visitor from Norfolk Virginia south of the Refuge may spend some money in Norfolk, some in North Hampton County and some in Accomack County, including Chincoteague. All of these purchases are related to a Refuge visit, but the expenditures occur in up to four different areas.

To address this issue, information from previous area studies will be used to help determine the proportion of Refuge spending occurring in Chincoteague and Accomack County. A study on the economic impact of NASA Wallops Island Flight facility (Beacon 2011) estimates where visitors spend their money when visiting the facility. The report estimates that 45 percent of expenditures are in Accomack County, 45 percent in Worcester County to the north and 10 percent out of the area. In lieu of any other currently available information, it is assumed that these percentages are reasonably representative of where Refuge visitors spend their money.

- The economic model used to estimate economic impacts can only derive estimates at the county level or above. The model can estimate impacts for the combined counties of Accomack and Worcester, but information is not currently available to derive Chincoteague economic impacts using the model. Consequently, an alternative approach is used to derive Chincoteague impacts (discussed below).
- The use of 80 percent as the percentage of Chincoteague's tourist economy attributable to Refuge visitation may be too high; reliance on a range of percentages based on expert opinion may be more reasonable.

#### 4.2.2. Economic Impacts Measures

The economic impact estimates of the Accomack -Worcester model is shown first. Economic impacts include expenditures (retail sales), economic output, jobs and job income and tax revenue. These are discussed below.

**Total expenditures** shows the total annual retail expenditures associated with recreational visits to the Refuge. Currently, it is not know where (geographically) exactly Refuge visitors spend money. This approach assumes that 100 percent of expenditures occur in the Accomack - Worcester County area.

**Economic output** (also known as *industrial output*) shows the total output generated by total recreation-related expenditures. Total output is the production value (alternatively, the value of all sales plus or minus inventory) of all output generated by recreation expenditures. Total output includes the direct, indirect and induced effects of these expenditures. Direct effects are simply the initial effects or impacts of spending money; for example, spending money in a grocery store for a fishing trip or purchasing ammunition or a pair of binoculars are examples of direct effects. The purchase of the ammunition by a sporting goods retailer from the manufacturer or the purchase of canned goods by a grocery from a food wholesaler would be examples of indirect effects. Finally, induced effects refer to the changes in production associated with changes in household income (and spending) caused by changes in employment related to both direct and indirect effects. More simply, people who are employed by the grocery, by the food wholesaler, and by the ammunition manufacturer spend their income on various goods and services which in turn generate a given level of output. The dollar value of this output is the induced effect of the initial (or direct) recreation expenditures<sup>7</sup>. The economic impact of a given level of expenditures depends, in part, on the degree of self-sufficiency of the area under consideration. For example, a county with a high degree of self-sufficiency (out-of-county imports are comparatively small) will generally have a higher level of impacts associated with a given level of expenditures than a county with significantly higher imports (a comparatively lower level of self-sufficiency). Consequently, the economic impacts of a given level of expenditures will generally be less for rural and other less economically integrated areas compared with other, more economically diverse areas or regions.

**Jobs and job income** include direct, indirect and induced effects in a manner similar to total industrial output. Employment includes both full and part-time jobs, with a job defined as one person working for at least part of the calendar year, whether one day or the entire year. Job income in the IMPLAN system consists of both employee compensation and proprietor income (MIG, Inc. 1999).

**Tax revenues** are shown for business taxes, income taxes, and a variety of taxes at the county, state and national level. Like output, employment and income, tax impacts include direct, indirect and induced tax effects of expenditures, output and job income.

Two types of information are needed to estimate the economic impacts of recreational visits to the refuge: (1) the amount of recreational use on the Refuge; and (2) expenditures associated with recreational visits to the Refuge. With this information, total recreation-related expenditures can be estimated. At the county level or above, these expenditures, in turn, can be used in conjunction with a county or regional economic model to estimate economic output, jobs, job income and tax impacts associated with these expenditures.

#### *4.2.3. Accomack and Worcester Counties Economic Impacts*

<sup>7</sup> Technically, direct effects are production changes associated with the immediate effects of changes in final demand (in this case, changes in recreation expenditures); indirect effects are production changes in those industries directly affected by final demand; induced effects are changes in regional household spending patterns caused by changes in regional employment (generated from the direct and indirect effects) Taylor et al. 1993, Appendix E, p. E-1)

The basic approach to estimating retail expenditures is to multiply per person per day expenditures by the number of visitors (visitor days) to obtain total expenditures. Previously, Table 23 showed per person per day recreation expenditures by activity and by resident and non-resident for Region 5 (Department of the Interior et al. 2007). Table 20 showed recreation visits and participation by activity for the Refuge in 2010. Since the number of visitors to the Refuge is primarily based on car counts, and since there is no overnight visitation on the Refuge, the total number of visitors (minus environmental education participants) can be interpreted to reflect total number of visitor days (one person visiting the Refuge for at least part of one day). Using the above information, retail expenditures, economic output, jobs, job income and tax revenue can be estimated for the Accomack - Worcester County area.

Table 24 shows estimates of Refuge recreation-related expenditures, and associated economic output, jobs, job income and total (county, state and Federal) tax revenue. Total retail expenditures are estimated at \$113.8 million; economic output at \$150.3 million; jobs at 1,794, job income at \$48.6 million and total tax revenue of \$10.6 million.

**Table 24**  
**Chincoteague NWR: 2010 Visitor Recreation Expenditures Within Accomack and Worcester Counties**  
**(Dollars in millions, adjusted for inflation to 2010 dollars)**

|                     | Residents | Non-Residents | Total   |
|---------------------|-----------|---------------|---------|
| Retail Expenditures | \$2.9     | \$110.9       | \$113.8 |
| Economic Output     | \$3.8     | \$146.5       | \$150.3 |
| Jobs                | 45        | 1,749         | 1,794   |
| Job Income          | \$1.2     | \$47.4        | \$48.6  |
| Total Tax Revenue   | \$0.6     | \$10.0        | \$10.6  |

Source: Estimates compiled by the Division of Economics, USWFS.

#### *4.2.4. Town of Chincoteague Economic Impacts from Refuge Visitation*

This section estimates the economic impacts that are specific to the Town of Chincoteague from Refuge visitation and related spending. Because the economic model used to estimate Accomack and Worcester County impacts cannot estimate impacts at the sub-county level, the following approach is adopted: First, this analysis estimates the amount of direct expenditures (in 2010 dollars) spent by refuge visitors from out of the area. Second, the analysis estimates how expenditures in the Town breakdown for lodging and food and other retail services. As a final step, the analysis estimates the number of jobs associated with these out of town expenditures.

Estimation of Total Spending by Refuge Visitors in the Town of Chincoteague

Step 1. Total non-resident refuge visitor expenditures in 2010 were estimated to be \$110.9 million (Table 24). Resident expenditures are not included in this calculation because it is likely that their expenditures for local goods and services such as food and gas would have occurred regardless of whether or not they visited the refuge.

Step 2. The Wallop Island Flight Facility study (section 3.3) estimated that 45 percent of visitor spending occurred in Accomack County. This analysis assumes that refuge visitor spending breaks down in the same manner. Based on this assumption 2010 refuge visitor expenditures in Accomack County are estimated to be \$49.9 million ( $0.45 * \$110.9$ ).

Step 3. The Springsted report (Review of Revenues Received by Accomack County from the Town, Springsted Inc, 2010) estimated that about 85 percent of travel-related expenditures in Accomack County occurred in the Town of Chincoteague (Table 16). Based on this assumption, this analysis estimates that in 2010 refuge-related visitor expenditures in the Town were \$42.4 million ( $0.85 * \$49.9$ ).

Estimation of Food and Lodging Expenditures by Refuge Visitors in the Town of Chincoteague

Step 1. Table 25 shows the lodging and prepared food excise tax collected by Chincoteague in 2010. The excise taxes for lodging and food are 3 and 4 percent respectively. Dividing the respective excise tax collected by the rate gives gross sales shows that total expenditures on lodging were \$20.1 million and \$12.2 million for prepared foods.

**Table 25**  
**2010 Chincoteague Lodging and Food Excise Tax Revenue and Estimated Gross Sales**

|               | <b>Excise Tax Revenue Collected</b> | <b>Gross Sales</b>    |
|---------------|-------------------------------------|-----------------------|
| Lodging       | \$602,800                           | \$20.1 million        |
| Prepared Food | \$487,100                           | \$12.2 million        |
| <b>Total</b>  | <b>\$1,089,000</b>                  | <b>\$32.3 million</b> |

Source: Excise Tax Revenue obtained from the Town of Chincoteague (Jim confirm), Estimation of gross sales conducted by the Division of Economics.

Step 2. Information on the percentage of gross sales of lodging and prepared food attributable to Refuge-related spending is not currently available. Given the volume of visitors to the Refuge and associated visits to Chincoteague, an estimate of 80 percent will be used for estimating further impacts. Accordingly, the portion of lodging and prepared food gross sales attributable to Refuge visitation is estimated to be \$25.8 million ( $0.8 * \$32.3$  million). By association, this implies that \$16.6 million in refuge-related visitor expenditures were associated with other types of retail expenditures, including groceries (\$42.4 million in total direct expenditures less \$25.8 million spent on lodging and prepared foods).

Step 3. Ideally, grocery expenditures would be included in a food and lodging estimate. To do this, this analysis estimates the number of jobs per \$1 million in expenditures for the prepared foods and accommodations sector and uses this ratio to estimate the amount of grocery sales based on the reported number of jobs in the grocery sector. Census reports that there were 454 jobs in the Accommodations and Food Service sector (NAICS 72, Table 8). Given that it was estimated that the total purchases in the Town for accommodations and prepared foods was \$32.3 million in 2010, it is estimated that 14.1 jobs are generated for each \$1 million in expenditures (454 divided by 32.3). The Virginia Employment Commission reports that there were 53 jobs in the grocery sector in 2010 (NAICS 4451), which by association implies that total sales were \$3.8 million (53 divided by 14.1).

Step 4. To estimate the amount of grocery sales (and associated jobs) related to refuge visitor expenditures, this analysis again assumes that 80 percent of grocery sales are related to refuge visitation. This implies that refuge visitors spent \$3.0 million on groceries.

#### Estimation of total jobs Associated with Refuge-Related Expenditures

Continuing with the job estimates, accommodation and food sectors accounted for 504 jobs in 2010. Using the 80 percent figure, 403 jobs are attributable to Refuge recreation visits. To estimate the number of jobs in other retail sectors, the 13.96 jobs per \$1 million in gross sales can be used. If other retail expenditures total \$13.6 million, then  $13.6 * 13.96$  results in 190 jobs associated with retail sales other than lodging and food. Consequently, total Chincoteague jobs affected by Refuge visitor expenditures are estimated to be 593 (403 plus 190). Table 26 summarizes the expenditure and employment impacts of Refuge visitation.

**Table 26**  
**Summary of Refuge Visitor Expenditures and Associated Employment**  
**in the Town of Chincoteague, 2010**

| Sectors                                                                                       | Direct Expenditures<br>(millions) | Employment |
|-----------------------------------------------------------------------------------------------|-----------------------------------|------------|
| Lodging and Food (including groceries)                                                        | \$28.8                            | 403        |
| All other retail sales                                                                        | \$13.6                            | 190        |
| Total Impacts                                                                                 | \$42.4                            | 593        |
| Source: Data compiled by the Division of Economics, U.S. Fish and Wildlife Service, May 2012. |                                   |            |

A general check on the accuracy of these impacts compared with the Accomack -Worcester County model can be achieved by running the lodging and food gross sales in the Accomack -Worcester County model, using the 80 percent figure to adjust for Chincoteague's share of Refuge expenditures, and comparing the job estimates with the actual jobs. This comparison is shown in Table 27. The model underestimates jobs for both sectors, but the estimates appear to be reasonable ball park estimates given the data used in the analysis.

**Table 27**  
**Comparison of Model Estimated Jobs with Actual Jobs**

| Sector        | Gross sales    | Actual jobs | Model Estimated jobs |
|---------------|----------------|-------------|----------------------|
| Lodging       | \$20.1 million | 248         | 211                  |
| Prepared Food | \$12.2 million | 203         | 171                  |

#### 4.3 Proximity Effects of Refuge on Local Property Values

It has been well documented that the value of certain types of real property is positively affected by the proximity of open space. (cite standard open space studies). Typically, this value is directly related to the density of the property development along with the scarcity of open space. In other words, all things equal, one would expect that the open-space premium for a given house abutting dedicated open space in an urban area would be greater than for a similar house in a rural area. With this in mind, the U.S. Fish and Wildlife Service recently commissioned a study to determine specifically how National Wildlife Refuges affect real property values.

This study identified 93 Refuges in the Lower-48 States whose boundary was within two miles of the boundary of an urbanized area with a population greater than 50,000. The study used micro-level Census data that contained information on owner-assessed housing values and housing characteristics along with location to develop an economic model that after controlling for housing characteristics and other variables determined the effect Refuge proximity had on housing values. Results from the study found that homes located within 0.5 miles of a Refuge and within eight miles of an urban center are valued four percent to five percent higher in the Northeast region.

While Chincoteague National Wildlife Refuge and its surrounding s were not included in the study, it is nonetheless feasible that the protection that the Refuge provides to Assateague Island and seashore is reflected to a degree in nearby home values. Unfortunately, the results of the Refuge Proximity study are not directly transferable to the Town of Chincoteague because the Town fails to meet the criteria that the study used to define urban areas for the analysis. Nonetheless, given the earlier findings concerning the Town's economic dependence on tourism and given the fact that the Refuge draws so many visitors it is entirely reasonable to expect that the Refuge exerts some influence on real property values although it is difficult to reliably quantify this relationship at this time.

## 5.0. Chincoteague NWR Budget Expenditures

### 5.1. Refuge Expenditures

As shown in Table 28, Chincoteague NWR spends \$3.4 million in operations and maintenance each year. Forty-five percent of this funding is spent on salaries to employees who live in the area. Employee benefits for these people are paid to the Social Security administration, insurance companies and other entities outside the refuge area so \$397,700 in benefit amounts are not counted in local spending.

**Table 28**  
**Chincoteague NWR: Budget Expenditures for fiscal year 2009**

|                               | Dollars      | Percent                       |
|-------------------------------|--------------|-------------------------------|
| <i>Local Expenditures</i>     |              |                               |
| Personnel Compensation        | \$1,507,699  | 44.8%                         |
| Transportation of People      | \$4,206      | 0.1%                          |
| Transportation of Things      | \$4,962      | 0.1%                          |
| Communications                | \$30,769     | 0.9%                          |
| Utilities                     | \$43,304     | 1.3%                          |
| Contracts                     | \$115        | 0.0%                          |
| Building Repairs              | \$1,196,301  | 35.5%                         |
| Equipment Maintenance         | \$74,809     | 2.2%                          |
| Supplies and Materials        | \$296,760    | 8.8%                          |
| Motor Vehicle Fuel            | \$37,571     | 1.1%                          |
| Equipment-Capitalized         | \$48,111     | 1.4%                          |
| Equipment-Non-capitalized     | \$123,806    | 3.7%                          |
| Local Sub-Total               | \$3,368,415  | 100.0%                        |
| <i>Non-Local Expenditures</i> |              | <i>Non-Local Expenditures</i> |
| Employee Benefits             | \$ 397,735   | Employee Benefits             |
| Air Travel                    | \$29,040     | Air Travel                    |
| <i>Non-Expense Item</i>       |              | <i>Non-Expense Item</i>       |
| Real Property                 | \$ 20,325    | Real Property                 |
| Grants                        | \$ 909       | Grants                        |
| Organization Total            | \$ 3,816,424 |                               |

Changes in the value of real property do not necessarily lead to local economic activity. Purchases of land, for example, are best understood as a change in the form of assets rather than expenditures. Therefore, these expenditures are not considered to benefit the local economy. Similarly, grants for research efforts at refuges often go to nearby research institutions to study significant wildlife issues. Although some of this funding may return to the local economy as researchers work in the area a significant portion may leave the immediate area, particularly if the recipients work off-site (e.g., research grants to a State university) and so grant funding is not counted as local spending in this study.

Refuge spending in the local economy paid for both locally produced items and things imported into the region for sale. So all of the expenditures did not result in increased local output. Table 29 shows \$2.7 million had a direct effect on local output. Typical purchasing patterns for households and industries in the region suggest the remaining spending flowed to suppliers outside the area. About \$663,900 became compensation for local workers in 36.3 jobs. The iteration of refuge spending through the local economy generated \$3.5 million in total output and 44.4 jobs.

**Table 29**  
**Chincoteague NWR: Economic Impacts of Refuge Budget Expenditures**

| Sector         | Output<br>(\$ 2010) |           | Employee Compensation<br>(\$ 2010) |         | Employment<br>(Number of Jobs) |       |
|----------------|---------------------|-----------|------------------------------------|---------|--------------------------------|-------|
|                | Direct              | Total     | Direct                             | Total   | Direct                         | Total |
| Agriculture    | 2,100               | 4,900     | 100                                | 400     | 0.0                            | 0.0   |
| Utilities      | 56,500              | 78,900    | 8,400                              | 11,600  | 0.1                            | 0.1   |
| Construction   | 100                 | 19,200    | 0                                  | 4,900   | 0.0                            | 0.2   |
| Manufacturing  | 126,800             | 142,100   | 33,600                             | 36,200  | 0.7                            | 0.8   |
| Trade          | 283,600             | 390,500   | 90,200                             | 125,900 | 4.1                            | 5.7   |
| Transportation | 7,700               | 14,000    | 2,400                              | 4,300   | 0.1                            | 0.2   |
| Information    | 29,300              | 75,800    | 4,300                              | 11,600  | 0.1                            | 0.2   |
| Finance        | 253,500             | 539,500   | 12,900                             | 40,900  | 0.5                            | 1.7   |
| Lodging        | 99,000              | 176,700   | 30,100                             | 53,900  | 1.5                            | 2.7   |
| Government     | 22,400              | 49,500    | 8,000                              | 17,800  | 0.1                            | 0.3   |
| Other          | 1,789,800           | 2,042,800 | 473,900                            | 566,600 | 29.2                           | 32.5  |
| Total          | 2,670,800           | 3,533,900 | 663,900                            | 873,900 | 36.3                           | 44.4  |
| Multipliers    |                     | 1.32      |                                    | 1.32    |                                | 1.22  |

Most of the increased output and employment occurs in the Finance, Trade, and Other Services industries. The Other sector includes upkeep for buildings and payments for planning services. Much of what employees buy locally falls into the trade and finance categories so these sectors appear to have very large multipliers. Chincoteague's economy is highly seasonal so earnings by seasonal laborers may not be spent within the region but returned to the workers' distant place of residence. This may help explain the high leakage and low multipliers.

### **5.2. Refuge Revenue Sharing and Payments in Lieu of Taxes**

Chincoteague contains 13,433 acres of fee lands that were appraised at \$42.3 million in FY2008. The refuge revenue sharing fund paid \$72,938 to Accomack County, Virginia, \$6,360 to Chincoteague, and \$6,099 to Worcester County, Maryland in fiscal year 2010. The refuge earned no funds for refuge revenue sharing. None of Chincoteague's lands were reserved from the public domain so PILT payments were not made for this refuge.

## 6.0 Alternatives Analysis

### 6.1 Alternative A: No Action

Alternative A is the No Action Alternative. It assumes that the Refuge will lose a significant number of beach parking spaces over the next 15 years. Losses are expected to occur because of the projected intensity and frequency of coastal storm and sea-level rise. Whether or not the U.S. National Park Service (NPS) will continue to be successful in obtaining repair/replacement funds for the parking lots is unknown. The Fish and Wildlife Service (Service) recently asked the U.S. Army Corp of Engineers for a cost proposal for beach re-nourishment activities to replace some of the recreational beach in front of the parking lots that has eroded over time. Beach re-nourishment would entail activities that would build up the beaches using dredge and fill technology. A recent cost estimate provided by the U.S. Army Corp of Engineers found that the total project cost for the first, initial phase of beach re-nourishment would be over \$24 million with an additional cost of \$8 million for every re-nourishment cycle, which could take place every three to seven years.

Under Alternative A, the Service is not able to accurately predict the availability of parking spaces over the next 15 years, the planning period for this CCP. Climate Change and the corresponding rise in sea levels, coupled with strong coastal storms, will likely continue to significantly damage existing beach parking areas ultimately requiring the complete rebuild of the 961 parking spaces/parking lots. Also, it is impossible to predict if a sufficient land base will remain so as to allow the rebuilding of the parking lots or that sufficient funding will be available to complete this task.

In conjunction with the NPS, the Service has surveyed the current recreational beach area and have determined that the land base directly behind parking lots 1 and 2 will likely have sufficient area to provide for 400 parking spaces over the 15 year planning period covered by this CCP but they will require constant rebuilds as strong coastal storms will erode and/or wash them away. These lots lie immediately north and south of Beach Road.

However, the fates of parking lots 3 and 4, which represent the southernmost parking areas, are less certain. These lots have a combined current capacity of 561 parking spaces and it can be projected that the land base for these parking lots may be partially or fully lost over time.

For the purposes of this analysis, the effect of losing these lots and the potential corresponding impact to visitation will be compared directly to the base year of the analysis without adjustment. This is done because the Service and NPS are unable to reliably predict at what point in the future period the parking lot spaces would be lost. The Services are also unable to predict whether the parking lot losses would all occur due to a single storm event or whether they would be lost incrementally over a period of years. Finally, the Service anticipates that it would take several years to identify alternative parking on-site or off-site and to develop a shuttle system; it is furthermore assumed that not all visitors are likely to ride the shuttle. Thus, by simply comparing how a total loss of 561 parking lot spaces affects the local economy under the assumption that neither alternative parking nor transit will be provided the analysis of this alternative makes clear the local economy's relationship to beach tourism in its current form.

### 6.1.1 *Estimating the Number of Visits Affected*

Over the years, the Chincoteague National Wildlife Refuge has tracked the total number of vehicles entering the Refuge. As previously shown in Table 21, 57 percent of Refuge visits occur during the summer months of June, July, and August. Using 2009 as a base year, Table 30 shows both the total number of vehicles entering the Refuge as well as the calculated daily average for the traditional summer beach season (Memorial Day weekend through Labor Day weekend). While a few data gaps exist due to equipment malfunction (data was collected via a pneumatic vehicle traffic counter) the data show the average daily number of vehicles entering the Refuge to be 1,505 in June, 2,881 in July, and 2,542 in August. On Memorial Day weekend the average number of vehicles entering the Refuge is 2,186 and on Labor Day weekend the average number of vehicles entering the Refuge is 2,843.

Not all vehicles entering the Refuge head to the beach parking area. Because the traffic counter was located at the main entrance to the Refuge it counted vehicle visits associated with other trip purposes. Along with visitors in vehicles intending to drive and park at the beach parking lot, it also includes vehicles crossing into the Refuge for other activities such as hiking, wildlife photography and/or observation. Visitors heading only to the visitor center and/or the lighthouse are also included in the count. Nonetheless, because it is likely that the vast majority of vehicles entering the Refuge during this time of year are associated with beach visits, this analysis does not attempt to make any adjustments to the summer count for non-recreational beach visits.

Given that current beach parking is limited to 961 spaces, it would appear that based on the average daily number of vehicles entering the Refuge that the parking lot would be full every single day during the summer months. This is not the case, however. In fact, since 2009, the parking lot has only been closed 24 times. Closures typically occur during mid-day as early arrivers start heading out but not necessarily before the arrival of afternoon beach visitors. According to a survey conducted by the NPS for Assateague Island National Seashore, beach visitors typically spend 4 hours at the beach.<sup>8</sup> Thus, while the data show that there are twice or more as many vehicles entering the Refuge as there are beach parking spaces, parking has been more or less ample for the majority of the visitors for the majority of the time as each parking lot space can potentially hold two or more vehicle visits per day.

<sup>8</sup> Assateague Island National Seashore Visitor Survey Report, p. 30.

**Table 30**  
**Total and Daily Average Vehicle Counts Entering Chincoteague NWR, 2009 – 2012**

| Year | Memorial Day Weekend |           | June   |           | July   |           | August |           | Labor Day Weekend |           |
|------|----------------------|-----------|--------|-----------|--------|-----------|--------|-----------|-------------------|-----------|
|      | Total                | Daily Avg | Total  | Daily Avg | Total  | Daily Avg | Total  | Daily Avg | Total             | Daily Avg |
| 2009 | 7,016                | 2,339     | 39,732 | 1,324     | 88,033 | 2,840     | 86,742 | 2,798     | 7,968             | 2,656     |
| 2010 | 3,799                | 1,266     | n/a    | 1,465     | 87,191 | 2,906     | 81,155 | 2,618     | 9,273             | 3,091     |
| 2011 | 5,852                | 1,951     | 51,767 | 1,726     | 91,987 | 2,967     | 72,058 | 2,324     | 8,349             | 2,783     |
| 2012 | 9,569                | 3,190     | n/a    | n/a       | 87,073 | 2,809     | 75,211 | 2,426     | n/a               | n/a       |
|      | Avg:                 | 2,186     | Avg:   | 1,505     | Avg:   | 2,881     | Avg:   | 2,542     | Avg:              | 2,843     |

Source: Chincoteague National Wildlife Refuge, US FWS. September 2012.

While 961 parking spaces appears to be ample to handle the majority of beach parking demand under baseline conditions the Refuge anticipates that the land base will only support the maintaining of 400 parking lot spaces under Alternative A. These spaces are located in Parking Lots 1 and 2, which the Refuge and NPS have identified as most likely to be reclaimable/restorable (if funding is available) given likely future erosion scenarios. This analysis assumes that the demand for vehicle access to the beach will remain relatively constant during the period of analysis. This assumption is based on the analysis of seasonal and annual total counts found in Table 22. Thus, this analysis assumes that 1,505 vehicle per day in June, 2,881 vehicles per day in July, and 2,542 vehicles per day in August will on average attempt to access the beach and parking during future years of this CCP. During the Memorial Day weekend this analysis assumes that the daily average number of cars entering the Refuge will be 2,186 and for Labor Day weekend 2,843 vehicles.

While the number of parking lots may be reduced by 58 percent, the total number of vehicles restricted from beach parking may be less because some of these vehicles enter either in the early morning hours and exit before the mid-day surge or arrive later in the evening at the end of the day. Nonetheless, the expected effect of losing 58 percent of parking spaces would be a significant increase in both the number and length of parking lot closures. Unfortunately, because the Service does not have any information or data pertaining to how often there are 400 or more parking spaces occupied at any given time, this analysis must again make a series of assumptions to estimate the effect on parking space demand.

#### *6.1.2 Estimating the Upper-bound Impact of the Loss of 561 parking lots*

This analysis makes a series of relatively conservative assumptions in order to avoid understating the economic impact associated with the loss of 561 parking lots. Although the Assateague Survey found that the average vehicle visit lasted approximately four hours, it follows that some visits lasted longer and others for a shorter period. Unfortunately, the Services do not have any data or information on how many parking lot spaces are occupied at any given time during the summer months. The only information that is collected is when 961 spaces are occupied at which time the Services must turn back visiting vehicles.

At the very extreme, it is feasible that the first 400 vehicles parking at the beach parking lot elect to spend the entire day at the beach thus preventing all other vehicles with occupants targeting the beach parking lot from obtaining access during the day. For the purposes of this analysis, the beach day is defined as the prime hours to be on the beach, which is between the hours of 10:00 am and 5:00 pm. While this scenario is highly unlikely, particularly for every single day of the summer season, this analysis will adopt this assumption in order to estimate an upper-bound estimate of potential economic impacts to the community. This assumption is reasonable because while it is known from the beach closure data along with the Assateague Survey that there are essentially two waves of visitation during the day, a morning wave and an afternoon wave, it is not known whether or not 400 total spaces could adequately handle the visitation shifts and associated overlaps. What is only known is that over the past several years, the beach parking lot consisting of 961 spaces has only experienced closures 24 times and that the closures involved mid-day periods that for the most part lasted only an hour or two. This data is shown in Table 31.

**Table 31**  
**Closure Dates and Times for Chincoteague NWR Beach**

| Year | Date      | Time Full           | Total Hours   |
|------|-----------|---------------------|---------------|
| 2009 | 7/03/09   | 11:30am - 3:00 pm   | 3.5           |
|      | 7/04/09   | 11:00am - 2:45pm    | 3.8           |
|      | 7/11/09   | 1:10pm - 3:05pm     | 2.0           |
|      | 7/19/09   | no time given       | 2.0           |
|      | 7/25/09   | 12:00pm - 1:30pm    | 1.5           |
|      | 8/02/09   | 1:30pm - 2:30 pm    | 1.0           |
|      | 8/03/09   | 1:00 pm - 2:00 pm   | 1.0           |
|      | 8/04/09   | 1:30 pm - 2:30 pm   | 1.0           |
|      | 8/07/09   | 12:00 pm - 2:30 pm  | 2.5           |
|      | 8/08/09   | no time given       | 2.0           |
|      | 8/09/09   | no time given       | 2.0           |
|      | 9/05/09   | 12:30 pm - 2:45 pm  | 2.3           |
| 2010 | 7/03/10   | 12:00 pm - 2:10 pm  | 2.0           |
|      | 7/04/10   | 11:20 pm - 2:15 pm  | 3.0           |
|      | 8/07/10   | 12:50 pm - 3:10 pm  | 2.5           |
|      | 8/14/10   | 12:15 pm - 2:30 pm  | 2.3           |
|      | Labor Day | no time given       | no time given |
| 2011 | 7/02/11   | 11:40 am - 2:30 pm  | 3.0           |
|      | 7/04/11   | 11:30 am - 12:45 pm | 1.3           |
|      | 7/16/11   | 12:45 pm - 2:35 pm  | 2.0           |
|      | 8/06/11   | 1:30 pm - 3:30 pm   | 2.0           |
|      | 9/03/11   | 10:30 am - 3:30 pm  | 5.0           |
|      | 9/04/11   | 9:30 am - 5:00 pm   | 7.5           |
|      | 9/05/11   | 10:45 am - 12:30 pm | 2.0           |
|      | 9/10/11   | 11:30 am - 1:15 pm  | 1.8           |
| 2012 | 8/8/2012  | 12:20 pm - 1:30 pm  | 1.0           |

Source: Chincoteague National Wildlife Refuge, US FWS. September 2012.

Notes: As a result of Hurricane Irene, parking was reduced to approximately 350 spaces for Labor Day Weekend 2011.

This analysis does make one adjustment to the total number of vehicles entering the Refuge to account for the fact that not all vehicles entering the Refuge during the day enter in order to spend the entire day parked at the beach parking lot. Because data is unavailable pertaining to the time that vehicles enter the Refuge and because the Refuge is open from dawn through dusk this analysis assumes that ten percent of the vehicles entering the Refuge arrive in the very early morning hours and that another ten percent arrive in the evening hours. This assumption is not unreasonable because it is commonly observed to see vehicles enter in the early morning to either watch the sun rise over the water, to fish before it becomes too light, or to observe wildlife before the heat of the day arrives. It is also very common to observe vehicles entering the Refuge in the evening hours to watch the sunset, fish, and/or observe wildlife.

Table 32, shows how the total number of vehicles, on average, would be affected through a reduction in the number of parking lot spaces at the Refuge beach. The percent of vehicle trips associated with full day recreational-beach use that would be affected under this scenario range from 82 percent to 67 percent.

**Table 32**  
**Estimated Number of Daily Vehicles Denied Access to Chincoteague NWR**  
**400 Space Parking Limit**

| Month                | Avg Daily Visits | Avg Daily Visits During Peak Hrs | Parking Available | Assumed Length of Stay (hrs) | Vehicles Denied Access | Pct of Day-long Beach Use Visits Affected |
|----------------------|------------------|----------------------------------|-------------------|------------------------------|------------------------|-------------------------------------------|
| Memorial Day weekend | 2,186            | 1,749                            | 400               | 8                            | 1,349                  | 0.77                                      |
| June                 | 1,505            | 1,204                            | 400               | 8                            | 804                    | 0.67                                      |
| July                 | 2,881            | 2,304                            | 400               | 8                            | 1,904                  | 0.83                                      |
| August               | 2,542            | 2,033                            | 400               | 8                            | 1,633                  | 0.80                                      |
| Labor Day weekend    | 2,843            | 2,275                            | 400               | 8                            | 1,875                  | 0.82                                      |

Notes: Assumes ten percent of average daily visits occur in early morning hours and that another ten percent occur in evening hours. Also assumes that remainder of vehicles cannot access beach or parking lot once first 400 vehicles park for remainder of beach day.

Table 33 shows the estimated impact to the economy associated with a loss of vehicle visits to the Refuge due to a reduction of 561 parking spaces from a baseline of 961. It is estimated that during a typical summer season, the economic impact to the region in terms of a loss of direct expenditures from tourists would be \$38.4 million. This estimate is based on the assumption that visitors who cannot access the parking lot spaces during peak beach visiting hours would elect not to travel to the region at all (i.e., Accomack and Worcester Counties). In reality, some visitors may elect to stay in the area but either travel for the day up to Assateague Island National Seashore or Ocean City, down to the Norfolk area, or even elect to stay in Town for its various other tourist-related amenities, including shopping, recreational charter fishing, bike riding, etc., so the impact may be less. Nonetheless, the estimated impact to the baseline estimate of direct regional expenditures for the year (\$113.8 million) is nearly 34 percent of the annual total.

Table 33

**Estimated Economic Impact Associated with Loss of 561 Parking Spaces  
Summertime Visits, Memorial Day weekend through Labor Day weekend  
Accomack and Worcester Counties**

| Month                | Daily Vehicles Denied Access | Associated Number of Daily Visitors Affected | Economic Impact Per Day | Economic Impact per Month/Holiday Weekend |
|----------------------|------------------------------|----------------------------------------------|-------------------------|-------------------------------------------|
| Memorial Day weekend | 1,349                        | 4,317                                        | \$ 361,073              | \$ 1,083,219                              |
| June                 | 804                          | 2,573                                        | \$ 215,185              | \$ 6,455,560                              |
| July                 | 1,904                        | 6,094                                        | \$ 509,720              | \$ 15,801,328                             |
| August               | 1,633                        | 5,227                                        | \$ 437,155              | \$ 13,551,794                             |
| Labor Day weekend    | 1,875                        | 5,999                                        | \$ 501,748              | \$ 1,505,243                              |
| Total                |                              |                                              | \$ 2,024,881            | \$ 38,397,143                             |

## 6.2 Alternative C

Alternative C considers a number of management changes to the refuge. Changes that could negatively affect visitation include:

- Reduce beach parking to 480 spaces
- Closing the service road to walkers/hikers
- Closing Beach Road causeway and Toms Hook to public access
- Eliminating off-road vehicle use
- Eliminating horseback riding.

While all of the above mentioned changes could negatively affect visitation, Alternative C also includes some changes that could serve to either mitigate the negative impacts to visitation or that would serve to increase visitation associated with other types of recreational activities on the refuge. Management changes under Alternative C that could positively affect visitation or serve to mitigate some of the negative impacts include:

- Instituting a shuttle bus system to allow visitors to access the refuge from remote sites
- Implementing a non-migratory goose hunting season
- Implementing light goose hunting
- Implementing fox and raccoon hunting

- Implementing fur bearer trapping

Of all these proposed changes to the management of the refuge, the most notable in terms of affecting visitation would be the loss of 481 parking spaces, which would primarily affect beach use activities during the busy summer season. This change would affect one-half of the current number of spaces, leaving a remaining 480 spaces. With partners, the refuge would pursue identification of off-site parking and institution of a shuttle system, but as for Alternative A, the timeline and ridership for such a service are unknown. Thus, following the same logic used to estimate the impacts under Alternative A, the loss of 481 parking spaces would result in a total economic impact of \$36.3 million in terms of reduced expenditures by visitors. This translates to a 32 percent reduction from current baseline expenditures of \$113.8 million that affect both Accomack and Worcester Counties. Table 34 shows the breakout of impacts for the summer season.

**Table 34**  
**Estimated Economic Impact Associated with Loss of 481 Parking Spaces**  
**Summertime Visits, Memorial Day weekend through Labor Day weekend**  
**Accomack and Worcester Counties**

| Month                | Daily Vehicles Denied Access | Associated Number of Daily Visitors Affected | Economic Impact Per Day | Economic Impact per Month/Holiday Weekend |
|----------------------|------------------------------|----------------------------------------------|-------------------------|-------------------------------------------|
| Memorial Day weekend | 1,269                        | 4,061                                        | \$ 339,661              | \$ 1,018,983                              |
| June                 | 724                          | 2,317                                        | \$ 193,774              | \$ 5,813,208                              |
| July                 | 1,824                        | 5,838                                        | \$ 488,309              | \$ 15,137,565                             |
| August               | 1,553                        | 4,971                                        | \$ 415,743              | \$ 12,888,031                             |
| Labor Day weekend    | 1,795                        | 5,743                                        | \$ 480,336              | \$ 1,441,008                              |
| Total                |                              |                                              |                         | \$ 36,298,795                             |

## 7.0. References

- Barrie, Elizabeth, Catherine Finch, and James Cole. **Assateague Island National Seashore. Visitor Survey Report.** Eppley Institute for Parks and Public Lands. Indiana University, Bloomington IN. January 16, 2007.
- Bay Area Economics. **Economic Impacts Study. Point Reyes National Seashore. Final Report.** Submitted to Superintendent Don Neubacher, Point Reyes National Seashore, National Park Service. Bay Area Economics. Emeryville CA. December 11, 2006.
- Bearss, E.C. **General Background study and historical map, Assateague Island National Seashore, Maryland-Virginia.** National Park Service, U.S. Department of the Interior. Washington D.C. 1968.
- Bunch, Sarah. **Wallops Island Economic Value Study: IMPLAN Simulation Results.** Business, Economic, and Community Outreach Network. Salisbury University. Salisbury MD. February 2011.
- Chincoteague Chamber of Commerce. **List of Hotels/Motels, Bed and Breakfasts/Country Inns, Rental Houses, and Property Management Rentals.** Chincoteague VA. 2011.
- Chincoteague NWR. **Annual Refuge Visitation 2007-2010: May -August.** Chincoteague National Wildlife Refuge, Chincoteague VA. 2011a.
- Chincoteague NWR. **Annual Refuge Visitation 1994-2000, 2005 - 2010.** Chincoteague National Wildlife Refuge, Chincoteague VA. 2011b.
- Chincoteague NWR. **Fee Programs: 2005 - 2011.** Chincoteague National Wildlife Refuge, Chincoteague VA. 2011c.
- Chincoteague, Town of. **Town of Chincoteague Comprehensive Plan.** Town of Chincoteague VA. January 4 2010.
- Chincoteague, Town of. **Business License Information.** Town of Chincoteague. 2011.
- Diriker, Dr. Memo. **Economic Development Value of the U.S. Navy Surface Combat Systems Center at Wallops Island.** Business, Economic and Community Outreach Network. Salisbury University. Salisbury, MD. No date.
- Eppley Institute for Parks and Public Lands, **Assateague Island National Seashore Visitor Survey Report.** Indiana University Research Park, Bloomington, IN. January 2007.
- Headwaters Economics. **A Socioeconomic Profile. Accomack County, Virginia.** Headwaters Economics. Missoula MT. February 13, 2009.
- Louis Berger Group, Inc. **Chesapeake Bay Bridge-Tunnel Commuter Toll Impact Study.** Prepared by The Louis Berger Group, Inc., East Orange NJ, for the Chesapeake Bay Bridge-Tunnel Commuter Toll Impact Study Committee. In Association with Travesky and Associates, Fairfax VA.
- Maryland Department of Natural Resources. **An Assessment of the Economic Value of the Coastal Bays' Natural Resources to the Economy of Worcester County, Maryland.** Prepared by The Greeley-Polhemus Group, Inc. West Chester PA. February 2001.
- MBCC. Minutes of meeting, March 25, 1941. Includes memorandum No. 3: Chincoteague NWR summarized statement of lands recommended for purchase. Migratory Bird Conservation Commission. Washington D.C. 1941.

- National Marine Fisheries Service. **Community Profile of Chincoteague Virginia**. Prepared under the Auspices of the National Marine Fisheries Service, Northeast Fisheries Science Center. Washington D.C. 2007.
- National Park Service. **Public Use Statistics for Assateague Island National Seashore**. National Park Service, U.S. Department of the Interior. Washington D.C. 2011.
- Potter, Mike, John Provo, Ph.D., Sibel Atasoy, Eric Howard, and Charlotte Anders. **Community Economic Development for the Eastern Shore: Summit Report**. Office of Economic Development. Virginia Tech. Blacksburg VA. May 2007
- Springsted Incorporated. **Memorandum from John Anzivino, Patty Kettles and Nick Dragisich to Robert Ritter, Town Manager. Review of Revenues Received by Accomack County from the Town**. Springsted Incorporated, Richmond VA. July 22, 2010.
- Stevens, Thomas J., Alan Hodges, W. David Mulkey and Mohammad Rahmani. **Economic Impact Assessment of the Proposed Commercial Vertical Launch Complex at Kennedy Space Center. Final Project Report**. University of Florida, Institute of Food and Agricultural Sciences, Food and Resource Economics Department. Gainesville FL. October 20, 2008.
- Town of Chincoteague, Resolution to Acknowledge that the Town of Chincoteague 2010 CENSUS Numbers are Erroneous.  
[http://www.chincoteagureports.com/my\\_weblog/2011/04/resolution-to-acknowledge-that-the-town-of-chincoteague-2010-census-numbers-are-erroneous.html](http://www.chincoteagureports.com/my_weblog/2011/04/resolution-to-acknowledge-that-the-town-of-chincoteague-2010-census-numbers-are-erroneous.html)
- Taylor, Laura, Xiangping Liu, Timothy Hamilton. **Amenity Values of Proximity to National Wildlife Refuges**. Center for Environmental and Resource Economic Policy, North Carolina State University, April 2, 2012.
- University of Virginia. **Taxable Sales**. Center for Economic and Policy Studies, Weldon Cooper Center for Public Service, University of Virginia. Provided courtesy of the Virginia Department of Taxation. 2011. <http://www.coopercenter.org/node/1160>
- U.S. Census Bureau, 2010 Demographic Profile Data, DP-1. Accessed at [www.factfinder2.census.gov](http://www.factfinder2.census.gov) on March 20, 2012.
- U.S. Census Bureau, 2010 Summary File 1. Accessed at [www.factfinder2.census.gov](http://www.factfinder2.census.gov) on March 20, 2012.
- U.S. Census Bureau, American Community Survey. Accessed at [www.factfinder2.census.gov](http://www.factfinder2.census.gov) on March 20, 2012.
- U.S. Census Bureau 2012. OnTheMap Application. Accessed at <http://onthemap.ces.census.gov/> on July 30, 2012.
- U.S. Census Bureau. **Accomack County: Profile of General Population and Housing Characteristics: 2010**. American Fact Finder. Census Bureau, U.S. Department of Commerce. Washington D.C. 2011a.
- U.S. Census Bureau. **State and County QuickFacts: Accomack County, Virginia**. QuickFacts. Census Bureau, U.S. Department of Commerce. Washington D.C. 2011b.
- U.S. Department of the Interior. Merritt Island National Wildlife Refuge. **Draft Comprehensive Conservation Plan and Environmental Assessment**. U.S. Department of the Interior, Fish and Wildlife Service. Southeast Region. Atlanta GA. November 2006.
- U.S. Fish and Wildlife Service. **Conserving the Future, Wildlife Refuges and the Next Generation**. October 2011.

- U.S. Travel Association. **The Economic Impact of Domestic Travel on Virginia Counties 2010**. A Study prepared for the Virginia Tourism Corporation by the U.S. Travel Association. Washington D.C. October 2011.
- Virginia Employment Commission. **Town of Chincoteague Employment Data 2007 -2010**. Virginia Employment Commission, Richmond VA. 2011a.
- Virginia Employment Commission. **Accomack County Profile**. Virginia Employment Commission. Richmond VA. 2011b.
- Virginia Tourism Corporation. **2009 - 2010 Accomack County Travel Economic Impacts**. Virginia Tourism Corporation, Richmond VA. 2011.
- Yochum, Gilbert R., Ph.D. and Agarwal, Vinod B., Ph.D. **2008 Virginia Beach Tourism Economic Impact Study**. College of Business and Public Administration, Old Dominion University Research Foundation. Norfolk Virginia. May 2009.
- Wroten, W.H. Jr. **Assateague**. Tidewater Publishers. Centerville MD. 1972.

## Appendix N



USFWS

*Aerial View of Refuge*

### **Chincoteague NWR: Recreational Beach Structured Decision Making Process, Locating the Best Site for a Recreational Beach and Parking Lot**





Chincoteague National Wildlife Refuge: Locating the Best Site for a Recreational Beach and Parking Lot

Summary Report

*A Structured Decision Making process to identify beach segments with the least amount of wildlife use and greatest public use attributes.*

*November 2011*

## Table of Contents

**Background**..... 4

**Problem Statement**..... 11

**Conceptual Model**..... 11

**Objectives**..... 13

1. Wilderness..... 16

2. Wildlife Dependent on Sparsely Vegetated Habitat..... 16

    a. Amount of Breeding Use (shorebirds, sea turtles, plants)..... 16

    b. Amount of shorebird use during migration. .... 19

    c. Amount of Non-Breeding Bird Use (winter beach use)..... 20

3. Additional Mandates..... 21

4. Waterbird Use of Wetlands ..... 21

    a. Level of Waterbird Use ..... 21

    b. Cumulative Use to Beach Segment..... 24

5. Forest Dependent Wildlife ..... 25

6. Scrub-Shrub Dependent Wildlife ..... 26

7. Expected Longevity of Infrastructure..... 28

8. Proximity to Existing Infrastructure ..... 30

9. Visitor Safety and Experience ..... 30

    a. Response Time by EMS ..... 31

    b. Points of Interest Along Route to Beach..... 31

    c. Traffic to Beach Impact on Trails..... 33

    d. Impacts to Existing Hunting Areas ..... 34

**Selection of Beach Segments**.....35

**"Fine Tuning" - Site Selection**.....36

A. Habitat Acreage Change ..... 36

B. Recreational Beach Visitor Experience ..... 36

    1. Direct Access for Mobility Impaired..... 37

    2. Distance to Shelter ..... 37

    3. Mode of Transportation..... 37

    4. Convenience..... 37

    5. Off-Road Vehicle Fishing Access ..... 37

C. Cultural Resources ..... 38

D. Initial Cost ..... 38

E. Cost of Annual Maintenance..... 38

Appendix 1. Beach Segment Matrix..... 39

Appendix 2. List of Workshop Participants ..... 41

# Background

---

Chincoteague National Wildlife Refuge (CNWR) was established under authority of the Migratory Bird Conservation Act in 1943. The Assistant Secretary of the Interior determined U.S. Fish and Wildlife Service (FWS) ownership of this land was necessary for protection during nesting and migration seasons of all those species of wildlife determined as being of great value as a source of food, or in destroying of injurious insects, or nevertheless in danger of extermination through lack of adequate protection (U.S. District Court, 1943).

Access to Assateague Island, CNWR, for recreational use and related development was authorized by Congress under Public Law 85-57 in June 1957. The law provided for construction of a bridge and road to the refuge as well as recreational facilities on the southeastern shore of the island. The Chincoteague-Assateague Bridge and Beach Authority (a political subdivision of the Commonwealth of Virginia) developed and managed beach front recreational facilities and provided visitor services (USFWS 1993).

In September 1965, Congress approved the Assateague Island Seashore Act (P.L. 89-195) establishing Assateague Island National Seashore (ASIS). The National Seashore's boundaries were drawn to encompass CNWR. The Act provided the Virginia portion of Assateague Island National Seashore be managed by the National Park Service (NPS) for general purposes and follow the laws and regulations applicable to national wildlife refuges, including administration for public recreation use in accordance with the provisions of the Refuge Recreation Act (P.L. 87-714) (USFWS 1993).

The NPS acquired the Chincoteague-Assateague Bridge and Beach Authority and other rights in 1966 after the national seashore was established. Since the 1966 acquisition, the NPS managed public recreation activity at the Toms Cove Hook beach as an agent of the FWS, which owns the beach as part of CNWR (USFWS 1993). In 1976, Congress amended the National Wildlife Refuge System Administrative Act (P.L. 94-223) giving the FWS primary responsibility for the administration of lands and waters included within the National Wildlife Refuge System. This clarified the role of the FWS at CNWR although the majority of refuge lands lay within the boundary of Assateague Island National Seashore (USFWS 1993).

A 2001 Interagency Agreement between FWS and NPS specified the NPS role on the Virginia portion of Assateague Island National Seashore. Today, NPS continues to manage public recreation within an "assigned public beach area". FWS has primary responsibility for managing the wildlife resources within this area, allowing beach and other recreational use in compliance with the Refuge Recreation Act (Public Law 87-714).

Wind, waves, and storm surges are constantly shaping and re-shaping the Refuge's barrier islands in a natural dynamic process. Strong waves and storm surges can erode entire beaches back to the dune line, or break through this protective barrier and overwash sand and salt water onto back dunes, flats, or wetlands. Natural dune location is determined by the frequency and extent of storms, and the rate at which prevailing winds and vegetation can rebuild dunes. The coastal edge of barrier islands progressively moves westward in a process called shoreline retreat. Sand is rolled across the dunes and marshes, and deposited into bays on the backside of the islands, such as Toms Cove on Assateague. This process, sometimes described as the "barrier island rolling over onto itself," will be accelerated with predicted climate change and sea level rise. For every one-foot rise in sea level, barrier islands move 100 to 1,000 feet inland (USFWS 1988).

Assateague Island is more than 37 miles long. The southern 17 miles are managed as Chincoteague NWR. Early 18<sup>th</sup> century maps show a smaller Assateague Island. It has developed southward as a series of re-curved spits deposited by currents that erode sands from northern beaches. Toms Cove Hook is a sand spit that has accreted since the 1850s (CNWR 2008). Assateague Island National Seashore staff continues to track this southward growth by mapping the entire shoreline twice a year.

Based on early 1950s photos in Refuge Annual Narratives, and accounts from a flight over the island in 1941 (NPS 2003), Assateague was historically a low, overwashed island with some low natural dunes. Conditions are unfavorable for the natural development of a tall dune system because strong waves and storm surges erode beaches back to the dune line, and create breaks in the dune line (CNWR 1993). During the 1950s, Refuge maintenance staff constructed several miles of "beach dikes" by bulldozing sand and installing sand fences to create dunes in order to facilitate building the Wash Flats and Old Fields Impoundments. These beach dikes were periodically blown out or washed out by storms, and repairs were frequent during the 1950s (Refuge Annual Narratives).

After a March 1962 nor'easter took out most of Assateague Island's "beach dikes", an artificial dune was created along the entire ocean-side of the island. It was constructed by bulldozing a dike of sand five feet high by 30 feet wide at base. A four foot high sand fence was placed on top of the dune to catch additional sand, and by 1963 wind-blown sand had been deposited against the fence to increase the height of the dune. In spots where insufficient sand was available to push up the dune, a larger dike was built that was approximately 6-7 feet high and 180-200 feet at the base with a 20:1 slope on the surf side; sand fence placed on top caught an additional four feet of drift sand (Refuge Annual Narrative 1962 and 1963).

From the 1960s into the 1990s, staff attempted to maintain the dune line in critical areas to protect impoundments and public use facilities from overwash and storm surges by repairing blowouts in the dunes, planting beach grass, and using fencing to encourage sand accumulation. For instance, high seas from Hurricane Gloria, in the fall of 1985, overwashed several portions of the dune line near Old Fields Impoundment and east of B Pool. These low gaps were filled in with sand before winter storms could cause more extensive damage. In January 1992, a nor'easter destroyed much

of the artificial dune line south of the parking lots; north of the beach parking lots portions of the artificial dunes were either overwashed or lost. Following the 1992 storm, about 2.5 miles of dunes between the north beach parking lot and D-Dike) were reconstructed and planted with beach grass (CNWR 1993 & Refuge Annual Narrative). After implementation of the 1993 Master Plan, maintaining the artificial dune line was de-emphasized, and occurred in selected areas to provide protection to facilities and wildlife habitat (CNWR 1993).

At present, Assateague Island's artificial dune system ranges from non-existent south of the beach parking lots, to well-developed with small gaps ocean-side of North Wash Flats and Old Fields Impoundments. Wash over occurs frequently in the Overwash Area, and in the parking lots. Overwash is common between autumn and spring, when nor'easters and prevailing winter winds scour the shoreline. Storm systems that occur during the highest lunar tides of the month can send sand filled waves over the beach, scouring everything in their paths, moving huge loads of sand from the ocean shoreline, depositing them in the cove side overwash fan. In summer, these events are less common. Prevailing winds blow sand from the overwash fan back to the beach, and littoral currents bring new sand from the north to further rebuild the beach face. Storm overwash has also occurred at numerous points along Wild Beach, sending sand and saltwater into the back dunes and barrier flats. These overwash events create ideal nesting substrate for piping plovers and terns; plover broods also forage in ponds that form in natural depressions behind the dunes.



Overwash at the terminus of Beach road due to the December 2009 Nor'easter (Nor'Ida).

The table below lists the notable storm events that have occurred since the late 1800's. Few severe storms are recorded previous to the 1990's; however Assateague Island has experienced an increase in severe storm activity in recent history. Most of the storm events have impacted the infrastructure (roads, parking lots and buildings) associated with the recreational beach.

| 1800's                | 1900 – 1999 (100 years)          | 2000 – 2011 (12 years)               |
|-----------------------|----------------------------------|--------------------------------------|
| 1878 - September Gale | 1933 – August Hurricane          | 2000 – December Snowstorm            |
| 1888 - Great Blizzard | 1936 – September Hurricane       | 2003 – North American Blizzard       |
|                       | 1962 – Ash Wednesday Storm       | 2005 – North American Blizzard       |
|                       | 1976 – NE U.S. Blizzard          | 2006 – Late November Nor'easter      |
|                       | 1984 – November Nor'easter       | 2007 – April Nor'easter              |
|                       | 1991 – 'Perfect Storm'           | 2009 – November Nor'easter (Nor'Ida) |
|                       | 1993 – 'Storm of the Century'    | 2009 – December Nor'easter           |
|                       | 1994 – Christmas Nor'easter      | 2010 – March Winter Storm            |
|                       | 1996 – North American Blizzard   | 2010 – November Nor'easter           |
|                       | 1997 – April Fools' Day Blizzard | 2010 – December Blizzard             |
|                       |                                  | 2011 – January Blizzard              |
|                       |                                  | 2011 – Hurricane Irene               |
|                       |                                  | 2011 – October Nor'easter            |

It is important to have an understanding of the history of storm occurrences and the effect they have had on the barrier beach. These changes in the beach front and dune system need to be considered while determining the best location for a recreational beach. The refuge is seeking to find an area of the beach that can maintain the infrastructure associated with a recreational beach and remain intact after storm events. The cost of rebuilding roads, parking lots, buildings etc. has become increasingly prohibitive.



Storm damage to the Tom's Cove Visitor Center and parking lot #1 (December 1992).

1991 Photo of parking lot and recreational beach.

As a result of severe storms, the beach front has narrowed and the shoreline is moving westward. The 1991 photo shows the parking area and visitor center that was located behind the artificial dunes. Storm activity removed the dunes, parking lots and buildings. The second photo (2003) shows the deposition of sand that is building the island in its westward movement. Using artificial dunes in an attempt to 'protect' the beach front only temporarily prevents the natural barrier beach process from occurring. The red lines in the photos delineate the 2008 road to the parking lots.



2003 Photo of parking lot and recreational beach.

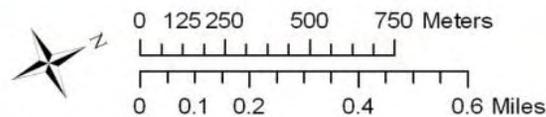


The westward movement of the beach can be seen in the photo below. This is an aerial photo taken in 2009. The far left side of the photo shows the road to the recreational beach and the remainder of the photo shows the stretch of beach to the north. The colored lines represent the location of the shoreline over the past 68 years, beginning with the blue line in 1942 to last year (the black line).



**Shoreline Position**

- April 2010
- Nov 2004
- Sept 1997
- 1961
- 1942

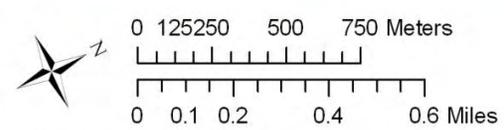


Aerial Photos November 2009  
(Post- Nor'Ida)

The shoreline is in a constant state of flux. Through time, some areas of the beach experience higher rates of change than other more stable areas of beach. The National Park Service’s Assateague Island National Seashore (ASIS) has been recording the rate of shoreline change (linear regression rate) of the high-water shoreline twice a year from 1997 to 2008. The rate of change is measured in meters (3.28 feet) per year. The majority of the beach has been experiencing a negative rate of change (loss of beach).



| Shoreline Change Rate |   |              |
|-----------------------|---|--------------|
| 1997-2008             | ● | -2.9 - -2.5  |
| m/yr (LRR)            | ● | -2.4 - -2.0  |
| ●                     | ● | -10.1 - -7.0 |
| ●                     | ● | -6.9 - -5.0  |
| ●                     | ● | -4.9 - -4.0  |
| ●                     | ● | -3.9 - -3.0  |
|                       | ● | -1.9 - -1.5  |
|                       | ● | -1.4 - -1.0  |
|                       | ● | -0.9 - 0.0   |
|                       | ● | 0.1 - 10.0   |



Aerial Photos November 2009  
(Post- Nor'Ida)

## Problem Statement

---

Workshop participants took some time to discuss the aspects of the problem and to develop a clear problem statement. It was determined that the refuge would like to continue to provide the same amount of recreational beach as it has in the past, approximately 1 mile. They want to provide access to the beach in a manner that has the least amount of impact to wildlife and habitat. The ocean is washing away the current recreational beach and parking lots, the refuge would like to explore the feasibility of relocating to a more stable section of beach. The scope of area to consider for relocation was determined to be Assateague Is. Providing access to a recreational beach and providing parking are two separate issues. It was decided to first identify appropriate segments of beach for a recreational beach and then explore parking scenarios. The following problem statement was developed to guide the SDM process:

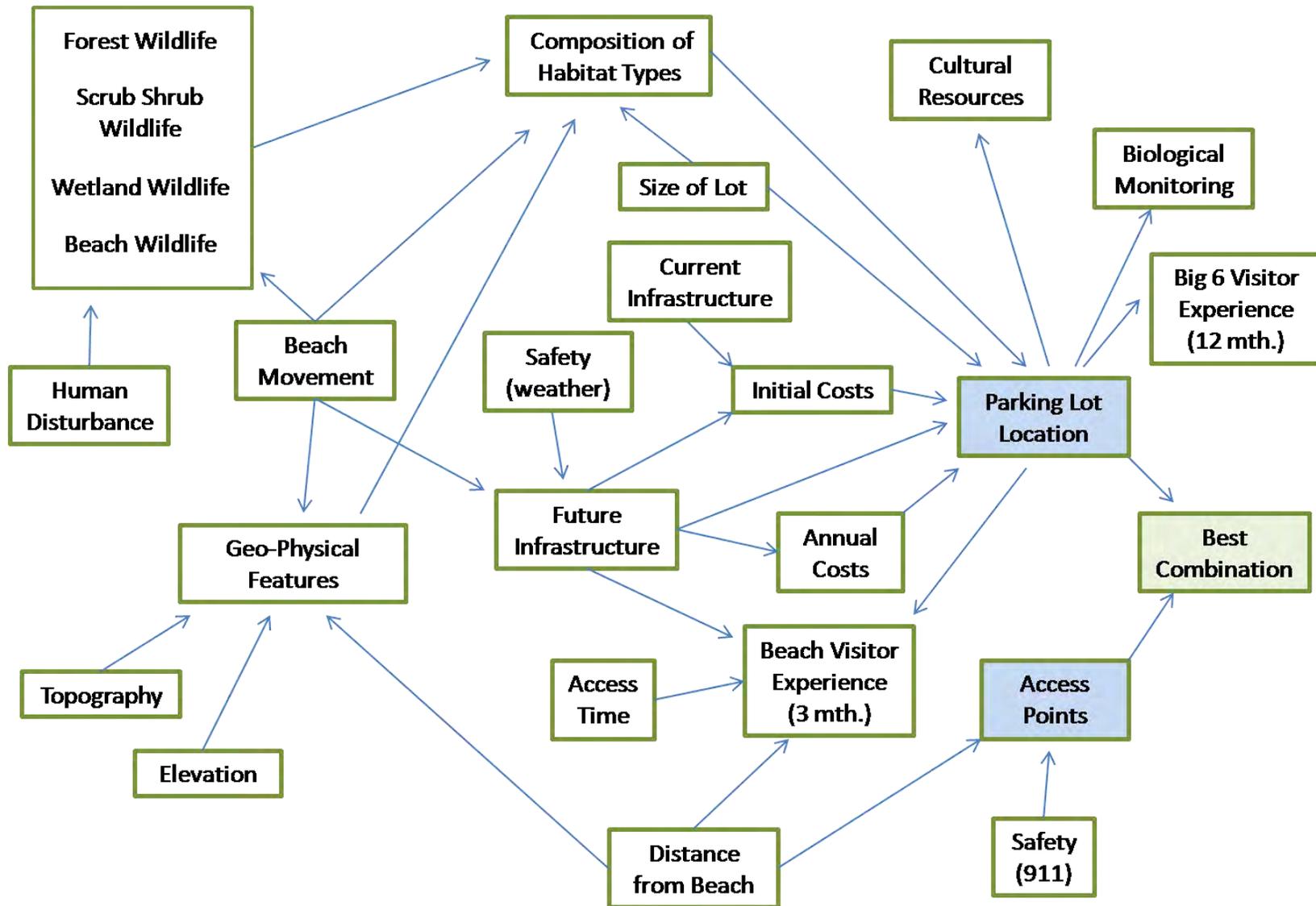
***What is the most responsible and sustainable (20-50 years) combination of a parking lot and access to a one mile recreational beach on Assateague Island with the least impact to wildlife and habitat?***

## Conceptual Model

---

A conceptual model is sometimes helpful to identify all the components of a complex problem. It is also used to ensure all the workshop participants have a mutual understanding of the problem or current conditions. While a conceptual model is being developed, participants can identify aspects of the problem that are important to them. The visual diagram demonstrates the interconnectedness of all the problem components.

The conceptual model built for this problem is on the following page.



## Objectives

---

Workshop participants brainstormed the objectives for a recreational beach. The issues they are concerned about related to managing a recreational beach: things they want to provide; things they want to ensure are not negatively impacted; things to consider, etc.

- Consideration of visitor safety, EMS vehicles, disabled visitor access/drop-off
- Proximity to existing infrastructure (restrooms, roads, electricity, etc.)
- Wildlife guilds/habitats:
  - Wildlife dependent upon sparsely vegetated beach and dune habitat (beach nesting birds, turtle nests, wildlife)
  - Waterbird use of wetlands (shorebird, waders, waterfowl)
  - Forest dependent wildlife (birds, DFS, etc.)
  - Shrub-scrub dependent wildlife
- Expected longevity of beach (island/beach migration rate)
- Ability to have some direct access
- Initial cost
- Cost of annual maintenance (fiscal sustainability)
- Consider impact to mandated recreation (Big 6)
- Maintain the visitor's experience as it is currently
- Impact on local economy
- Cultural resources – (unknown constraints)

Objectives are used to build a consequence table; they become the criterion which allows for a comparison to be made between potential recreational beach segments. The objectives are measured and used to identify the beach segments that best meet the criterion. On the second day of the workshop, we reviewed the objectives, refined them and determined how each would be measured. Influence diagrams were developed for each objective, to help identify measurable attributes.

Through the process, the above items evolved into the following list of objectives and sub-objectives.

1. Wilderness Status
2. Wildlife Dependent on Sparsely Vegetated Habitat
  - a. Amount of use during migration
  - b. Amount of non-breeding (winter) bird use
  - c. Amount of breeding use

3. Additional Legal Mandates
4. Waterbird Use of Wetlands
  - a. Level of waterbird use
  - b. Cumulative use of beach segment
5. Forest Dependent Wildlife
6. Shrub-scrub Dependent Wildlife
7. Expected Longevity of Infrastructure
8. Proximity to Existing Infrastructure
9. Visitor Safety and Experience
10. Habitat Acreage Change
11. Recreational Beach Visitor Experience
12. Cultural Resources
13. Initial Costs
14. Cost of Annual Maintenance

These were used to score each of the beach segments and resulted in the selection of a few segments which were then used to develop parking lot scenarios. Influence diagrams were built for some of the objectives to assist with determining the data needed for scoring. The data and process used to score each of the objectives is described in this section.

A simple scoring method was developed. For each Objective and Sub-objective, the group identified the best information they had to measure the objective and developed categories if necessary. The categories, such as High, Medium, and Low, were given a numerical score. The objective scores are added, the segments with the highest score represent the best segments to locate a recreational beach.

The refuge wants to find the best location for a recreational beach, therefore objectives that reflect features that are desirable for a recreational beach such as, close proximity to existing infrastructure, visitor safety, and easy access have scores where high = 3 and low = 1. It is just the reverse for wildlife and habitat objectives. To answer the Problem Statement, the refuge needs to locate areas with the least amount of impact to wildlife and habitat. Therefore objectives that reflect wildlife or habitat features have scores where high levels of use = 1 and low levels of use = 3. Segments that have a low impact to wildlife get a higher score.



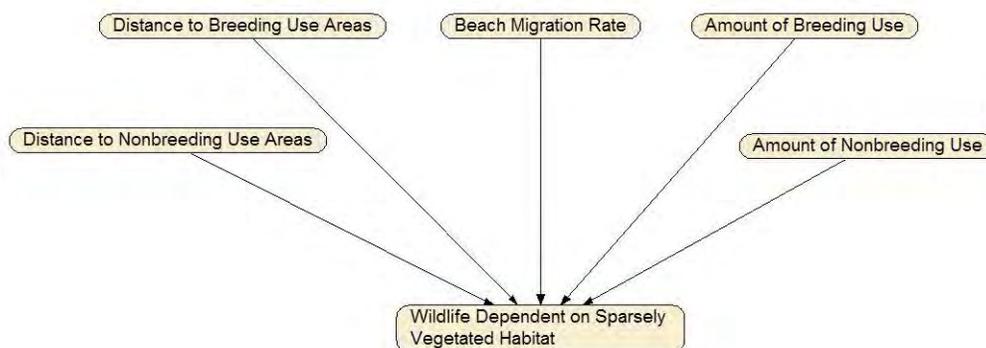
## 1. Wilderness

Portions of the Assateague Island Wilderness Proposal are located within CNWR. The proposal includes 1,740 acres in CNWR and ASIS of which 882 acres are south of the Maryland/Virginia state line, extending from mean low water (MLW) along the Atlantic Ocean to MLW along Chincoteague Bay. Congress has not yet acted on the proposal. Wilderness lands or lands that have been proposed for Wilderness have restrictions. There is limited human activity, restricted mechanical operations and restrictions on building structures.

This was the first Objective of the consequence table because it removes these beach segments from further analysis. Beach segments that fall within the area that is being proposed for Wilderness cannot be considered as areas for a recreational beach. In the consequence table these beach segments received a 'Y' for yes (Segments 9 – 12, the northern portion of the refuge beach). Beach segments that are not in the proposed Wilderness area received an 'N' for no, and continued to be scored for the next Objective.

## 2. Wildlife Dependent on Sparsely Vegetated Habitat

Influence diagram depicting elements that affect wildlife dependent on sparsely vegetated habitat.



### a. Amount of Breeding Use (shorebirds, sea turtles, plants).

Chincoteague NWR is an important breeding area for beach nesting birds and species dependent on sparsely vegetated habitat. The Federally Threatened piping plover nest

during the summer months, as well as, State listed species such as the least tern. Sea turtles use the beach to lay their eggs. Areas of the Federally Threatened sea beach amaranth have become established and need to remain undisturbed to thrive. This period of plant and animal reproduction overlaps with the time of heaviest human use. It is critical that the breeding use score represents all species dependent upon this habitat.

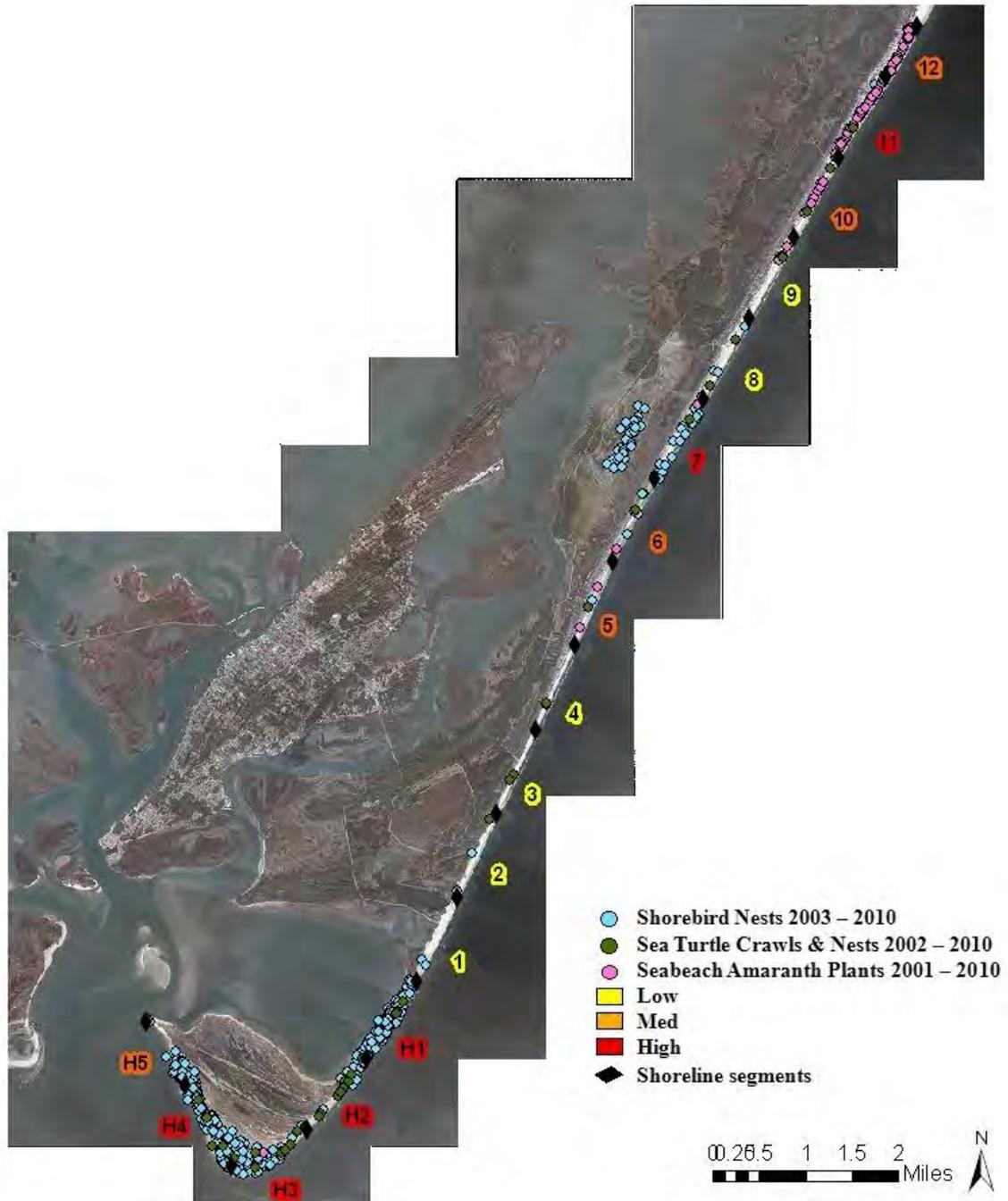
Breeding shorebirds were grouped together. Segments with more than 20 nests have a high level of use and received a breeding score of 3. Segments with 10-19 nests have a medium level of use and received breeding score of 2. Segments with 1-9 nests have a low level of use and received a breeding score of 1. Segments with no use received a breeding score of 0.

| Breeding Use on Sparsly Vegetated Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |                |               |             |              |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|-------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Segment #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Bird Score                                                                                                                                                                                                                                                                                                                             | Sea Turtle Score                                                                                                                                                                                                                                                                                   | Amaranth Score | Average Score | Final Score | Matrix Score |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                                                                                                                                                                                                                                                                      | 0                                                                                                                                                                                                                                                                                                  | 0              | 0.33          | L           | 3            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 0              | 0.67          | L           | 3            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 0              | 0.33          | L           | 3            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 0              | 0.33          | L           | 3            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 1              | 1.00          | M           | 2            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 1              | 1.00          | M           | 2            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 1              | 1.67          | H           | 1            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 0              | 0.67          | L           | 3            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 1              | 0.67          | L           | 3            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 2              | 1.00          | M           | 2            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                  | 3              | 1.67          | H           | 1            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1                                                                                                                                                                                                                                                                                                                                      | 0                                                                                                                                                                                                                                                                                                  | 3              | 1.33          | M           | 2            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| H1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                                                                                                                                                                                                                                                                                                                      | 2                                                                                                                                                                                                                                                                                                  | 0              | 1.67          | H           | 1            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| H2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2                                                                                                                                                                                                                                                                                                                                      | 3                                                                                                                                                                                                                                                                                                  | 0              | 1.67          | H           | 1            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| H3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                                                                                                                                                                                                                                                                                                                      | 3                                                                                                                                                                                                                                                                                                  | 1              | 2.33          | H           | 1            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| H4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                                                                                                                                                                                                                                                                                                                      | 3                                                                                                                                                                                                                                                                                                  | 0              | 2.00          | H           | 1            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| H5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                                                                                                                                                                                                                                                                                                                      | 0                                                                                                                                                                                                                                                                                                  | 0              | 1.00          | M           | 2            |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| Score                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 - 0.9 = L                                                                                                                                                                                                                                                                                                                            | 1.0 - 1.5 = M                                                                                                                                                                                                                                                                                      | > 1.5 = H      |               |             |              |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |
| <table border="0"> <tr> <td style="vertical-align: top;"> <p><u>Shorebird Nest Scale</u></p> <p><input type="checkbox"/> Null = 0 nests</p> <p><input type="checkbox"/> Low = 1 - 9 nests</p> <p><input type="checkbox"/> Med = 10 - 19 nests</p> <p><input type="checkbox"/> High = ≥ 20 nests</p> <p><input type="checkbox"/> Shoreline segments</p> </td> <td style="vertical-align: top;"> <p><u>Sea Turtle Activity Scale</u></p> <p><input type="checkbox"/> Null = 0 crawls or nests</p> <p><input type="checkbox"/> Low = 1 - 2 crawls or nests</p> <p><input type="checkbox"/> Med = 3 - 4 crawls or nests</p> <p><input type="checkbox"/> High = ≥ 5 crawls or nests</p> <p><input type="checkbox"/> Shoreline segments</p> </td> <td style="vertical-align: top;"> <p><u>Seabeach Amaranth Scale</u></p> <p><input type="checkbox"/> Null = 0 plants</p> <p><input type="checkbox"/> Low = 1 - 9 plants</p> <p><input type="checkbox"/> Med = 10 - 19 nests</p> <p><input type="checkbox"/> High = ≥ 20 plants</p> <p><input type="checkbox"/> Shoreline segments</p> </td> </tr> </table> |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |                |               |             |              | <p><u>Shorebird Nest Scale</u></p> <p><input type="checkbox"/> Null = 0 nests</p> <p><input type="checkbox"/> Low = 1 - 9 nests</p> <p><input type="checkbox"/> Med = 10 - 19 nests</p> <p><input type="checkbox"/> High = ≥ 20 nests</p> <p><input type="checkbox"/> Shoreline segments</p> | <p><u>Sea Turtle Activity Scale</u></p> <p><input type="checkbox"/> Null = 0 crawls or nests</p> <p><input type="checkbox"/> Low = 1 - 2 crawls or nests</p> <p><input type="checkbox"/> Med = 3 - 4 crawls or nests</p> <p><input type="checkbox"/> High = ≥ 5 crawls or nests</p> <p><input type="checkbox"/> Shoreline segments</p> | <p><u>Seabeach Amaranth Scale</u></p> <p><input type="checkbox"/> Null = 0 plants</p> <p><input type="checkbox"/> Low = 1 - 9 plants</p> <p><input type="checkbox"/> Med = 10 - 19 nests</p> <p><input type="checkbox"/> High = ≥ 20 plants</p> <p><input type="checkbox"/> Shoreline segments</p> |
| <p><u>Shorebird Nest Scale</u></p> <p><input type="checkbox"/> Null = 0 nests</p> <p><input type="checkbox"/> Low = 1 - 9 nests</p> <p><input type="checkbox"/> Med = 10 - 19 nests</p> <p><input type="checkbox"/> High = ≥ 20 nests</p> <p><input type="checkbox"/> Shoreline segments</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><u>Sea Turtle Activity Scale</u></p> <p><input type="checkbox"/> Null = 0 crawls or nests</p> <p><input type="checkbox"/> Low = 1 - 2 crawls or nests</p> <p><input type="checkbox"/> Med = 3 - 4 crawls or nests</p> <p><input type="checkbox"/> High = ≥ 5 crawls or nests</p> <p><input type="checkbox"/> Shoreline segments</p> | <p><u>Seabeach Amaranth Scale</u></p> <p><input type="checkbox"/> Null = 0 plants</p> <p><input type="checkbox"/> Low = 1 - 9 plants</p> <p><input type="checkbox"/> Med = 10 - 19 nests</p> <p><input type="checkbox"/> High = ≥ 20 plants</p> <p><input type="checkbox"/> Shoreline segments</p> |                |               |             |              |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                    |

Sea turtles and sea beach amaranth were given category scales of high, med and low reflective of their abundance. The biological scores were placed into an excel table. The biological scores were averaged for each segment. Segments with a biological average of 0.0 -0.9 had a low level of use and received a matrix score of 3. Segments with a biological

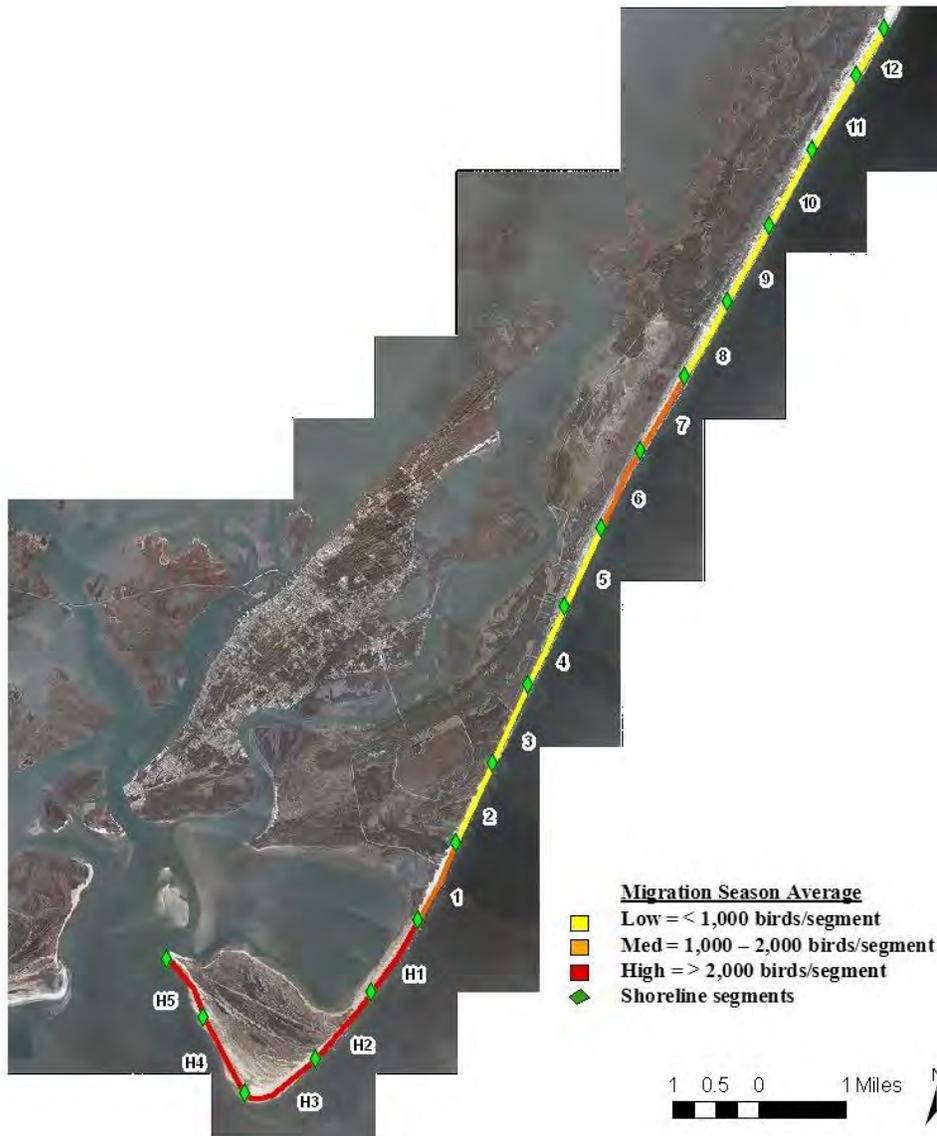
average of 1.0-1.5 had a medium level of use and received a matrix score of 2. Segments with a biological average of >1.5 had a high level of use and received a matrix score of 1.

Generalized locations for nesting shorebirds, sea turtles and sea beach amaranth plants, (blue, green and purple dots) along with the level of averaged breeding use (red, orange and yellow numbers) for beach segments.



### b. Amount of shorebird use during migration.

The refuge has been conducting shorebird migration surveys since 1991. This data was summarized and each segment received a score based on the average level of use that has been observed. Segments that had an average use of <1000 birds displayed a low level of use and received a score of 3. Segments that had an average use of 1000 – 2000 birds represent a medium level of use and received a score of 2. Segments with high levels of use, > 2000 birds, received a score of 1.



**c. Amount of Non-Breeding Bird Use (winter beach use).**

The refuge has been conducting shorebird surveys during the winter season with the same observer that performs the migration surveys. We applied the same scoring we used for shorebird use during migration.



### 3. Additional Mandates

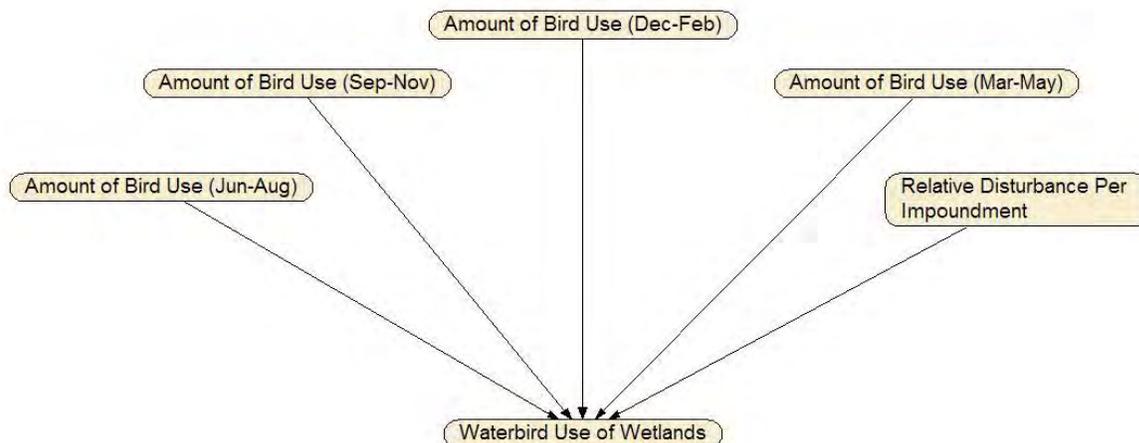
This objective recognizes mandates that the refuge is required to meet. It includes legal and policy obligations such as the Endangered Species Act. Beach Segments H1 – H5 receive a ‘Y’ for yes in the matrix because of piping plover monitoring and management activities, as stated in the 2008 USFWS Biological Opinion and Intra-Service Section 7 Biological Evaluation.

In addition, the NASA controlled airspace that overlays the Tom’s Cove Hook and Overwash would preclude development of public use infrastructure due to potential flight hazards. Currently, refuge visitors are restricted from access on the Hook and Overwash during a scheduled launch event.

Due to the additional mandates placed on Segments H1-H5, these segments do not proceed to the next Objective.

### 4. Waterbird Use of Wetlands

Influence diagram for elements that affect waterbird use of refuge wetlands.



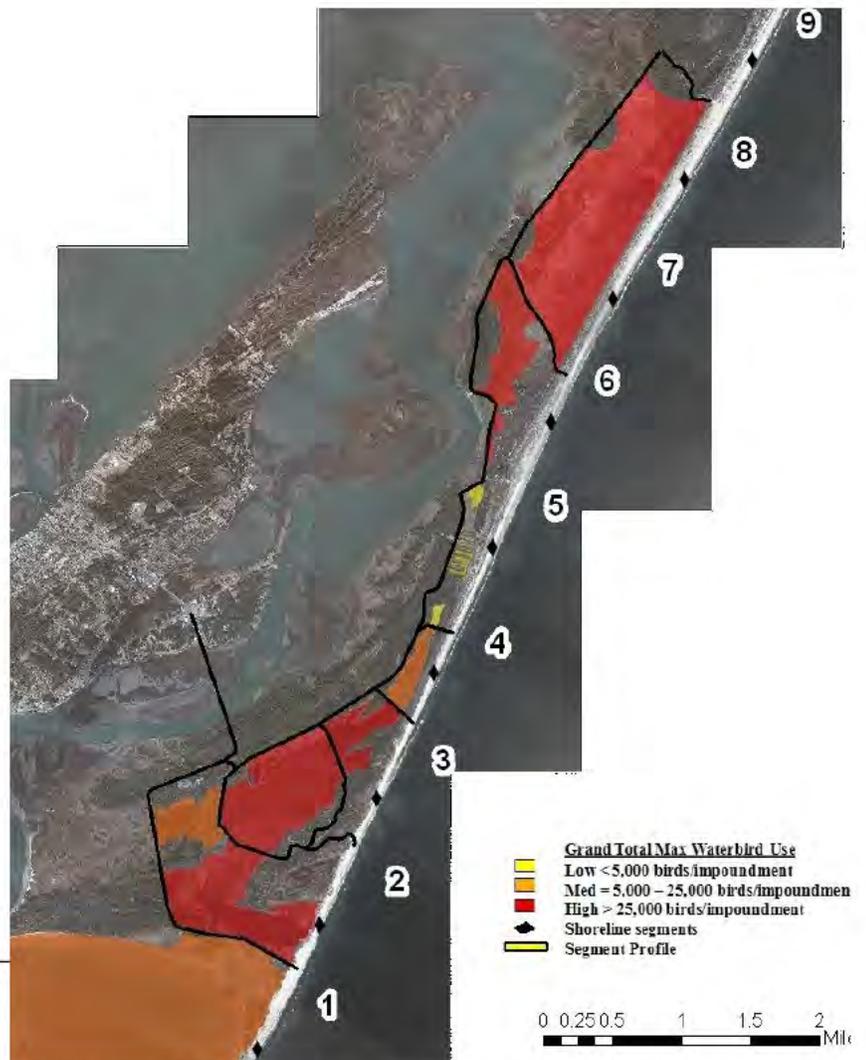
#### a. Level of Waterbird Use

Chincoteague NWR manages 10 freshwater impoundments. These wetlands along with Tom’s Cove (saltwater wetlands) support waterfowl, shorebirds and wading birds (waterbirds) during different times of the year. The impoundments provide food and resting areas for migrating

waterfowl and shorebirds, as well as, food during the wading bird breeding season. The refuge wanted to include the potential impact beach visitors would have on waterbirds using the impoundments by ranking the level of use for each impoundment.

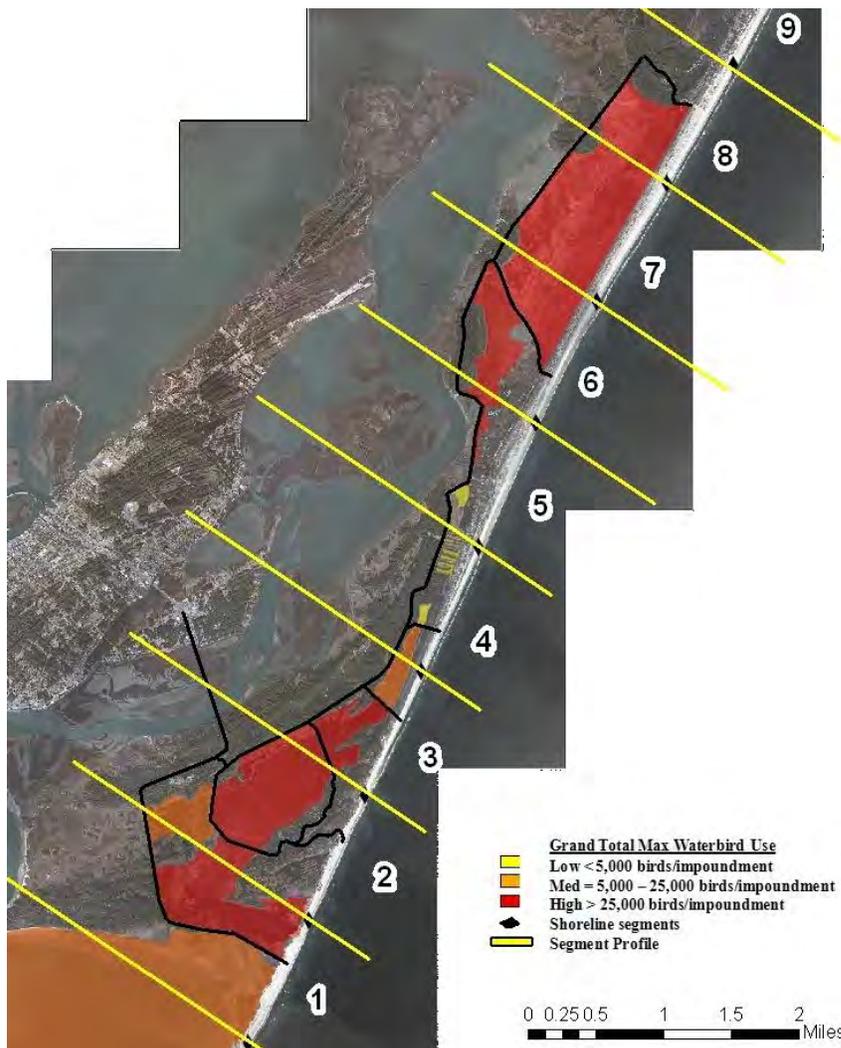
The refuge analyzed waterbird data from 2005 to 2009. From this data, they developed the following table and map of maximum waterbird use for each wetland. Each wetland (Tom's Cove and 10 impoundments) received a relative rank according to the level of use: <5,000 birds/impoundment = low; medium = 5,000 – 25,000; and high = > 25,000. The map shows the rank for each wetland (yellow = low, orange = medium, red = high). The rank was then converted into a score for the matrix. Wetlands with a high level of use were given a 1, medium a 2, and low a 3. Recall that we are scoring for the least impact to wildlife, therefore wetlands with low use get a higher score.

| Waterbird Use of Wetlands |                               |      |
|---------------------------|-------------------------------|------|
| Impoundment/<br>Wetland   | Total Max<br>Waterbird<br>Use | Rank |
| Tom's Cove                | 20970                         | M    |
| F-Pool'                   | 29298                         | H    |
| A-Pool                    | 6047                          | M    |
| B-South Pool              | 132191                        | H    |
| B-North Pool              | 26739                         | H    |
| C-Pool                    | 7973                          | M    |
| D-Pool                    | 121                           | L    |
| Farm Fields               | 1910                          | L    |
| E-Pool                    | 3312                          | L    |
| South Wash<br>Flats       | 25343                         | H    |
| North Wash<br>Flats       | 26695                         | H    |



For the purposes of this analysis, the refuge has been split into beach segments. Each of the segments contains one or two wetlands. Beach segments 1 – 8 (the other segments have been removed from the analysis based on earlier criteria) received a score which was the average score of the two wetlands within that segment, or just the score if only one wetland was in the segment. These are listed in the table (and entered into the matrix) followed by the map of beach segments and wetlands within each segment.

| Waterbird Use of Wetlands per Segment (color combo) |           |           |               |
|-----------------------------------------------------|-----------|-----------|---------------|
| Segment Profile #                                   | Wetland 1 | Wetland 2 | Average Score |
| 1                                                   | 2         | 1         | 1.50          |
| 2                                                   | 2         | 1         | 1.50          |
| 3                                                   | 2         | 1         | 1.50          |
| 4                                                   | 2         | 3         | 2.50          |
| 5                                                   | 3         | 1         | 2.00          |
| 6                                                   | 1         | 1         | 1.00          |
| 7                                                   | 1         |           | 1.00          |
| 8                                                   | 1         |           | 1.00          |

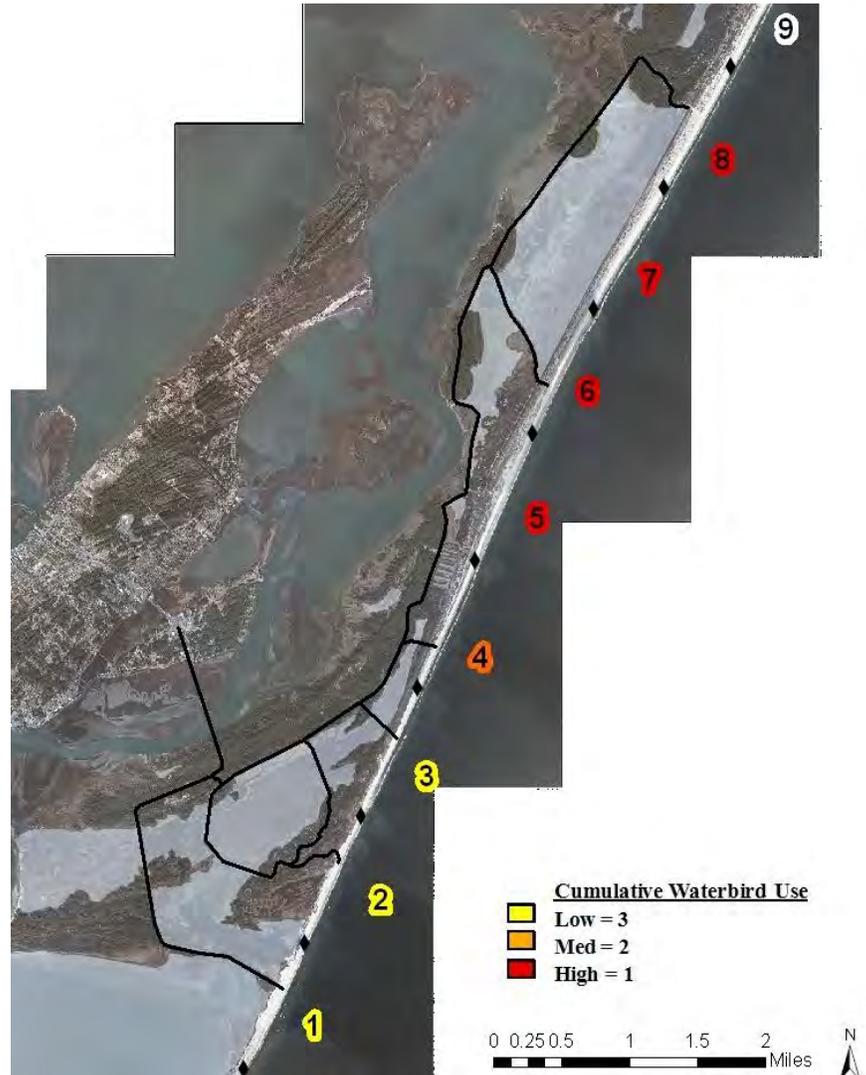


**b. Cumulative Use to Beach Segment**

| Cumulative waterbird max use along route to beach segment |           |           |           |           |           |           |           |           |       |              |
|-----------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|--------------|
| Segment Profile #                                         | Impound 1 | Impound 2 | Impound 3 | Impound 4 | Impound 5 | Impound 6 | Impound 7 | Impound 8 | Sum   | Matrix Score |
| 1                                                         | 1         | 2         | 2         |           |           |           |           |           | 5.00  | 3.00         |
| 2                                                         | 1         | 2         | 1         | 1         |           |           |           |           | 5.00  | 3.00         |
| 3                                                         | 1         | 1         | 2         |           |           |           |           |           | 4.00  | 3.00         |
| 4                                                         | 1         | 1         | 2         | 3         | 3         |           |           |           | 10.00 | 2.00         |
| 5                                                         | 1         | 1         | 2         | 3         | 3         | 3         | 1         |           | 14.00 | 1.00         |
| 6                                                         | 1         | 1         | 2         | 3         | 3         | 3         | 1         | 1         | 15.00 | 1.00         |
| 7                                                         | 1         | 1         | 2         | 3         | 3         | 3         | 1         | 1         | 15.00 | 1.00         |
| 8                                                         | 1         | 1         | 2         | 3         | 3         | 3         | 1         | 1         | 15.00 | 1.00         |

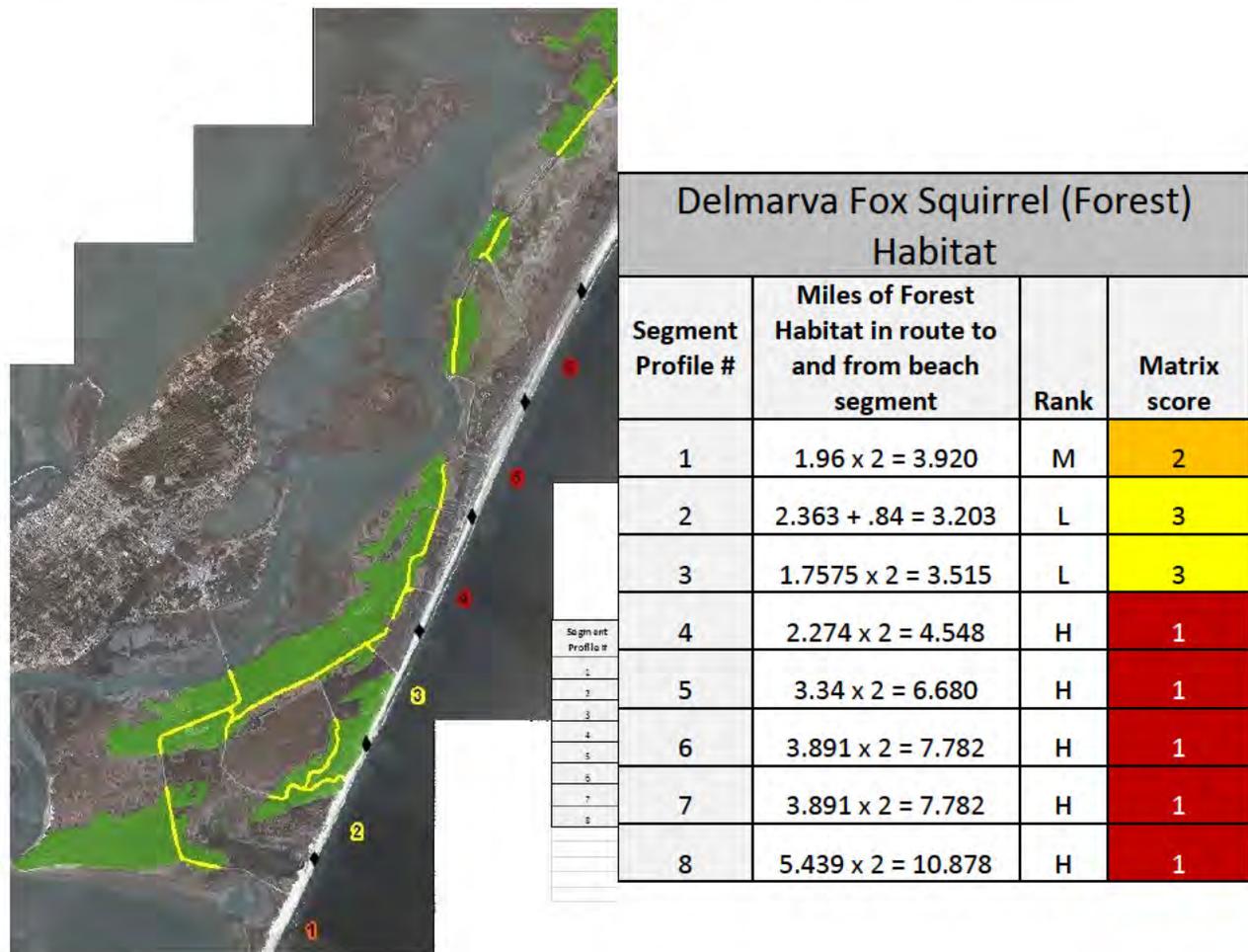
An access road to the recreational beach will cause some disturbance based on the number of cars that travel to the beach. In order to assess the level of relative disturbance to waterbirds using the wetlands, we developed a score for the each segment based on the wetlands that an access road would pass as it traverses the refuge to the beach segment.

In the table below, each wetland (impoundment columns) receives a score based on the level of waterbird use. Then each section (segment profile rows) received a sum of those use levels. The sums were converted into a matrix score of 3 for sums of 0-5 (low cumulative sums i.e. low disturbance), 2 for sums 6-10, and 1 for sums 11-15 (high cumulative sums).



### 5. Forest Dependent Wildlife

The federally endangered Delmarva Peninsula fox squirrel (DFS), were translocated to Assateague Island from 1968-1971 to encourage recovery. The population has increased and expanded from the initial release sites on Lighthouse Ridge and Headquarters areas to all suitable loblolly pine habitats on the Refuge. The population is considered stable and estimated at 200 animals. Management consists of maintaining nest boxes, mowing roadside grasses to reduce vehicle/DFS collisions, thinning forest understory, and monitoring/controlling southern pinebark beetle outbreaks when they threaten habitat. Population estimates are made biannually with mark-recapture techniques. DFS are now a candidate species for delisting.

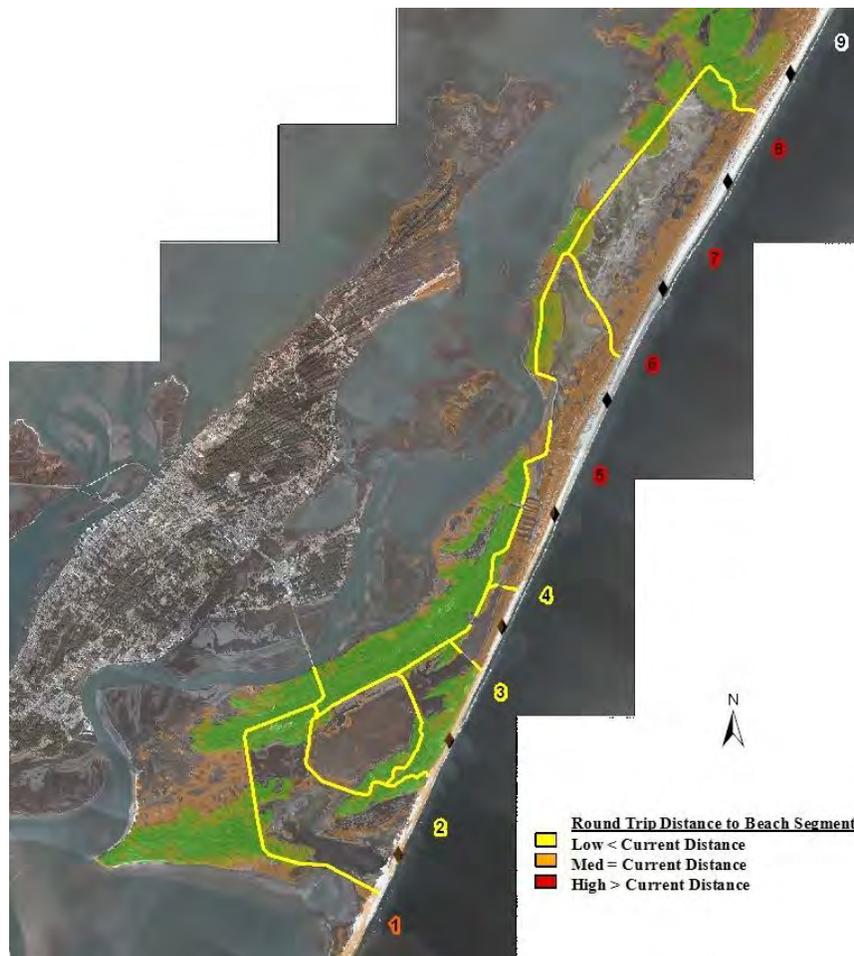


The access road to the recreational beach bisects forested areas. The analysis needed to reflect the potential negative impacts an access road may have on the squirrel population, which are car collisions and reduced habitat. To assess this, the refuge measured the linear distance through forested habitat the current access road bisects (approx. 4 miles round trip).

Using GIS, the refuge delineated the path an access road would take to and from each beach segments 1-8, and measured the linear distance that would pass through forested habitat. The results are in the table above. Paths that were less than the current access road distance through forested habitat were given a rank of low and matrix score of 3 (less impact than current conditions). Paths equal to 4 miles received a rank of medium and score of 2, and those longer than 4 miles were ranked as a high level of impact and received a score of 1.

## 6. Scrub-Shrub Dependent Wildlife

Scrub-shrub is a critical coastal habitat. The majority of this habitat, covering 2,872 acres (roughly 25- 30%) of Assateague Unit, extends north and south on barrier flats and backdunes, gradually merging on the east with dune grasses of the beach/dune community, and on the west with marshes or forests. Small pockets of this habitat are scattered throughout Assateague Island. Shrubs, small trees, and vines are predominant plant forms. Common species include wax myrtle, northern bayberry, black cherry, Canada serviceberry, blackberry, poison ivy, and greenbrier. Evergreens are less frequent, but include red cedar and American holly.



Bird species that depend on shrubs and other early-successional habitats are declining in the eastern U.S. due to loss of habitat. Shrubs provide an abundance of insect food for breeding birds, and berries during the fall migration and/or throughout the winter. The large number of yellow-rumped warblers that winter on the Refuge, as well as tree swallows feed on wax myrtle berries.

The refuge has not specifically conducted surveys in the scrub-shrub habitat. The primary concern is the loss of habitat due to the access road that would traverse through the scrub-shrub and reduce its value to wildlife. Therefore, we used a similar measurement, ranking and score system applied to the forested habitat.

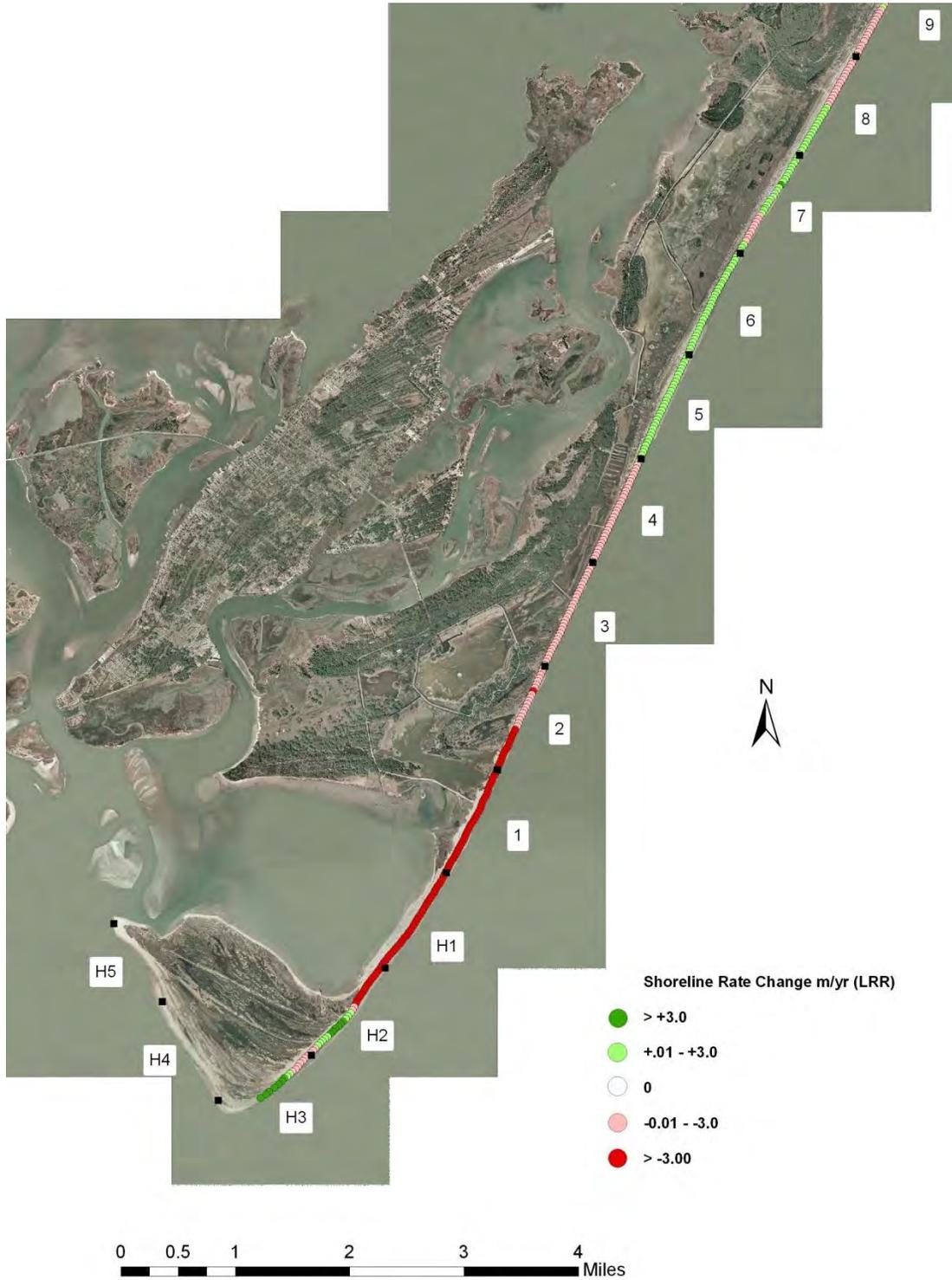
| Miles of Scrub Shrub Habitat |                                                                 |      |              |
|------------------------------|-----------------------------------------------------------------|------|--------------|
| Segment Profile #            | Miles of Scrub Shrub Habitat in route to and from beach segment | Rank | Matrix score |
| 1                            | $2.88 \times 2 = 5.76$                                          | M    | 2            |
| 2                            | $3.82 + .84 = 4.66$                                             | L    | 3            |
| 3                            | $1.89 \times 2 = 3.78$                                          | L    | 3            |
| 4                            | $2.31 \times 2 = 4.62$                                          | L    | 3            |
| 5                            | $3.61 \times 2 = 7.22$                                          | H    | 1            |
| 6                            | $5.75 \times 2 = 11.50$                                         | H    | 1            |
| 7                            | $5.75 \times 2 = 11.50$                                         | H    | 1            |
| 8                            | $7.26 \times 2 = 14.52$                                         | H    | 1            |

Using GIS, the refuge delineated the path an access road would take for beach segments 1-8, and measured the linear distance that would pass through scrub-shrub habitat. The results are in the table below. Paths that were less than the current access road distance (approx. 6 miles round trip) were given a rank of low and matrix score of 3 (less impact than current conditions). Paths equal to 6 miles received a rank of medium and score of 2, and those longer than 6 miles were ranked as a high level of impact and received a score of 1.

## 7. Expected Longevity of Infrastructure

Due to the destruction from storm activity in recent years, meeting participants wanted to include a measurement that would reflect a level of permanence for the road, parking lots and structures associated with a recreational beach. After some discussion, it was decided to use the ASIS's beach migration rates. Each segment has 32 dots which represent a rate of change for that portion of the beach. These ranged from slow accretion (green + 3 meters/year) to rapidly decreasing (red – 3 meters/year). For beach segments 1-8, the dots were summed for each rate of shoreline change and used to derive a score for the matrix. The rate of change was then converted to the matrix score (see chart below). For example, segment profile #2 illustrates a rate of change of 43.75% or fourteen dots and a rate of change of 56.25% or eighteen dots for a total of 100% or 32 dots. Each rate of change score was then converted to the new matrix score and then averaged to create the matrix score.

| Shoreline Change  |             |              |     |              |            |              |
|-------------------|-------------|--------------|-----|--------------|------------|--------------|
| Segment Profile # | > -3.0      | -0.01 - -3.0 | 0   | +0.01 - +3.0 | > +3.0     | Matrix score |
|                   | = -2        | = -1         | = 0 | = 1          | = 2        |              |
| 1                 | 32 = 100%   |              |     |              |            | -2           |
| 2                 | 14 = 43.75% | 18 = 56.25%  |     |              |            | -1.44        |
| 3                 |             | 32 = 100%    |     |              |            | -1           |
| 4                 |             | 32 = 100%    |     |              |            | -1           |
| 5                 |             |              |     | 32 = 100%    |            | 1            |
| 6                 |             |              |     | 32 = 100%    |            | 1            |
| 7                 |             | 9 = 28.125%  |     | 22 = 68.75%  | 1 = 3.125% | 0.47         |
| 8                 |             | 16 = 50%     |     | 16 = 50%     |            | 0            |



## 8. Proximity to Existing Infrastructure

There are a number of utilities needed for the comfort of recreational beach users, such as running water and electricity. The refuge currently has utilities at the Wildlife Loop Parking Lot; these would need to be run to the new recreational beach location. The National Park Service has a Visitor Center at Tom's Cove which has utilities. The Tom's Cove VC is approximately 2.5 miles from the Wildlife Loop Parking Lot. In an attempt to gauge the relative cost of running utilities to the different beach sections, each beach segment received a score according to its distance from the Wildlife Loop Parking Lot. If a segment was further than 2.5 miles from the Wildlife Loop Parking Lot, it received a score of 1 (least desirable condition because it was further than the Tom's Cove VC). A segment received a score of 2 if it was equal to 2.5 miles and a score of 3 if it was shorter than 2.5 miles (closer than the Tom's Cove VC). The distances were calculated using GIS and the scores entered into the matrix.

## 9. Visitor Safety and Experience

Visitor Safety and Experience is comprised of four sub-objectives. These four sub-objectives are to score visitor issues such as safety in the form of how quickly the Emergency Medical Services would be able to respond to an emergency at the recreational beach. The placement of a recreational beach in one of the beach segments will have some level of impact on other visitor services such as walking trails and hunting areas. The quality of the recreational beach visitor's experience is addressed in another set of sub-objectives, these sub-objectives are to score use by non-recreational beach visitors.

### a. Response Time by Emergency Medical Services (EMS)

The amount of time that is estimated for EMS to respond to a visitor's need was scored based on current response time estimates and the distance to the beach segment from the beginning of the Wildlife Loop Parking Lot. The Refuge's visitor services staff and Town representatives estimated the current response time to be approximately 5-10 minutes. The distance to each of the beach segments was reviewed and was given a rank of high, medium or low based on the distance to the beach segment. A segment was scored 3 (high) if the response time would be less than 5 minutes, 2 if it would be 5-10 minutes (medium) and a score of 1 (low) if the response time would be greater than 10 minutes. These scores were entered into the matrix.

| Distance to Beach Segment |                                                                             |      |              |
|---------------------------|-----------------------------------------------------------------------------|------|--------------|
| Segment Profile #         | Distance to beach segment (Beginning at Wildlife Loop Parking Lot) in miles | Rank | Matrix score |
| 1                         | 2.550                                                                       | M    | 2            |
| 2                         | 1.650                                                                       | H    | 3            |
| 3                         | 1.640                                                                       | H    | 3            |
| 4                         | 2.100                                                                       | H    | 3            |
| 5                         | 2.310                                                                       | H    | 3            |
| 6                         | 5.940                                                                       | L    | 1            |
| 7                         | 5.940                                                                       | L    | 1            |
| 8                         | 7.490                                                                       | L    | 1            |

### b. Points of Interest along Route to Beach

As people travel to the beach, there are opportunities to view wildlife and points of interest like the historic lighthouse. Depending upon the beach segment, an access route will have different points of interest. The refuge developed a list of 'Points of Interest' based on past requests by visitors to see refuge resources. Many visitors come to the refuge to see the ponies, the historic lighthouse and visitor center. The opportunity to see a variety of wildlife is based on the habitats that the access route travels through. The refuge's freshwater wetlands, saltmarsh

and borrow ditches provide habitat for waterfowl, shorebirds and wading birds and opportunities to visitors to view them. The Wildlife Loop and forested habitat provide additional opportunities to view upland wildlife.

| Points of interest  | Beach Profile # |   |   |   |   |   |   |   |
|---------------------|-----------------|---|---|---|---|---|---|---|
|                     | 1               | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Pony viewing        | 1               |   |   |   | 1 | 1 | 1 | 1 |
| Forest              | 1               | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Lighthouse access   | 1               |   |   |   |   |   |   |   |
| VCS                 | 1               |   |   |   |   |   |   |   |
| Freshwater wetlands | 1               | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Salt marsh          | 1               |   |   |   | 1 | 1 | 1 | 1 |
| Borrow ditches      | 1               | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Wildlife Loop       |                 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total               | 7               | 4 | 4 | 4 | 6 | 6 | 6 | 6 |

The number of points of interest was summed for each of the Beach Segments. The Segment was given a rank of high, medium or low and translated to a matrix score. Segments with medium were given a score of 2, and segments with high received a score of 3 (more points, more desirable).

| Points of Interest along Route to Beach |                                         |      |              |
|-----------------------------------------|-----------------------------------------|------|--------------|
| Segment Profile #                       | Points of interest along route to beach | Rank | Matrix score |
| 1                                       | 7.000                                   | H    | 3            |
| 2                                       | 4.000                                   | M    | 2            |
| 3                                       | 4.000                                   | M    | 2            |
| 4                                       | 4.000                                   | M    | 2            |
| 5                                       | 6.000                                   | H    | 3            |
| 6                                       | 6.000                                   | H    | 3            |
| 7                                       | 6.000                                   | H    | 3            |
| 8                                       | 6.000                                   | H    | 3            |

### c. Traffic to Beach Impact on Trails

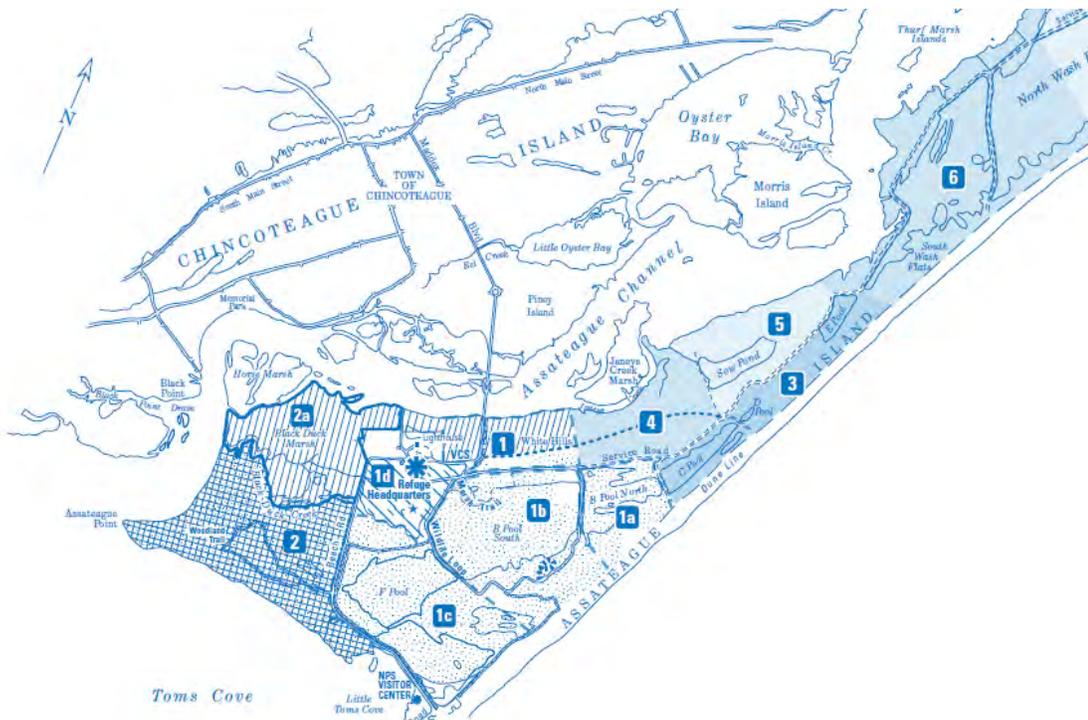
An access route to the recreational beach will use existing roads and trails to minimize habitat impacts and construction costs. Depending on the route to a beach segment, there may be sections of walking/biking trails that will include traffic to and from the beach. Currently, the refuge offers 4.5 miles of walking/biking trails with no automobile traffic.

Using GIS, the refuge obtained the length of walking/biking trails that would coincide with automobile traffic for each beach segment. Segments with routes that would result in less than 4.5 miles of traffic free trail were ranked low and given a matrix score of 1. Segments with a similar amount of traffic free trail (4.5 miles) were ranked medium and scored 2. Segments with routes that would provide more than 4.5 miles of traffic free trails ranked high and were given a matrix score of 3.

| Traffic to beach impact on trails |      |              |
|-----------------------------------|------|--------------|
| Segment Profile #                 | Rank | Matrix score |
| 1                                 | M    | 2            |
| 2                                 | L    | 1            |
| 3                                 | H    | 3            |
| 4                                 | H    | 3            |
| 5                                 | H    | 3            |
| 6                                 | H    | 3            |
| 7                                 | H    | 3            |
| 8                                 | H    | 3            |

### d. Impacts to Existing Hunting Areas

The Refuge has many hunt areas that provide a variety of opportunities to hunters. An access road bisecting a hunt unit would have a negative impact to that unit due to restrictions that are required to keep non-hunting visitors safe.



For beach segments 1-8, a one was given to the Hunt Zone that would be bisected by an access route to that beach segment. The ones were summed and each beach segment received a rank of low (matrix score of 3) if the sum was zero; medium rank if 1-5, and a high rank (matrix score of 1, least desirable) if greater than 5.



use. The remaining segments (#1 - #8) continued through the scoring of Shoreline Change and Access Route objectives.

From the analysis, beach segments #2, 3, and 4, received the highest scores, indicating this is the area of beach in which a recreational beach would have the least impact on wildlife and habitat and provide a quality recreational beach experience in the most responsible and sustainable manner. This information was used by the Fish and Wildlife Service to develop draft alternatives for public consideration and discussion. See Appendix 1.

## “Fine Tuning” – Site Selection

---

During the workshop, participants identified objectives that contribute to determining the best location for an access road and parking lot. This location will be determined by future engineer planning, and was beyond the scope of this workshop, which was to evaluate the biological aspects of the location of a recreational beach. The full criteria will be used in determining any future infrastructure development (i.e. parking lots, restrooms, visitor contact station, roads, etc.).

### A. Habitat Acreage Change

Workshop participants felt it was necessary to consider the amount of habitat that would be lost or gained by relocating the access road and parking lot area. For each of the main habitat types, beach, wetland, forest and shrub-scrub, the change in acreage needs to be calculated and entered into the matrix table. Some habitats may need to be weighted higher, such as shrub-scrub, because the refuge does not have a lot of it and many migrating species are dependent upon this habitat type. The change in acreage may need to be converted to a score, rather than entering just the +/- acreage.

### B. Recreational Beach Visitor Experience

The following sub-objectives were developed to assess the quality of experience a recreational beach visitor would have for different parking lot location scenarios. The current recreational

beach is located in Beach Segment 1. The refuge staff used the ranking and scores below to fill out the matrix for the current recreational beach.

### **1. Direct Access for Mobility Impaired**

This is either 'yes' or 'no' to the question, 'Is there direct access for people who are mobility impaired?' A 'yes' receives a score of 3 (most desirable) and a 'no' receives a score of 1.

The current recreational beach received a 3.

### **2. Distance to Shelter**

This objective assesses the distance a recreational beach visitor would have to travel to reach shelter from the beach. Shelter is defined as a covered shelter which could protect a visitor during a sudden rain storm, or the protection of a visitor's automobile. If the distance is < 50 yards receives 3 (most desirable); 50-100 yds. receives 2; and a distance of >100 yds. receives a 1 (least desirable). The current recreational beach received a 3.

### **3. Mode of Transportation**

How a visitor arrives at the beach is important. Some transportation options are viewed as more convenient than others and visitors generally like to have the option of more than one mode of transportation. Modes of transportation include: personal automobile, bicycle, motorcycle, walking, shuttle bus, etc. This objective provides a score for the transportation options a visitor has depending on the parking lot scenario. Five modes of transportation receive a 5; four receives 4; three modes receive 3; two receives 2; and one receives a 1.

The current recreational beach received 3.

### **4. Convenience**

The workshop participants wanted to assess the level of 'convenience' a parking lot scenario provides a recreational beach visitor. This objective attempts to assess the amount of time it would take to reach the beach from the parking lot and the distance a visitor would have to travel from an access point. It is based on the number of parking spaces available and the mode of transport to the beach. If a parking lot scenario provides the same number of parking spaces that currently exist, it receives a 3. If a parking lot scenario provides a combination of parking spaces near the beach and alternative transport from another location, it receives a 2. If the parking lot scenario is not near the recreational beach and can only be accessed by alternative transportation, the scenario receives a 1.

### **5. Off-Road Vehicle Fishing Access**

The ability to access fishing areas using an off-road vehicle (ORV) is highly valued by visitors fishing on the beach. The refuge wanted to include this objective to reflect the additional

use of a recreational beach by fishermen. This is simply a score of 2 for 'yes, there is ORV access', and a score of 1 for 'no, there is no ORV access'.

### **C. Cultural Resources**

The construction of an access road and parking lot areas will most likely involve disturbance to the upper levels of soil. Grading and ground removal, if needed, could potentially impact cultural resources. In 1989, USFWS regional archeologists conducted an archeological reconnaissance in which they surveyed the refuge and produced a report. Based on this report, regional archeologists would be able to determine whether or not construction associated with an access road and parking lots would impact cultural resources. The parking lot scenario would receive a score of 2, if it is in an area where it is unlikely to impact cultural resources. A scenario would receive a score of 1, if it is in an area that will impact cultural resources.

### **D. Initial Cost**

The initial costs of new construction associated with an access road, parking lots areas and structures should be included in parking lot scenarios. The participants did not go into detail on how this would be done, just expressed the need to include some type of cost estimate that could be translated into a score for the matrix.

### **E. Cost of Annual Maintenance**

Similar to Initial Costs, workshop participants felt that an estimate of annual maintenance costs should be included in the evaluation of parking lot scenarios. Annual costs may include maintenance of the access road (based on its length), storm repairs (due to the rate of beach movement), building up keep, etc. As biologists, the participants did not get into the details of how this would be estimated, but wanted to include a cost estimate that could be translated into a score for the matrix.

**Appendix 1. Beach Segment Matrix**

| Objectives      |                                                       | One Mile Recreational Beach Segments from the Current Rec. Beach to the MD/VA Border and Tom's Cove Hook |              |              |              |              |              |              |              |              |               |               |               |               |               |               |               |               |
|-----------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                 |                                                       | Beach Seg. 1 Current                                                                                     | Beach Seg. 2 | Beach Seg. 3 | Beach Seg. 4 | Beach Seg. 5 | Beach Seg. 6 | Beach Seg. 7 | Beach Seg. 8 | Beach Seg. 9 | Beach Seg. 10 | Beach Seg. 11 | Beach Seg. 12 | Beach Seg. H1 | Beach Seg. H2 | Beach Seg. H3 | Beach Seg. H4 | Beach Seg. H5 |
| <b>Wildlife</b> | <b>1. Wilderness (proposed)?</b>                      | N                                                                                                        | N            | N            | N            | N            | N            | N            | N            | Y            | Y             | Y             | Y             | N             | N             | N             | N             | N             |
|                 | <b>2. Wildlife Dependent on Sparsely Veg. Habitat</b> |                                                                                                          |              |              |              |              |              |              |              |              |               |               |               |               |               |               |               |               |
|                 | a. Amount of breeding use                             | 3                                                                                                        | 3            | 3            | 3            | 2            | 2            | 1            | 3            |              |               |               |               | 1             | 1             | 1             | 1             | 2             |
|                 | b. Amount of use during migration                     | 2                                                                                                        | 3            | 3            | 3            | 3            | 2            | 2            | 3            |              |               |               |               | 1             | 1             | 1             | 1             | 1             |
|                 | c. Amount of non-breeding (winter) bird use           | 3                                                                                                        | 3            | 3            | 3            | 3            | 3            | 3            | 3            |              |               |               |               | 2             | 2             | 1             | 1             | 1             |
|                 | <i>Subtotal</i>                                       | 8                                                                                                        | 9            | 9            | 9            | 8            | 7            | 6            | 9            |              |               |               |               | 4             | 4             | 3             | 3             | 4             |
|                 | <b>3. Additional Mandates</b>                         |                                                                                                          |              |              |              |              |              |              |              |              |               |               |               | Y             | Y             | Y             | Y             | Y             |
|                 | <b>4. Waterbird Use of Wetlands</b>                   |                                                                                                          |              |              |              |              |              |              |              |              |               |               |               |               |               |               |               |               |
|                 | a. Level of Waterbird Use                             | 1.5                                                                                                      | 1.5          | 1.5          | 2.5          | 2            | 1            | 1            | 1            |              |               |               |               |               |               |               |               |               |
|                 | b. Cumulative use to beach segment                    | 3                                                                                                        | 3            | 3            | 2            | 1            | 1            | 1            | 1            |              |               |               |               |               |               |               |               |               |
|                 | <i>Subtotal</i>                                       | 4.5                                                                                                      | 4.5          | 4.5          | 4.5          | 3            | 2            | 2            | 2            |              |               |               |               |               |               |               |               |               |
|                 | <b>5. Forest Dependent Wildlife</b>                   |                                                                                                          |              |              |              |              |              |              |              |              |               |               |               |               |               |               |               |               |
|                 | <i>Subtotal</i>                                       | 2                                                                                                        | 3            | 3            | 1            | 1            | 1            | 1            | 1            |              |               |               |               |               |               |               |               |               |

|                                   |                                               |       |       |       |       |      |      |      |      |  |  |  |  |  |  |  |  |  |
|-----------------------------------|-----------------------------------------------|-------|-------|-------|-------|------|------|------|------|--|--|--|--|--|--|--|--|--|
| 6. Shrub-scrub Dependent Wildlife |                                               |       |       |       |       |      |      |      |      |  |  |  |  |  |  |  |  |  |
|                                   | <i>Subtotal</i>                               | 2     | 3     | 3     | 3     | 1    | 1    | 1    | 1    |  |  |  |  |  |  |  |  |  |
|                                   | <b>Sum of Wildlife Subtotals</b>              | 16.5  | 19.5  | 19.5  | 17.5  | 13.0 | 11.0 | 10.0 | 13.0 |  |  |  |  |  |  |  |  |  |
| Shoreline Change                  | 7. Expected Longevity of Infrastructure       |       |       |       |       |      |      |      |      |  |  |  |  |  |  |  |  |  |
|                                   | <i>Is route to Beach Segment Sustainable?</i> |       |       |       |       |      |      |      |      |  |  |  |  |  |  |  |  |  |
|                                   | <b>Shoreline Change Rate</b>                  | -2.00 | -1.44 | -1.00 | -1.00 | 1.00 | 1.00 | 0.47 | 0.00 |  |  |  |  |  |  |  |  |  |
| Access Route                      | 8. Proximity to Existing Infrastructure       |       |       |       |       |      |      |      |      |  |  |  |  |  |  |  |  |  |
|                                   | <i>Subtotal</i>                               | 2     | 3     | 3     | 3     | 3    | 1    | 1    | 1    |  |  |  |  |  |  |  |  |  |
|                                   | 9. Visitor Safety and Experience              |       |       |       |       |      |      |      |      |  |  |  |  |  |  |  |  |  |
|                                   | a. Response time by EMS                       | 2     | 3     | 3     | 3     | 3    | 1    | 1    | 1    |  |  |  |  |  |  |  |  |  |
|                                   | b. Points of interest along route to beach    | 3     | 2     | 2     | 2     | 3    | 3    | 3    | 3    |  |  |  |  |  |  |  |  |  |
|                                   | c. Traffic to beach impact on trails          | 2     | 1     | 3     | 3     | 3    | 3    | 3    | 3    |  |  |  |  |  |  |  |  |  |
|                                   | d. Impacts to existing Hunting Areas          | 3     | 2     | 2     | 2     | 1    | 1    | 1    | 1    |  |  |  |  |  |  |  |  |  |
|                                   | <i>Subtotal</i>                               | 10    | 8     | 10    | 10    | 10   | 8    | 8    | 8    |  |  |  |  |  |  |  |  |  |
| <b>Sum of Access Route</b>        | 12                                            | 11    | 13    | 13    | 13    | 9    | 9    | 9    |      |  |  |  |  |  |  |  |  |  |
| <b>Cumulative Subtotals</b>       | 26.5                                          | 29.1  | 31.5  | 29.5  | 27.0  | 21.0 | 19.5 | 22.0 |      |  |  |  |  |  |  |  |  |  |

## Appendix 2. List of Workshop Participants / Invitee

| Participants      | Agency                                    | Telephone    |
|-------------------|-------------------------------------------|--------------|
|                   |                                           |              |
| Bill Neville      | Town of Chincoteague                      | 757-336-6519 |
| Lou Hinds         | Chincoteague NWR                          | 757-336-6122 |
| Kim Halpin        | Chincoteague NWR                          | 757-336-6122 |
| Kevin Holcomb     | Chincoteague NWR                          | 757-336-6122 |
| Amanda Daisey     | Chincoteague NWR                          | 757-336-6122 |
| Sue Rice          | Eastern Shore of VA NWR                   | 757-331-2760 |
| Hal Laskowski     | USFWS, Region 5                           | retired      |
| Jennifer Casey    | USFWS, Region 5                           | 603-482-3415 |
| Bill Thompson     | USFWS, Region 5                           | 413-253-8200 |
| Jack Kumer        | NPS - Assateague Island National Seashore | 410-629-6070 |
| Ruth Boettcher    | VA - Division of Game & Inland Fisheries  | 757-787-5911 |
| Michael Stroeh    | Coastal Delaware NWR Complex              | 302-653-9345 |
|                   |                                           |              |
| <b>Invitee</b>    |                                           |              |
|                   |                                           |              |
| Jim McGowan       | County of Accomack, Director of Planning  | 757-787-5726 |
| Trish Kicklighter | NPS - Assateague Island National Seashore | 410-629-6080 |
| Bill Hulslander   | NPS - Assateague Island National Seashore | 410-629-6061 |
| Todd Englemeyer   | VA - Division of Game & Inland Fisheries  |              |

## Appendix O



Amanda Boyd/USFWS

*Piping Plover*

# Section 7 Biological Opinion for Alternative B





# United States Department of the Interior



FISH AND WILDLIFE SERVICE  
Ecological Services  
6669 Short Lane  
Gloucester, Virginia 23061

Date:

## Online Project Review Certification Letter

Project Name:

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Virginia Field Office online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the referenced project in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended (Eagle Act). This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

The species conclusions table in the enclosed project review package summarizes your ESA and Eagle Act conclusions. These conclusions resulted in “no effect” and/or “not likely to adversely affect” determinations for listed species and critical habitat and/or “no Eagle Act permit required” determinations for eagles regarding potential effects of your proposed project. We certify that the use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate determinations. Therefore, we concur with the “no effect” and “not likely to adversely affect” determinations for listed species and critical habitat and “no Eagle Act permit required” determinations for eagles. Additional coordination with this office is not needed.

Candidate species are not legally protected pursuant to the ESA. However, the Service encourages consideration of these species by avoiding adverse impacts to them. Please contact this office for additional coordination if your project action area contains candidate species.

Should project plans change or if additional information on the distribution of listed species, critical habitat, or bald eagles becomes available, this determination may be reconsidered. This certification letter is valid for one year.

Applicant

Page 2

Information about the online project review process including instructions and use, species information, and other information regarding project reviews within Virginia is available at our website [http://www.fws.gov/northeast/virginiafield/endspecies/project\\_reviews.html](http://www.fws.gov/northeast/virginiafield/endspecies/project_reviews.html). If you have any questions, please contact Kimberly Smith of this office at (804) 693-6694, extension 124.

Sincerely,

/s/ Cynthia A. Schulz

Cindy Schulz  
Supervisor  
Virginia Field Office

Enclosures - project review package