

Chapter 2. Alternatives	<a href="#">2-1</a>
Introduction	<a href="#">2-1</a>
How We Developed Alternatives	<a href="#">2-1</a>
Alternative A. Species-specific Management	<a href="#">2-7</a>
Blackwater National Wildlife Refuge—Alternative A	<a href="#">2-7</a>
Chesapeake Island Refuges—Alternative A	<a href="#">2-26</a>
Alternative B. Conservation Biology for Trust Species Diversity (Preferred Alternative)	<a href="#">2-38</a>
Blackwater National Wildlife Refuge—Alternative B	<a href="#">2-39</a>
Chesapeake Island Refuges—Alternative B	<a href="#">2-90</a>
Alternative C. Maximum Public Use with No Habitat Management	<a href="#">2-109</a>
Blackwater National Wildlife Refuge—Alternative C	<a href="#">2-109</a>
Chesapeake Island Refuges—Alternative C	<a href="#">2-134</a>
Tabular Comparison of Alternatives	<a href="#">2-147</a>
Blackwater NWR	<a href="#">2-147</a>
Island Refuges	<a href="#">2-162</a>

*Figures*

<b>Figure 1.</b> Alternatives A and B: Waters closed to boating (color plate)	<a href="#">2-14</a>
<b>Figure 2.</b> Alternative A: Public use facilities (color plate)	<a href="#">2-22</a>
<b>Figure 3.</b> Alternative A: Shotgun deer hunt areas (color plate)	<a href="#">2-24</a>
<b>Figure 4.</b> Alternative B: Proposed public use facilities (color plate)	<a href="#">2-82</a>
<b>Figure 5.</b> Alternative B: Proposed public use facilities (color plate)	<a href="#">2-83</a>
<b>Figure 6.</b> Alternative B: Proposed turkey hunt areas (color plate)	<a href="#">2-86</a>
<b>Figure 7.</b> Alternative B: Proposed resident Canada goose hunt areas (color plate)	<a href="#">2-87</a>
<b>Figure 8.</b> Alternative C: Public use facilities (color plate)	<a href="#">2-128</a>
<b>Figure 9.</b> Alternative C: Public use facilities (color plate)	<a href="#">2-129</a>
<b>Figure 10.</b> Alternative C: Hunt areas (color plate)	<a href="#">2-131</a>

*Tables*

<b>Table 1.</b> Ongoing biological surveys at the Refuge Complex	<a href="#">2-35</a>
<b>Table 2.</b> Refuge Complex minimum staff	<a href="#">2-37</a>
<b>Table 3.</b> Blackwater refuge minimum staff	<a href="#">2-37</a>
<b>Table 4.</b> Chesapeake Island refuges minimum staff	<a href="#">2-37</a>
<b>Table 5.</b> Refuge Complex fire management minimum staff	<a href="#">2-38</a>

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# Chapter 2. Alternatives

## Introduction

The National Environmental Policy Act (NEPA) requires that we rigorously evaluate a reasonable range of alternatives for all major Federal actions before selecting the best possible approach. This chapter fully describes our alternatives and the criteria we applied in developing them. It briefly discusses other alternatives that we considered but did not develop in detail. The three alternatives we developed in detail follow that discussion.

Each of the three alternatives contains goals for managing each refuge in the Refuge Complex, objectives for achieving those goals, strategies for accomplishing those objectives, and elements for monitoring our progress. Our preferred alternative B, “Conservation Biology for Trust Species Diversity (Preferred Alternative),” describes the goals, objectives, strategies, and monitoring elements we would incorporate into a CCP for the Refuge Complex, if our Regional Director were to select alternative B for implementation.

## How We Developed Alternatives

Into our planning, we integrated delineating boundary revisions for Blackwater and the Chesapeake Island refuges and developing a CCP for the Refuge Complex, while conforming to NEPA requirements. NEPA and Service policy also require that we examine alternative management approaches, alternative boundary revisions, and their potential consequences, before we implement a CCP or revise refuge unit boundaries.

We developed our alternatives based on statutory and policy requirements and the issues the public raised at our scoping meetings or in written correspondence. The public also recommended we evaluate these major themes or management approaches: Species-specific management; biological diversity and compatible public use with habitat management; and, maximum public use with not habitat management.

Each alternative identifies a different approach to managing populations and habitats of fish, wildlife, and plants; wildlife-dependent recreation, education, and interpretation; cultural resources; facilities; and law enforcement based upon one of those three themes. Although the goals, objectives, and strategies in different alternatives are similar, each alternative takes a different approach overall.

For that reason, their goals may differ slightly, particularly among alternative A and alternatives B and C, which share common goals. The primary reason for that difference is that alternative A is based on the Station Management Plan (1991), which had pre-established goals and objectives, unlike alternatives B and C, which were new management approaches.

When we restore or enhance the environment of a refuge under any management approach, adverse impacts could affect other resources that are not a focus of that approach. Adverse impacts on off-refuge resources or economies also could occur. Where appropriate, we identify actions to minimize, avoid, or eliminate significant adverse impacts on the affected environment from proposed management activities.

## **Features and Assumptions Common to All Alternatives**

All CCP alternatives share some common features and assumptions.

### **Funding Considerations**

Because we must analyze all alternatives equally, we must address funding considerations. We present the cost of implementing each alternative, based on staffing and project-cost estimates. We would implement the management activities and projects outlined as funds become available.

### **Federal Regulations**

We will comply with all applicable Federal laws and regulations when implementing the alternative selected (see appendix A, “Federal Mandates”). For example, we would have to mitigate any adverse impacts to threatened- or endangered-listed species, in conformance with ESA regulations. Any retrofitting of existing facilities or new construction for public use will include our assessment of, and adherence to, specific guidance outlined in the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990. We will manage cultural and historic resources in conformance with applicable laws.

### **Wildlife Management Themes**

We will focus on conserving native fish, wildlife, and plants, and providing opportunities for compatible, wildlife-dependent recreation. We may provide other public uses, if we find they are appropriate and compatible with refuge purposes, including assurances that those uses would not divert funding and staff away from the priorities listed above.

We would prohibit introducing species not native to any refuge, except for biological control agents, which may be released to control other, non-native invasive species, after proper testing and approval by the U.S. Department of Agriculture Technical Advisory Group for the Biological Control of Weeds. Wherever possible, we would use local sources of plant material and avoid out-of-state sources. Where mandated by State law, the control of invasive species will continue.

### **Managing Public Use**

The Secretarial Closing Order that prohibits the taking of waterfowl at Martin NWR will remain in effect.

## **Determining Compatibility**

The Refuge Recreation Act of 1962 and the Refuge Administration Act of 1966 place into law the concept that all refuges are closed to all recreational uses until each use proposed for a refuge had been determined compatible with that refuge's establishing purpose, and, that sufficient funds were available to administer the use. Ensuring the compatibility of all public use activities would comply with this law and the refuge purpose. The National Wildlife Refuge System Improvement Act of 1997 (NWRISA) strengthens the compatibility process, and directs us to provide increased opportunities for families to experience compatible wildlife-dependent recreation. Therefore, under each of the alternatives, we will determine the compatibility of all recreational and economical uses in conformance with the new policy published in the Federal Register, Vol. 66 (202):62484, October 18, 2000.

## **Reviewing for Wilderness Designation**

Before our next scheduled CCP revision 15 years from now, we will complete a wilderness review of the Refuge Complex, which will evaluate newly acquired or existing lands for their potential for wilderness designation. Our wilderness review will reevaluate the Blackwater and Chesapeake Island refuges. Martin NWR, a roadless island, was proposed for wilderness designation in 1971.

## **Protecting Historical and Cultural Resources**

We will comply with all existing methods and regulations for protecting historical and cultural resources across the Refuge Complex in any of the alternatives.

## **Adaptive Management**

All of the alternatives will maintain our flexibility to manage the Refuge Complex adaptively, using the information produced by the Complex-wide Resource Inventory and Monitoring Program outlined below. In guiding our adaptive management, we will seek to answer these three questions:

- “Are we doing what we said we would do, when we said we would do it?” This monitoring element will track accomplishment of the strategies identified under each objective of the selected alternative. Determining whether strategies are being implemented is the first step in evaluating the effectiveness of any plan. This step will also help to identify budget and staffing shortcomings.
- “Are the prescribed strategies helping us achieve our objectives?” We would periodically analyze the monitoring data for the strategies that are implemented, to evaluate their effectiveness in achieving the objectives. This second level of monitoring is the traditional focus of monitoring programs. If we find that carrying out the prescribed strategies for a particular objective or set of objectives is not achieving them, we may need to change strategies.

- “Are the objectives helping us accomplish refuge goals and purposes?” Once we have determined which objectives are being met, we must ask this question. The refuge goals and purposes identified in chapter 1 will be the ultimate measure of this CCP. If we are not meeting those goals or purposes, we will modify the CCP objectives, based on monitoring results. Again, we would need to comply with NEPA, whenever CCP amendments include significant changes to management strategies.

## **Monitoring and Inventorying Resources**

Some refuges of the Refuge Complex have collected a substantial number of years of data on Federal trust resources and habitats. Other agencies also have data on species, habitats, community types, and ecosystem processes within the larger Chesapeake Bay watershed. For example, The Nature Conservancy recently completed its preliminary ecological profile, or assessment, of the biological resources of the Nanticoke River, the “Nanticoke River Bioreserve Strategic Plan” (1998).

However, many ecological processes, species population biology, and habitats remain poorly understood. For example, Martin NWR is part of the internationally designated Chesapeake Bay RAMSAR site. Only 18 such sites exist in the United States. Yet, although the island refuges support diverse indigenous flora and fauna, we do not have benchmark data from which to measure changes in the landscape and biota.

One of our primary concerns is progressive changes in species and habitats throughout the Refuge Complex, due to the effects of development, habitat loss, and the larger effects of sea-level rise and land subsidence. Therefore, under any of the alternatives, we will develop a Complex-wide Resource Inventory and Monitoring Program, to integrate existing information into our management programs, which will accomplish the following objectives: (1) determine the occurrence, distribution, and relative abundance of selected flora and fauna; (2) assess long-term trends in occurrence, distribution, and relative abundance of selected flora and fauna; (3) refine and complete the preliminary habitat mapping or ecological assessment; and (4) profile and identify the ecological processes affecting the relationships between communities and species.

As part of this program, we would assess the ecological condition, health, and species composition on existing refuge lands and newly acquired lands. We would employ permanent plots on a systematic grid to establish baseline conditions. Subsequent sampling would not only involve these plots but temporary plots that are randomly distributed within habitat strata. The importance of establishing permanent inventory points across the landscape is that both floral and faunal data are collected that are not only representative of the refuge as a whole, but, with an adequate sample size, can be used to develop statistical models of species–habitat relationships. We would handle all data as digital layers in a GIS: data that can be expressed as attributes associated with a fixed point on the refuge. We can then explore the relationships among flora, fauna, habitat, and landscape attributes. Perhaps our most powerful statistical tool is the use of logistic regression modeling to explain the distribution and, sometimes, the relative abundance of species or communities.

Faunal data to be collected may include species densities, abundance, and occurrence. In general, we would use nonlethal and passive field methods. For example, aerial insect abundance may be measured with malaise traps, microtine populations with Sherman™ live traps, and herpetofauna with PVC tubes and cover boards. We would catalogue the occurrence of any rare or otherwise legally protected species with the Maryland Natural Heritage Program.

All field sampling protocols would follow standardized published methodologies, unless superseded by Region- or Service-wide protocols. Establishing a sampling grid for inventorying and monitoring some biological components, however, does not preclude more traditional survey methods for other populations. We would almost certainly continue spotlight surveys of deer, ground and aerial counts of waterfowl, counts of roosting bald eagles, exit surveys of waterbird colonies, and roadside detections of calling anurans, as population-specific monitoring. On the island refuges, priority monitoring would include wintering and nesting waterfowl, marsh call back surveys, contributions of nesting structures, tiger beetles, SAV, avian and mammalian predators, and the evaluation of the use of fire in improving habitats for migratory birds.

The key to a meaningful inventory program is to ensure that the data are:

- representative of each refuge as a unit;
- adequately standardized to allow data to be rolled up into Complex, regional, and national data bases;
- robust enough that planned and unplanned habitat changes would not invalidate the baseline data; and,
- sufficiently sampled to permit statistical evaluations of habitat–species relationships.

## **Alternatives we considered but did not develop in detail**

We considered two other alternatives for managing wildlife and habitat on the Refuge Complex: Custodial Maintenance, and Ecological Restoration to Historic Conditions. However, because we found these approaches inappropriate to refuge purposes, or unrealistic, this draft CCP and EA does not evaluate them in detail.

### **Custodial Maintenance**

This alternative would abandon all active management on the Refuge Complex and prohibit or suspend all public use. As we began building the alternative, it became clear that such a hands-off approach simply could not achieve the Refuge Complex goals or refuge purposes identified in chapter 1. Completely natural, unmanaged refuges may continue to provide some habitat value, but would do little to compensate for habitat loss throughout the rest of the Nation. Blackwater NWR, in particular, is an intensively managed land base; discontinuing its active management would significantly reduce its productivity.

The existing habitat conditions on these refuges resulted from human activities both on and off the Refuge Complex, including building dikes, clearing land, polluting water, introducing exotic species, and so forth. Given those factors, it is unrealistic to assume that a completely hands-off management approach would result in natural biological diversity on the Refuge Complex.

### **Ecological Restoration to Historic Conditions**

Service policy on biological integrity, diversity, and environmental health establishes that management programs should be considered to restore historic conditions on national wildlife refuges. We considered building an alternative based on that policy; however, similar to a custodial maintenance alternative, restoring historic conditions would not achieve the goals of the Refuge Complex or the purposes of its refuges. Service policy clearly states that refuge purposes should take precedence over restoration to historic conditions.

We will attempt to restore historic conditions, where restoration can help contribute to refuge purposes. However, we will need to manage most of the Refuge Complex intensively to maximize biodiversity and habitat for Federal trust species.

## **Alternatives we considered and developed in detail**

We developed the three alternatives that follow in great detail. Each outlines entirely different ways of addressing refuge purposes and the Refuge System mission, using a different philosophy, or school of thought, on managing the Refuge Complex for desired ends. In some cases, the conditions of the desired ends differ. In others, the means for reaching them differ.

- Alternative A. Species-specific Management
- Alternative B. Conservation Biology for Trust Species Diversity (Preferred Alternative); and
- Alternative C. Maximum Public Use with No Habitat Management



# **Alternative A. Species–specific Management**

## **Introduction**

Alternative A, the no-action alternative, provides a baseline for comparing the action alternatives B and C. It assumes that our management of the Blackwater and Chesapeake Island refuges (Martin and Susquehanna NWRs and the various divisions) generally would follow the goals, objectives, and strategies outlined in the Station Management Plan (1991).

Primary management programs would focus on providing for the needs of specific Federal trust wildlife species, not on providing for biological diversity and ecosystem management. We would emphasize providing high-quality wintering habitat for waterfowl and colonial birds; managing for endangered species, principally Delmarva fox squirrels (DFS) and bald eagles; managing wildlife and habitat data; and maintaining the public use program. We would limit our land acquisition to buying inholdings (privately owned parcels within existing refuge boundaries) from willing sellers. There would be no boundary expansion and no Service involvement on the Nanticoke River.

We would continue a limited hunting program for managing deer populations. We would provide opportunities for environmental education, wildlife observation, fishing, and other uses, but would provide no additional facilities for those uses. Managing furbearers and fishing would continue much as in the past. As in the recent past, we would continue to manage the Chesapeake Island refuges in an almost custodial manner that emphasizes protecting and monitoring the nesting colonies of colonial species, protecting wintering waterfowl, and monitoring black duck production.

## **Blackwater National Wildlife Refuge—Alternative A**

### **Concepts Used for Developing Alternative A**

**Land Protection.**—The existing boundary of Blackwater NWR would remain unchanged (see chapter 1, figure 1). We would acquire inholdings from willing sellers as opportunities arise.

**Fish, Wildlife, and Habitat Management.**—Alternative A would continue the management strategies that were in place before we began emphasizing ecosystem management and biodiversity. We would focus on providing the habitat needs of key Federal trust species and groups of species: most notably, wintering and nesting waterfowl, endangered species and species of special emphasis, and other migratory birds. We would emphasize the priorities below in managing habitats and populations.

**HIGH PRIORITY**

1. Bald eagle nesting and maintenance habitat
2. Delmarva fox squirrel maintenance habitat
3. Canada goose migrating and wintering habitat
4. Dabbling duck migrating and wintering habitat

**MEDIUM PRIORITY**

5. Wood duck production
6. Osprey production
7. Lesser snow goose wintering habitat

**MEDIUM-TO-LOW PRIORITY**

8. Black duck production

In accomplishing the high priority objectives, our primary tools would be water management, cropland management, moist soil management, invasive species control, furbearer management, maintenance of artificial nesting structures, and prescribed burning. We would continue to compile long-term data sets and periodically analyze effective data management systems.

**Public Use.**—Outreach is two-way communication between us and the public to establish mutual understanding and promote public involvement in improving joint stewardship of our natural resources. One concept that would guide our outreach in alternative A is that public awareness of the Service, its mission, and its role in wildlife conservation is needed for the effective management of the Refuge System as a whole. The American public cannot appreciate or support what it does not know exists, or does not understand. To improve refuge management, we must build a strong base of public understanding and support, reaching beyond the public that visits refuges. The following concepts would guide our management of public use.

1. Promote the Station Message, thereby providing visitors a more enjoyable experience and, perhaps, helping reduce visitor impacts on other wildlife areas.
2. Provide environmental education and training that incorporates the Station Message for teachers and students.
3. Increase opportunities that promote the Station Message for the public to educate itself (especially, printing an adequate quantity of brochures).
4. Provide compatible opportunities for wildlife observation, photography, hunting, and fishing.
5. Provide professionally produced interpretive information at appropriate locations.
6. Improve staff and volunteer training to enable them to provide the public quality interpretive experiences that convey the Station Message.
7. Maintain and improve visitor facilities to ensure that high quality, safe, enjoyable, and educational experiences of different levels and requiring different abilities are available.

8. Conduct effective outreach and work with State and local organizations to provide recreational facilities that enable visitors to enjoy the Refuge Complex without adversely affecting either wildlife or wildlife habitat.
9. Public uses will not interfere with important nesting or wintering seasons of listed species.
10. No public use activities will be permitted where public safety or trust resources are adversely affected.

## Goals, Objectives, Strategies, and Monitoring Elements in Alternative A for Managing Blackwater NWR

### **Goal 1.** Provide resting and feeding areas for wintering waterfowl.

**Objective 1.1.** Provide sufficient habitat to annually support 5,500,000 wintering AP (Atlantic Population) Canada goose use days, with peak populations annually averaging 50,000, and a midwinter population annually averaging 25,000 during the 5-year period.

*Basis of the objective.*—Blackwater NWR historically has been extremely important to migrating and wintering Canada geese. That species has been a focus of management since the mid-1940s. The Chesapeake Waterfowl Management Plan, the North American Waterfowl Management Plan, and the Canada Goose Management Plan for Maryland recognize the importance of the refuge in managing for this species. The objectives are based on historical averages of Canada geese that use the refuge as a migratory stop-over and wintering area. According to population surveys, the refuge historically has provided habitat for approximately 6 percent of the Maryland Canada goose flock.

**Objective 1.2.** Provide sufficient habitat to support 2,500,000 dabbling duck use days annually, with peak populations averaging 20,000 annually and midwinter populations averaging 10,000 during the 5-year period.

*Basis of the objective.*—The importance of Blackwater NWR to migrating and wintering dabbling ducks was the principal reason for its establishment. It was not until the 1940s that Canada geese became a major focus waterfowl species. The targeted use days reflect the average use of the refuge from 1970 to 1990.

**Objective 1.3.** Provide sufficient habitat to annually support 450,000 wintering lesser snow goose use days, with the annual peak population averaging 3,000 during the 5-year period.

*Basis of the objective.*—Blackwater NWR is important to a unique population of lesser snow geese that are believed to originate from the Mississippi and Central Flyways. Almost 50 percent

of the flock is composed of the blue phase. The targeted use days reflect the average use of Blackwater NWR during the period 1970 to 1990.

*Strategies to achieve objectives 1.1, 1.2, and 1.3.*—Since the strategies to achieve these objectives are very similar, we have grouped them, but have annotated strategies that apply to a specific objective.

We would maintain the existing inviolate sanctuary area, which totals approximately 11,270 acres and represents 85 percent of the total marsh and water area of the refuge, and would prohibit public entry into that sanctuary each year from October 1 through March 31. Management actions would focus on the tidal wetlands, impounded wetlands or moist soil management units, and croplands.

Within the tidal wetlands, we would prescription-burn approximately 3,000 acres on a 1- to 3-year rotation to promote the growth and productivity of native plant foods desired by waterfowl, in accordance with our Fire Management Plan, which was subjected to NEPA requirements and approved on September 15, 2000. The refuge furbearer management program would remove nutria and muskrats from refuge tidal wetlands to protect those systems from excessive and competitive herbivory by these exotic and indigenous rodents. We would lease furbearer management units to the highest bidder.

We would manage the water levels in 24 moist soil management impoundments totaling approximately 370 acres. Although benefitting AP Canada geese and lesser snow geese, our management of the moist soil impoundments would focus more on dabbling duck maintenance. When implementing moist soil management, pool drawdowns typically would occur between mid-March and early June, depending on the wildlife objectives and moist soil plant or invertebrate response desired. Drawdown would begin in most pools first by gravity flow, but pumping often may be required in most of the impoundments to remove all the water. We would maintain several permanent and seasonal pumping stations, using gasoline, diesel, and electric pumps. Rates of drawdown can be critical and, depending on the pool bottom topography and soil type or organic content, can either occur rapidly or must be prolonged. We would complete all drawdowns by mid-June, and would keep pool bottoms as moist as weather conditions will allow, to facilitate the germination, growth, and production of a wide diversity of emergent moist soil plants, such as smartweed, beggartick, red-root Cyperus, Panicum, Walters' and barnyard millets, dwarf spike rush, and others.

We would monitor and record water levels, pH, conductivity, and salinity weekly during the growing season and biweekly during periods of flooding. We will describe exact water level management plans in our Annual Water Management Program, which we would use as an annual management guide (rainfall-dependent).

We would conduct vegetative transects between mid-June and mid-July, and again before October 1, to determine seed productivity and cover percentage of preferred plant species, and maintain that information in a computer data base. If preferred emergent vegetation should fail to grow, and weeds like cocklebur and fleabane become dominant, these areas would be disced and planted in small grain crops such as millet or sorghum.

Gradual reflooding would begin in September, depending on having the necessary fresh water, which would be supplied by rainfall runoff through Kentuck and Green Briar Swamps, adjacent freshwater ponds, or by a limited number of small wells (two supplying the pool 3 system and two supplying the Green Briar Swamp system). The waters of the Blackwater and Little Blackwater Rivers and the adjacent marshes (once fresh and used for these purposes) are now too salty for this use. When used for flooding in the past, waters from these rivers have significantly contributed to increased soil salinity (and subsequent soil sterilization) in several impoundments, particularly sub-impoundment 5b.

Runoff can be significant at times (particularly during hurricanes and tropical storms) from adjoining private land in Kentuck and Green Briar Swamps. This is particularly true for the lands adjacent to impoundments 3 and 5, which are separated from Kentuck Swamp by Key Wallace Drive. It is not uncommon to observe water sheeting across 2 miles of Key Wallace Drive and State Route 335 after heavy rains. Appropriate consideration must always be given to ensure that dikes and water control structures are properly constructed, sized, and maintained so as not to inadvertently flood adjoining private lands.

The refuge's flat topography leaves few opportunities to create additional impoundments or maintain water reserves, since the presence of supporting impoundment infrastructures can severely restrict historical drainage patterns and create flooding of private lands. Periodic disturbance of the soil through discing would destroy monocultures and set back succession. Moist soil wetlands that are normally dominated by seed-producing annuals, may shift to less desirable perennials after several years and need to be rejuvenated. Undesirable plants that have little or no wildlife value need to be controlled so that they do not out-compete plants with greater habitat values.

When manipulation is required, we would time it so that the resultant decomposing vegetation can be used effectively by wetland invertebrates. Manipulating managed wetlands is often better described as a learned craft or art, rather than strictly as applied science. Each impoundment and sub-impoundment has its own unique characteristics, and preliminary assessments for managing these wetlands would include the following considerations.

1. Locating sites to assess salinity and pH;
2. Determining topography to better understand subtle elevation differences within specific managed wetland sites, and to better predict vegetational responses to disturbances and water regimes;
3. Maintaining systematic records of water level changes to assess vegetation response and determine availability of optimum foraging depths (we would also include a monitoring program to record the amounts of water from the flooding sources);
4. Monitoring water quality;
5. Inspecting and monitoring sites to evaluate site use and to identify manipulations needed to enhance or prevent certain vegetative conditions;

6. Identifying plants to ensure proper timing and type of manipulation;
7. Determining the effects of burrowing animals to maintain integrity of levees and dikes;
8. Determining equipment capabilities, availability, and readiness; and finally,
9. Identifying critical time periods for implementing preferred management strategies (Fredrickson and Reid, 1988).

In addition to monitoring water levels and water chemistry, we would continue to study concentrations of pollutants or contaminants and their effects on wildlife during specific projects. Each year, we would continue to maintain the 11 miles of dikes; 25 miles of ditches; 53 water control structures; 6 permanent and portable pumping stations; 6 associated pumps; 4 wells; 4,000 linear feet of water distribution lines; and 2 miles of electrical service. We would use chemical control on exotic plants, like Phragmites, to stem invasion and reduce competition with native vegetative species that are preferred food resources. (Note: Chemical control of Phragmites would not occur in the tidal wetlands; only in the refuge impoundments.)

Using refuge staff, equipment, and funds, we would cultivate approximately 160 acres of cropland to produce “hot” foods rich in carbohydrates (e.g., corn and sorghum) that supplement natural foods and help provide energy to wintering waterfowl during the cold winter months. We would maintain croplands through drainage, crop rotations, soil testing, the addition of soil amendments, and best management practices, including developing and utilizing an Individual Pest Management Plan. Whenever practical, we would use no-till farming.

For AP Canada geese and lesser snow geese, we would plant about 480 acres of cool season grasses and forbs, principally ladino clover and winter wheat, for “green browse” to supplement natural foods, focus feeding away from damaged marshlands, and meet important protein needs following migration. Haying and mowing of these grasslands may be permitted to maintain the cool season grasses at the preferred height and palatability, to reduce weed species competition, and minimize or eliminate force account labor.

We would manage, monitor, and maintain two existing “green tree reservoirs” totaling 10 acres to provide seasonal sources of flooded hard mast and macro invertebrates as food resources, principally for wood ducks, black ducks, and mallards. Drawdown would occur in early March to maintain living or “green” timber that would produce hard and soft mast and detritus for macro invertebrate production year after year. Flooding would occur in late September, or whenever there is sufficient rainfall. We would monitor water levels biweekly during the winter, and maintain them in conformance with our Annual Water Management Program.

We would inventory waterfowl species with weekly ground counts, bimonthly aerial surveys, and the Midwinter Waterfowl Inventory. Banding of geese and ducks would occur when we receive banding quotas from the State waterfowl biologist or our Region 5 waterfowl biologist.

*Monitoring element for objectives 1.1, 1.2, and 1.3.—Annual use days and population peaks.*

**Goal 2.** Provide protection and essential habitat for endangered species, focusing on bald eagles, Delmarva fox squirrels, and red-cockaded woodpeckers.

**Objective 2.1.** Provide protection and habitat sufficient to maintain, over a 5-year period, an average of 17,000 bald eagle use days, and a midwinter population of 150 bald eagles.

*Basis of the objective.*—Blackwater NWR historically has been noted for its large concentration of wintering bald eagles. Targets are based on historical averages from 1985 to 1999.

*Strategies to achieve the objective.*—We would maintain an inviolate sanctuary of 11,270 acres of water and marsh, or approximately 85 percent of the refuge marshlands, for bald eagle feeding habitat. No public entry or boating would be permitted in the sanctuary from October 1 through April 1, when most eagles winter on the refuge (see figure below, “Waters closed to boating”). We would conduct monthly surveys to locate and protect roost sites, and post known roost sites “Closed Area” to eliminate human disturbance.

Refuge staff would participate in the Midwinter Eagle Survey each January. Since dead snags are limited in certain areas of the refuge, particularly around the impoundment system, we would erect “perch trees” at strategic locations to provide opportunities for wintering eagles to better take advantage of large waterfowl concentrations as food resources. The refuge outreach and environmental education programs would focus on ways to protect this endangered species from the effects of pollution, the destruction of habitat, development, poisoning, shooting, and human disturbance.

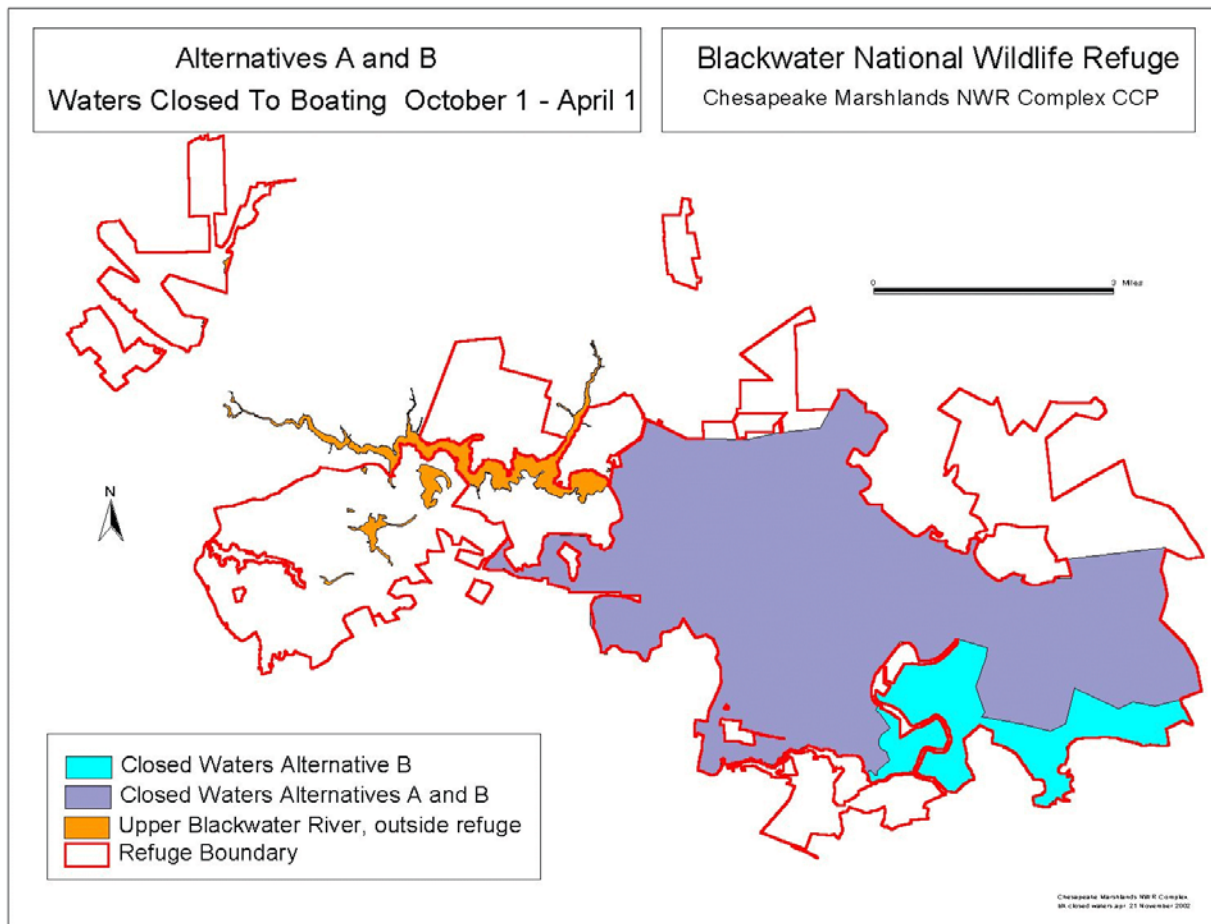
*Monitoring element.*—The number of use days and peak population.

**Objective 2.2.** Provide protection and habitat to support an average of 10 bald eagle nests each year over a 5-year period, with an average annual production of 1.5 young per nest.

*Basis of the objective.*—Dorchester County has the largest nesting population of bald eagles north of Florida on the Atlantic Coast, and most of these nests are located on or immediately adjacent to Blackwater NWR. Target numbers are based on historical averages.

*Strategies to achieve the objective.*—During the nesting period (mid-December through March), we would maintain an inviolate sanctuary with no public use in 11,270 acres of marsh and water, or 85 percent of the refuge marsh and water area. Also, when bald eagles are nesting, we would close 8,346 acres of forest land, or 35 percent of the refuge, to all public use and disturbance. We would protect existing eagle nest trees that may be destroyed by wildfires or influenced by other prescribed fire programs, by prescribed burning around the nest trees before the nesting season (National Wildlife Federation 1985).

*Monitoring element* —The number of nests and number of young fledged per nest.



**Figure 1.** Alternatives A and B: Waters closed to boating (color plate)

**Objective 2.3.** Provide protection and habitat to support an average of 200,000 use days per year by DFS during a 5-year period.

*Basis of the objective.*—Dorchester County has the largest extant population of DFS. A large percentage of the DFS habitat remaining lies on, or immediately adjacent to, Blackwater NWR. Target numbers are based on historical averages and use on current refuge acreage.

*Strategies to achieve the objective.*—The following activities would conform to the strategies identified in the “Delmarva Fox Squirrel Recovery Plan” and “Station Management Plan” (1991).

1. Conduct benchmark surveys on the Jarrett (Moneystump Swamp) and Egypt Road Tracts, consisting of installing and maintaining 58 artificial nesting boxes at each site (for protocols, consult appendix E of the DFS recovery plan, available at headquarters).
2. Trap DFS twice daily for 3 days at each site during the spring on 5,500 linear feet of trapline, using 29 live traps that have been prebaited for 5 days.



3. Ear-tag, age, sex, and weigh captured DFS.
4. Recapture denning DFS in January between 8:00 p.m. and 4:00 a.m., thereby using these mark or recapture techniques to estimate populations, sex and age structure, and movements.
5. Plant 25 acres of food plots adjacent to forest lands to supplement natural DFS habitat during winter.
6. Provide representation on the DFS Recovery Team.
7. Participate in State and Federal recovery programs, including capturing DFS for translocation to unoccupied sites in its historical range.
8. Conduct time counts to determine DFS utilization and distribution in various refuge forest lands.
9. Install and maintain signs on adjacent County roadways to educate the public about the presence of DFS and to help minimize highway mortality.
10. Develop and produce a brochure on DFS biology and recovery.
11. Enforce speed limits on refuge roadways to minimize vehicular mortality.
12. Monitor road kills on and adjacent to the refuge.

Other strategies would include conducting a forest type inventory, conducting a DFS literature search, correlating forest types with DFS inventory results, developing and implementing a forest management plan, and encouraging DFS life history research on the refuge. Immediate research includes studies to evaluate DFS feeding habit conflicts with other species, management conflicts between DFS and red-cockaded woodpeckers, comparison of DFS densities with deer densities, and an analysis of DFS response to creating edge habitat on the Jarrett Tract.

*Monitoring element.*—The number of use days.

**Objective 2.4.** Maintain 1,000 acres of mature loblolly forest habitat of the size and age structure capable of supporting nesting red-cockaded woodpeckers.

*Basis of the objective.*—Old growth loblolly pine forests on Blackwater NWR historically provided one of the most northern nesting areas for red-cockaded woodpeckers. They were last observed on the refuge in 1976; however, the habitat to support this endangered species should be maintained should this species return to nest on the refuge.

*Strategies to achieve the objective.*—Woodlots having the proper size and age structure of loblolly pines would be maintained in conditions conducive to red-cockaded woodpecker nesting. No active management would occur in these woodlots, other than preserving the trees.

*Monitoring element.*—The number of acres of mature loblolly pine forests.

**Goal 3.** Provide nesting and wintering habitat for National Species of Special Emphasis (e.g., wood duck, black duck, and osprey).

**Objective 3.1.** Fledge 750 “nest box” wood ducks annually.

*Basis of the objective.*—The forested wetlands in the Blackwater area were historically important nesting areas for wood ducks. Most of these old growth forests were harvested before refuge acquisition, leaving few natural nesting cavities. The Service considered nest boxes important substitutes. The production objective is based on historical wood duck box use and fledgling success for the 10-year period of 1980 to 1990.

*Strategies to achieve the objective.*—The most obvious strategy would be to maintain 200 wood duck boxes in conformance with Region 5 standards and the recommended 75-percent occupancy rate. We would service the boxes in January and early February each year before the spring migrants arrive, when the waterways are frozen and staff can conveniently access almost all of the boxes. Approximately 20 new boxes would be constructed and used for replacements annually; all previous season nesting materials would be removed; new shavings would be added to each box; hinges and doors would be properly repaired and secured, ice-damaged boxes would be repositioned and straightened; and predator shields would be checked, repaired, or replaced as needed.

In July, we would check all the boxes again to determine the percentage of occupancy, number of eggs per box, and hatching success. We would conduct brood counts throughout the summer, using standardized protocols and time counts. Under special use permits, snapping turtles would be trapped in the impoundments in spring. We would implement other types of predator control if fledging rates were to drop below 80 percent.

*Monitoring element.*—The number of fledgling wood ducks observed during surveys

**Objective 3.2.** We would develop a black duck production objective if meaningful production is determined to be feasible.

*Basis of the objective.*—In 1931, Dr. Oliver L. Austin, Jr., Ornithologist, Biological Survey, testified before the Migratory Bird Commission that “black duck and blue-winged teal breed here (on Blackwater) in more concentrated numbers than any other place I have encountered them on the Eastern Shore. I consider the area to be the most important waterfowl breeding area on the Atlantic coast south of Labrador.” The NAWMP and the ACJV place special emphasis on black ducks, supporting the need for this objective. Therefore, although black duck production in recent refuge history was not considered significant, it was determined that staff should obtain sufficient information to validate whether or not a meaningful production objective should be developed

*Strategies to achieve the objective.*—Strategies include the development of specific brood census techniques; production evaluation by censusing the number of pairs, conducting brood counts, and estimating fledgling success; scientifically analyzing the historical pair, nest, and brood data collected since refuge establishment; and subsequently determining a black duck production objective with more specific strategies if warranted.

*Monitoring element.*—Resulting decision to establish or not establish a black duck production objective.

**Objective 3.3.** Fledge an average of 25 osprey annually over a 5-year period.

*Basis of the objective.*—Blackwater and the surrounding marshlands provide essential habitat that supports the Chesapeake Bay nesting osprey population. Natural nesting sites can be supplemented with artificial structures that improve the capacity of the refuge to contribute to the overall production of ospreys.

*Strategies to achieve the objective.*—We” would maintain” 30 osprey platforms to supplement natural nesting habitat, and would monitor production annually by conducting two checks of the nesting platforms: once during incubation in the spring, and another during the early summer just before young birds take flight.

*Monitoring element*—The number of eggs laid and the number of ospreys fledged each year.

**Goal 4.** Conduct effective public outreach. [Because of their similarity, outreach objectives and strategies will be treated as a unit, rather than individually.]

**Objective 4.1.** Actively inform visitors and the general public about the refuge, refuge events, wildlife and management programs and projects in order to create an understanding of how refuge management activities benefit wildlife, wildlife habitat, and the protection of historical or cultural resources.

**Objective 4.2.** Foster cooperation and communication with other state and Federal agencies, museums, civic organizations, environmental and conservation groups, and other interest groups, such that topics in the Station Message become better understood by all.

**Objective 4.3.** Seek new audiences who may not otherwise be aware of the refuge or Fish and Wildlife Service management issues.

**Objective 4.4.** Inform the public about the responsibilities of the Fish and Wildlife Service as a land management agency.

**Objective 4.5.** Continue outreach programs with local citizens to develop an awareness and understanding of wetland restoration activities such as the North American Waterfowl Management Plan and the Farm Bill.

**Objective 4.6.** Provide for public involvement in refuge activities through an organized volunteer program, a cooperating association, and through public meetings and other forums, as appropriate.

*Basis of objectives 4.1–4.6.*—A well-rounded program of public outreach can enable large segments of the public to learn about the importance of refuge wetland and upland habitats, endangered species, cultural resources, refuge management, and the refuge role in the Refuge System. An effective Public Outreach Program can also help win friends and proactively deal with controversial refuge management activities. This program can be used to anticipate and avoid potential conflicts between the needs of wildlife and other refuge uses.

*Strategies to achieve objectives 4.1–4.6.*—Outreach methods would include continued interactions and relations with congressional entities, local businesses, news media, constituent groups, local communities, schools, state and local governments and agencies, as well as public involvement in planning processes and information products, such as brochures, leaflets, and videos (USFWS 1997). These methods would provide ways for the public to be involved with the Refuge Complex during the planning processes and beyond.

In alternative A, refuge staff would continue to conduct outreach through interactions with the public. Proactive efforts would include involving the public in planning processes; we would participate in special events and programs, public meetings, presentations and speeches, and cooperative outreach partnerships.

We would issue news releases to local and regional print and electronic media when newsworthy events occur, to announce scheduled activities, and to keep the public informed about refuge management activities. Refuge staff would present programs both on- and off-site to audiences throughout Maryland's Eastern Shore as requested, and as staff time and funds permit. We would maintain regular contact with private, state, local, and other Federal agencies, environmental groups, congressional offices, and other interested parties. Refuge staff would routinely respond to written, telephone, and in-person inquiries from the public. Refuge staff and volunteers would regularly display exhibits at special events on Maryland's Eastern Shore.

We would produce and distribute to the public our current leaflets, consisting of a general brochure, bird list, reptile and amphibians list, mammals list, Wildlife Drive guide, endangered species guide, interpretive leaflet for the Marsh Edge Trail, Friends of Blackwater brochure, handout on entrance fees, deer hunt information and map, and a brochure on the Canada goose. The Friends of Blackwater would issue a quarterly newsletter to their membership and discuss refuge management programs. Audio visual programs would be available on request to visitors in the Visitor Center auditorium. We would present informational material through a menu board, exhibits, brochure racks, and personal contact.

We would administer an active volunteer program of 60 volunteers, contributing more than 7,000 hours annually. The refuge would participate in the Cambridge Christmas Parade each year. Refuge staff would annually participate in career days, assist in judging science events, and play an active role in sponsoring training for the Dorchester County Envirothon.

We would maintain a cooperative association and friends group, the Friends of Blackwater, who would raise an estimated \$15,000 each year for special projects. Refuge staff would periodically conduct special seminars on wildlife management issues, techniques or problems. Staff would regularly be called upon by the Washington Office and others to provide tours to VIPs, foreign dignitaries, and foreign resource professionals. The refuge would continue to be used frequently as a model example of the Refuge System.

*Monitoring element.*—The numbers and types of outreach activities, special events, or programs, and numbers of public reached when appropriate (the number of participants at group presentations, number of participants viewing off-site exhibits, and the number of volunteers and members of the friends group).

**Goal 5.** Provide sites and opportunities for environmental education and interpretation, emphasizing techniques and strategies that improve the visitors' awareness of issues central to the Station Message.

**Objective 5.1.** Provide an average of 6,000 hours of quality environmental education opportunities to students each year.

*Basis of the objective.*—Environmental education helps raise overall awareness of the importance of Blackwater NWR and the Refuge System to wildlife needs, and builds support when students become adults. Dorchester County teachers are now required to include environmental education at Blackwater NWR in the second grade curriculum.

*Strategies to achieve the objective.*—We would made Blackwater NWR available to an average of 2,000 students annually through contacts with officials at Dorchester, Talbot, Caroline, and Somerset County School Districts; refuge staff would provide activities and specific information to teachers before their visits; staff or volunteers would meet environmental education groups and give a brief orientation at the Visitor Center before teacher-led activities; volunteers would give tours along the Wildlife Drive when they are available. We would made the Marsh Edge Trail, its pavilion, and boardwalk available for environmental education. We would purchased and loan to students items used to assist in environmental education, such as bird books, binoculars, and dip nets. We would maintain a Memorandum of Understanding with the Chesapeake Bay Foundation, Inc., to use refuge property for conducting environmental education for 700 students each year. Most of this use would occur on the Bishops Head Division of the Chesapeake Island refuges.

We would schedule environmental education visits in advance, in order to stay within the following capacity limits: One bus of students would be scheduled at one time at the Visitor Center; school groups who visit the refuge would be limited to three single buses or two double buses at one time; no more than three environmental education groups would be scheduled in 1 day; only one environmental education group would be scheduled at the Marsh Edge Trail and pavilion or Woods Trail at any one time.

We would implement the recommended strategies in such a way as to be compatible with refuge objectives and wildlife needs. Environmental education would take place in refuge areas and at times of the year that would not adversely impact refuge wildlife or habitat. We would schedule these activities to stay within the capacity limits of refuge facilities and habitats; regularly monitor activity sites for signs of physical overuse; and, take action as necessary to avoid habitat or facility deterioration.

*Monitoring element*—The number of hours of student environmental education.

**Objective 5.2.** Provide an average of 250 hours of quality environmental education training to teachers annually within a 5-year period.

*Basis of the objective.*—Teachers can lead their own group(s) if properly trained, thereby minimizing the amount of staff time involved. More students ultimately can be taught about refuge and Service roles and responsibilities and the importance of protecting our wildlife resources and wild places. However, teachers need refuge specific instructional materials in order to convey the right information.

*Strategies to achieve the objective.*—We would provide teachers with activities and specific information before their scheduled visits. We would provide Habitat Teacher Packets, but, unfortunately, only in numbers insufficient to meet demand. We would hold one 1-day teacher workshop each year. We would provide the items mentioned in the previous objective's strategies (e.g., binoculars) on loan.

*Monitoring element* —The number of hours of teacher environmental education training.

**Objective 5.3.** Annually provide an average of 10,000 hours of conducted interpretation to a diversity of local, national, and international groups.

*Basis of the objective.*—Conducted interpretation tours during special events are essential to share state-of-the-art wildlife management techniques and technical information with members of the public, planners, politicians, and other wildlife professionals.

*Strategies to achieve the objective.*—Staff and volunteers would provide interpretation for bus tours and other groups, and present slide talks and show films, as requested and as time permits. Generally, we would limit conducted tours to special groups, such as colleges, other agencies, dignitaries, foreign visitors, and so forth.

*Monitoring element.*—The number of hours.

**Objective 5.4.** Annually provide an average of 150,000 hours of self-guided interpretation to members of the public and a diversity of local, national, and international groups.

*Basis of the objective.*—Self-guided interpretation is crucial to providing information that orients visitors and informs them about refuge wildlife and management activities. Self-guided

interpretation requires significantly less staff time than conducted interpretation, and can reach more people more efficiently.

*Strategies to achieve the objective.*—We would maintain an accessible full-service Visitor Center with 2,500 square feet of exhibit space, a 45-seat auditorium, paved entranceway, and parking, with exhibits, films on various wildlife and their management, orientation programs, interpretation displays, and a retail sales concession operated by the Friends of Blackwater. More than 60 volunteers would assist in staffing the Center, which would operate 7 days a week, but close on weekends in June, July, and August and on all Federal holidays. We would offer film presentations, slide programs, and videos on request, and provide visitors with maps and brochures containing information on the refuge and other areas of interest in the County. We would also publish seven interpretive brochures.

We would maintain a 6½-mile paved self-guided interpretation tour of the Wildlife Drive, offering a leaflet that would correspond to numbered stops, and an audio tour tape available for purchase at the Visitor Center. Around the Wildlife Drive, we would post interpretive signs describing on-going management activities, permitted and prohibited activities, entrance fees, and dates and times when the refuge is open to the public.

We would maintain a 0.3-mile paved accessible self-guided interpretation tour of the Marsh Edge Trail, offering a leaflet that would correspond to numbered stops, including a self-contained restroom. Four interpretation kiosks would be available, with a variety of panels to orient visitors and describe management programs, activities, and strategies. We would install wood duck, barn owl, blue bird, bat, and prothonotary warbler boxes in public use areas to demonstrate their design and effective use.

*Monitoring element.*—Hours of self-guided interpretation.

**Goal 6.** Provide sites and opportunities for quality wildlife-dependent recreation (wildlife observation, photography, hunting, and fishing).

**Objective 6.1.** Provide an average of 75,000 hours of wildlife or wildlands observation annually.

*Basis of the objective.*—Wildlife or wildlands observation is an integral part of visitation to Blackwater NWR. Opportunities should be provided in ways which would not adversely impact wildlife populations. Many people visit the refuge throughout the year, and nearly all visitors do so for some form of wildlife or wildland observation.

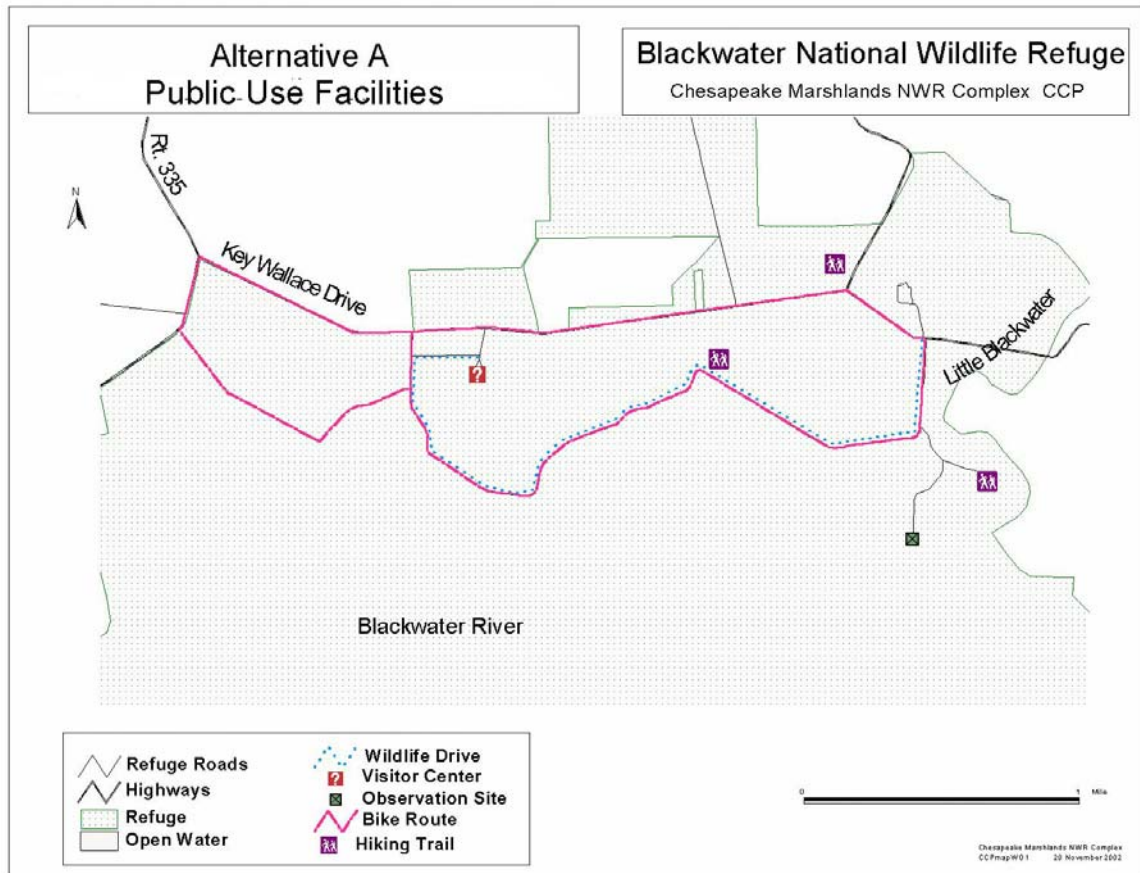


Figure 2. Alternative A: Public use facilities (color plate)

*Strategies to achieve the objective.*—We would maintain the Visitor Center with observation areas and spotting telescopes, pull-offs on the Wildlife Drive, the paved and accessible Marsh Edge Trail, the Woods Trail, and public roads, to provide access for wildlife observation. When a staff member or volunteer is available, we would provide bus tours and trail walks on request to assist the visitor in observing wildlife. We would offer guided bird walks four to six times a year, with an experienced volunteer birder providing observation opportunities and techniques for visitors. We would install osprey platforms, bald eagle and other raptor roosting snags, wood duck and mallard nesting boxes, tree swallow and bluebird houses, and barn owl nesting boxes in areas where the public may observe wildlife activity.

Although wildlife observation is generally associated with walking the trails or driving a vehicle around the Wildlife Drive, it would also be allowed by canoe, kayak, motor boat, and bicycle. The Maryland Bicycle Touring Map, published by the Maryland Association of Bicycle Organizations, would highlight the refuge. The refuge would also provide cyclists with alternative bicycle routes throughout the lower County that travel over public roadways that transect or parallel refuge properties. Wildlife observation by canoe, kayak, or boat would only be permitted from April 1 through September 30. Boat-launching would not be permitted on the refuge.



*Monitoring element.*—The number of hours of wildlife or wildland observation.

**Objective 6.2.** Provide an average of 20,000 hours of photography annually.

*Basis of the objective.*—Photographing wildlife and wildlands is a popular activity that permits the public the opportunity to learn about and appreciate refuge resources. It is also a major means of advertising and publicizing the refuges. Emphasis on improving wildlife and wildland observation opportunities would generate increased photographic opportunities, resulting in a potential increase in photography activities. Blackwater NWR should encourage and make use of this opportunity to publicize the Station Message.

*Strategies to achieve the objective.*—We would permit photography from the Wildlife Drive, the Marsh Edge Trail, the Woods Trail, the Visitor Center, and along public roadways that bisect the refuge. Newspaper, magazine, TV, and independent photographers would use the refuge to photograph wildlife and, one hopes, write unsolicited articles supporting the Refuge System, its mission, and the mission of the Service.

*Monitoring element.*—The number of hours of photography.

**Objective 6.3.** Provide an average of 12,000 hours of quality big game hunting annually.

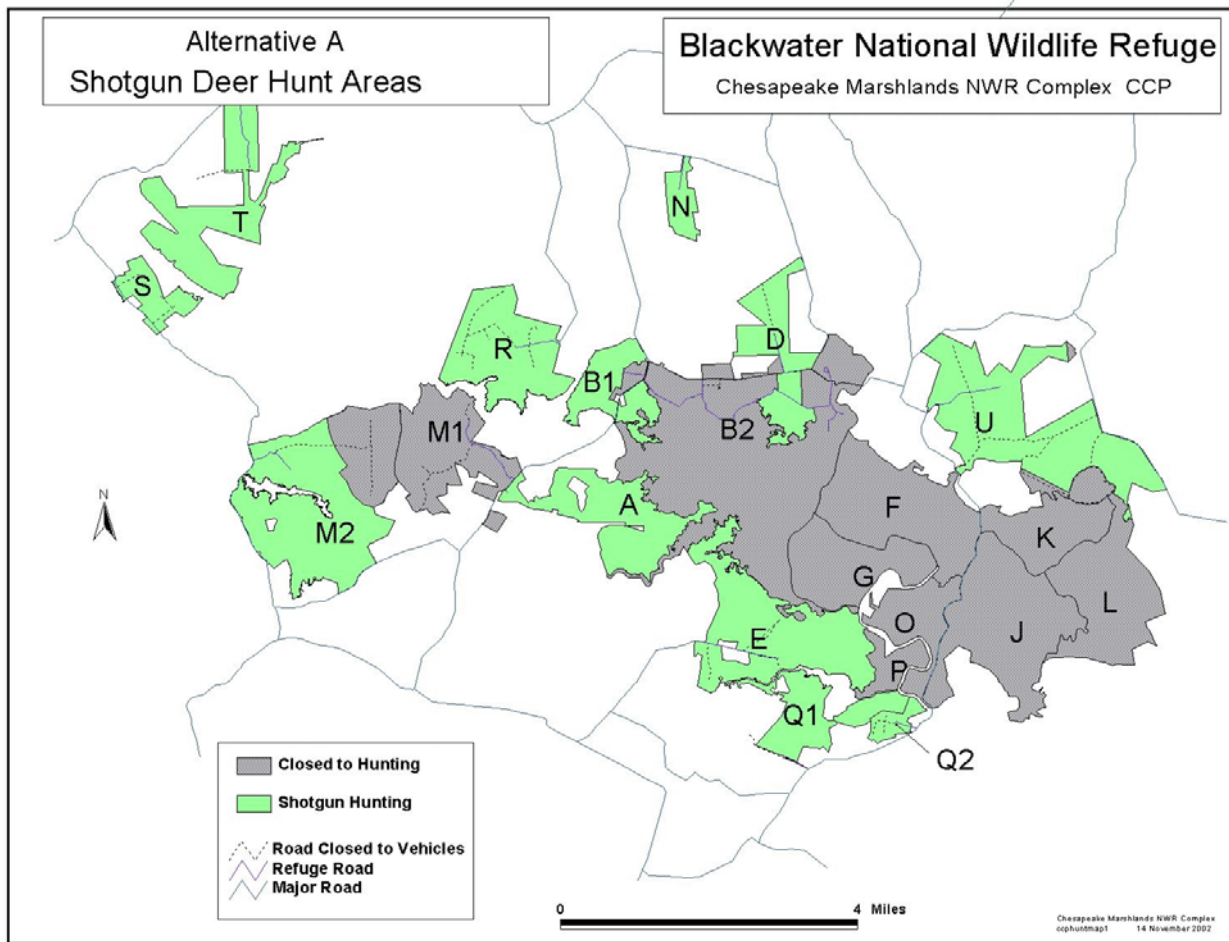
*Basis of the objective.*—Big game hunting is a biological necessity required to keep white-tailed and sika deer populations within the refuge habitat carrying capacity. It provides wholesome recreational opportunities, and permits the wise use of a renewable natural resource. Hunting on the Eastern Shore is a cultural recreational activity that is enjoyed by thousands of people annually.

*Strategies to achieve the objective.*—We would permit big game hunting for white-tailed and sika deer for 4 days of muzzleloading rifle and shotgun hunting (see figure below, “Shotgun deer hunt areas”), in conformance with State seasons and bag limits; provide hunting opportunities a maximum of 1600 hunters each year (400 hunters per day) on a lottery quota system. A \$10 fee would be required to apply for a quota permit. Senior citizens and youth would receive a 50 percent discount on these fees. We would prepare and submit an annual hunt program for review before July 1.

We would restrict hunters to zoned areas for safe distribution, with a ratio of no more than 1 hunter per 20 acres, although some areas may have only 1 hunter per 40 acres. Refuge staff and volunteers would operate check stations during the hunts to obtain age, sex, species, weight data. We would publish summaries of that biological information in our Annual Narrative Report.

We would prepare and publish hunt leaflets, regulations, and maps each year, and distribute them to hunters. We would not designate a specific area for wheelchair-bound or disabled hunters. Refuge-specific regulations would be published annually in the Federal Register and in 50 CFR Part 32. We would maintain a hunter data base to facilitate mailing and distributing information. We would regulate hunting times and areas to eliminate conflicts with endangered species and other public uses, and to ensure compatibility with refuge purposes.

*Monitoring element.*—The number of activity hours and hunter surveys to determine quality.



**Figure 3.** Alternative A: Shotgun deer hunt areas (color plate)

**Objective 6.4.** Provide an average of 12,000 hours of quality fishing and crabbing annually.

*Basis of the objective.*—Fishing and crabbing have been historical consumptive recreational uses of the refuge that should be continued when compatible with refuge purposes.

*Strategies to achieve the objective.*—We would permit fishing and crabbing only by boat, and only from April 1 through September 30. No refuge permit would be required. Fishing and crabbing would conform with State seasons, size and creel limits, methods, and any other restrictions or regulations. Persons fishing must possess a valid State of Maryland Tidewater Fishing License. No license is required for crabbing.

*Monitoring element.*—The number of hours of fishing provided and fishermen surveys on the quality of the experience.

**Goal 7.** Provide a site for conducting scientific research leading to the enhancement of wildlife and natural resource management.

**Objective 7.1.** Foster relationships with government agencies, conservation groups, and institutions of higher education and communicate the most critical research needs of the refuge.

*Basis of the objective.*—Appropriate research is critical to the mission of the refuge. Service policy encourages and supports research and management studies that provide additional scientific data upon which to base decisions regarding management of the Refuge System (4 RM 6). Research is the key to sound resource management. Providing places to conduct research also provides students and teachers with the opportunity to learn the concepts of field research (4 RM 6).

*Strategies to achieve the objective.*—We would actively seek partnership opportunities, and would consider unsolicited proposals for research in a variety of disciplines, including wildlife, public use, and cultural resources. All reports, surveys, and scientific papers generated from such endeavors would be made available to staff and catalogued for future reference. In addition to wildlife-oriented research, we might also permit the use of the refuge for other investigatory scientific purposes determined compatible with refuge purposes, goals, and objectives. We would give priority to studies that contribute to the enhancement, protection, use, preservation, and management of native wildlife populations and their habitats (4 RM 6).

*Monitoring element.*—The number of research projects conducted, and number of participants for each.

**Objective 7.2.** Provide facilities and equipment for use by researchers.

*Basis of the objective.*—Providing facilities and equipment would facilitate research by non-Service institutions in support of the previous objective.

*Strategies to achieve the objective.*—Housing, equipment storage, and use of Service equipment would be provided at the discretion of the Project Leader, with priority given to research that furthers the goals and purposes of the refuge.

*Monitoring element.*—Inventory of facilities and equipment available for researchers.

## Chesapeake Island Refuges—Alternative A

### Concepts Used for Developing Alternative A

**Land Protection Program.**—Alternative A would maintain the existing boundaries of Martin NWR, Susquehanna NWR, and the Barren Island, Bishops Head, and Watts Island Divisions (see chapter 1, figure 1). We would continue to acquire inholdings from willing sellers as opportunities arise.

**Fish, Wildlife, and Habitat Management Program.**—Since we prepared the Station Management Plan (1991), the responsibility for managing the Susquehanna NWR and the Barren Island, Bishops Head, and Watts Island Divisions has been added to Martin NWR. We refer to these areas collectively as the Chesapeake Island refuges of the Refuge Complex and, therefore, the following sections include more information than the 1991 plan.

We would manage the island refuges as sanctuaries closed to most public uses to prevent human intrusion and disturbance of the most important breeding sites for colonial nesting birds in the Chesapeake Bay watershed. Management would consist of providing secure breeding habitats for colonial nesting birds, custodial maintenance of the land, and routine monitoring of bird populations.

The 1.5-acre Battery Island (Edmondson Island or Shad Battery) still contributes to the original refuge purpose and the mission of the Refuge System, although the formerly extensive SAV beds have been lost. In alternative A, we would enter into a cooperative management agreement for Susquehanna NWR with either Harford County or a non-profit organization.

Overall, the island refuges mission would be to provide habitat for wintering and nesting waterfowl, for endangered species and species of special emphasis, and for nesting colonial birds. We would continue to periodically analyze long-term data sets and effective data management systems. We would emphasize the following priority in managing habitats and populations.

#### HIGH PRIORITY

1. Bald eagle nesting and maintenance habitat
2. Peregrine falcon nesting and maintenance habitat
3. Wintering waterfowl maintenance
4. Black duck production
5. Osprey production
6. Colonial bird production

**Public Use.**—To protect its wildlife and sensitive island ecosystems, we would close the island refuges to public use, except for limited interpretation tours conducted by refuge staff; self-guided interpretation at the Martin NWR visitor contact station in Ewell on Smith Island; and structured environmental education, conducted in accordance with a Memorandum of Understanding with the Chesapeake Bay Foundation, Inc. Distribution of information about the island refuges could educate the public about the need for, and benefits of, national wildlife refuges, including those which cannot be directly used by the public. Harford County or an NGO would administer public use programs on Susquehanna NWR. Public uses will not interfere with important nesting or wintering seasons of listed species. No public use activities will be permitted where public safety or trust resources are adversely affected.

## Goals, Objectives, Strategies, and Monitoring Elements in Alternative A for Managing the Chesapeake Island Refuges

**Goal 1.** Provide resting and feeding habitat for wintering waterfowl, and nesting habitat for waterfowl, wading birds, shorebirds, ospreys, and peregrine falcons.

**Objective 1.1.** Provide sufficient habitat to support an average of 300,000 wintering AP (Atlantic Population) Canada goose use days, 2,000,000 duck use days, and 150,000 tundra swan use days annually during the 5-year period.

*Basis of the objective.*—The island refuges historically have been extremely important to wintering waterfowl. The Chesapeake Waterfowl Management Plan, North American Waterfowl Management Plan, and the Canada Goose Management Plan for Maryland recognize and promote the importance of Martin NWR in managing for these species. The objectives are based on historical averages of wintering waterfowl use days.

*Strategies to achieve the objective.*—The 1960 Secretarial Order closing Martin NWR to the taking of waterfowl would remain in effect. Refuge staff and law enforcement personnel would patrol regularly to discourage human disturbance in areas where waterfowl concentrate. Staff would conduct weekly waterfowl inventories and monthly aerial surveys.

*Monitoring element.*—The number of waterfowl use days for each of the groups.

**Objective 1.2.** We would develop a black duck production objective if meaningful production is determined to be feasible.

*Basis of the objective.*—The NAWMP and the ACJV place special emphasis on black ducks, supporting the need for this objective. Black ducks broods are regularly observed on Martin NWR, but little is known about the black duck brood habitat, or if black ducks are nesting on the

refuge in significant numbers. Therefore, we determined that staff should obtain sufficient information to validate whether a meaningful production objective should be developed.

*Strategies to achieve the objective.*—Strategies include the development of specific brood census techniques; production evaluation by censusing the number of pairs, conducting brood counts, and estimating fledgling success; scientifically analyzing the historical pair, nest, and brood data collected since refuge establishment; and subsequently determining a black duck production objective with more specific strategies if warranted. Fox predation control would continue at current levels, but may be readjusted to reflect the pending black duck production objective. The refuge would continue to band a quota of 400 black ducks annually.

*Monitoring element.*—Decision to establish or not to establish a black duck production objective.

**Objective 1.3.** Provide a sufficient amount of nesting habitat, free from human disturbance and other threats, for colonial nesting birds during the breeding season.

*Basis of the objective.*—These colonies of colonial nesting birds, the most productive in the Chesapeake Bay, are sensitive to disturbance during nesting and while chicks are young. Eggs and chicks are left exposed to predation and weather when adults leave the nest due to disturbance. Ground-nesting species are also vulnerable to having eggs and young trampled by mute swans which concentrate on island beaches to loaf. Mute swans were documented as the principal cause of least terns and black skimmers abandoning the Barren Island Division. Gulls and fish crows also prey on young and eggs of many of the colonial nesters. This objective is critical to the accomplishment of the goal.

*Strategies to achieve the objective.*—The islands would remain closed to public access and use. We would conduct regular law enforcement patrols to keep the public from disturbing rookeries. Refuge staff would destroy mute swan nests and kill the adults. We would control gull and fish crow populations.

*Monitoring element.*—Acreage of available nesting habitat of suitable quality, level of compliance or noncompliance with the closure, and response by birds (e.g., number of breeding pairs, number of chicks per nest, nest success, number of nest failures or dead nestlings).

**Objective 1.4.** Provide sufficient habitat for the maintenance of an average of 11,000,000 shorebird, gull, tern, and marsh and water bird use days annually over the 5-year period.

*Basis of the objective.*—The island refuges provide critical habitats for migrating shorebirds, gulls, terns, allied species, and marsh and water birds. The islands form a natural migratory chain of stop-over resting and feeding locations as birds migrate from Cape May across Delaware Bay and shift their migration to the eastern shoreline of the Chesapeake Bay. The objective numbers are derived from historical averages.

*Strategies to achieve the objective.*—We would protect the existing habitat, and inventory these species biweekly.

*Monitoring element.*—The annual average number of use days.

**Objective 1.5.** Closely monitor the breeding population of each colonial nesting species to track the number of nesting pairs, nestlings, and fledglings each year.

*Basis of the objective.*—Refuge Managers can only determine whether the goal is being attained by obtaining estimates of the breeding population and juveniles successfully reared.

*Strategies to achieve the objective.*—Monitoring would continue much as it has in the past. We would conduct at least two counts each month from April through July, to obtain the number of nesting pairs, number of chicks per nest, and the number of fledglings. The refuge monitoring plan would provide additional details.

*Monitoring element.*—The number and type of count by period.

**Objective 1.6.** Promote research opportunities that would increase our understanding of colonial nesting bird life history requirements and potential limiting factors.

*Basis of the objective.*—Research conducted by organizations outside the Service is often needed to obtain specific information on colonial nesting bird species life history requirements and factors limiting breeding success, such as food availability and contaminant levels.

*Strategies to achieve the objective.*—Identify research needs and coordinate with interested universities or individuals to establish research projects. Design all projects to avoid disturbing breeding birds and their nests, nestlings, and fledglings.

*Monitoring element.*—Reports of research results.

**Objective 1.7.** Annually fledge an average of 50 osprey.

*Basis of the objective.*—The island refuges provide essential habitat that supports the Chesapeake Bay nesting osprey population. Natural nesting sites can be supplemented with artificial structures that improve the capacity of these areas to contribute to the overall production of ospreys.

*Strategies to achieve the objective.*—We would maintain 70 osprey platforms to supplement natural nesting habitat, and monitor production annually by conducting two checks of the nesting platforms: once during incubation in the spring, and another during the early summer just before young birds take flight.

*Monitoring element.*—The number of osprey fledged annually.

**Objective 1.8.** Annually fledge an average of 12 peregrine falcons.

*Basis of the objective.*—The island refuges provide essential habitat that supports the Chesapeake Bay nesting peregrine population. Natural nesting sites can be supplemented with artificial structures that improve the capacity of these areas to contribute to the overall production of peregrines.

*Strategies to achieve the objective.*—We would maintain four peregrine nesting towers to supplement natural nesting habitat, and monitor production annually by conducting two checks of the nesting platforms: once during incubation in the spring, and another during the early summer just before young birds take flight. We would band young peregrines before fledging.

*Monitoring element.*—The number of peregrines fledged annually.

**Goal 2.** Provide protection and essential habitat for endangered species, focusing on bald eagles.

**Objective 2.1.** Provide protection and habitat to support an average of 3 bald eagle nests each year, with an average annual production of 1.5 young per nest.

*Basis of the objective.*—Target numbers are based on historical averages. Dorchester County has the largest nesting population of bald eagles north of Florida on the Atlantic Coast, and most of their nests are located on or immediately adjacent to units of the Refuge Complex.

*Strategies to achieve the objective.*—During the nesting period (mid-December through March), we would maintain marsh and water areas as inviolate sanctuaries with no public use.

*Monitoring element.*—The number of nests and number of young fledged per nest.

**Goal 3.** Provide quality environmental education and interpretation opportunities for refuge visitors.

**Objective 3.1.** Provide an average of 1,000 hours of conducted interpretation annually.

*Basis of the objective.*—Because of the limited size of most of the islands, difficulty of access, and the high degree of sensitivity of most of their wildlife to human disturbance, interpretation is critically important to help inform visitors that these areas are primarily for wildlife and the reasons they are closed to public use. Interpretation is also critically important to share management and technical information with peers, other wildlife professionals, private groups and individuals, and foreign conservation interests.

*Strategies to achieve the objective.*— The existing contact station, the Middleton House on Martin NWR, would continue to provide the few existing displays and mounts, which fail to capitalize on the human inhabitants' unique island culture, fishing and crabbing industry, or on the islands' crucial role in Chesapeake Bay ecology. No staff would be available for environ-



mental interpretation. We would conduct a limited number of guided tours for wildlife professionals, private groups and individuals, and foreign conservation interests, when these activities would not disturb wildlife.

*Monitoring element.*—The number of hours of interpretation conducted.

**Objective 3.2.** Provide an average of 9,000 hours of self-guided interpretation annually.

*Basis of the objective.*—Because of the limited size of most of the islands, the difficulty of access to them, and the high degree of sensitivity of most of the wildlife species on them to human disturbance, interpretation is critically important in informing visitors that these areas are primarily for wildlife, and why they are closed to public use. Approximately 40,000 people visit Smith Island each year. We need to inform them about the island refuges and their contribution to the Refuge System.

*Strategies to achieve the objective.*—We would limit self-guided interpretation to the Martin NWR visitor contact station, the Middleton House, which is located at the administrative center for the refuge in Ewell, Maryland, and is geographically isolated from the main body of Martin NWR and the other divisions. It would be open during working hours, Monday–Friday, each week of the year, but would remain inaccessible to disabled visitors. Approximately 900 square feet of marginal secondhand self-guided exhibits, maps, displays, and brochures would be available to the public. A kiosk describing the refuge would be available to interpret refuge activities and describe its location to visitors when the visitor contact station is closed. Brochures describing Martin NWR would be available to the public at the State-maintained Visitor Center in Ewell, operated by the State of Maryland Department of Tourism.

*Monitoring element.*—The number of hours.

**Objective 3.3.** Provide an average of 16,000 hours of environmental education annually.

*Basis of the objective.*—As with interpretation, quality environmental education is critically important in informing visitors why the island refuges are closed to public use: that they are primarily for wildlife. Environmental education builds support when its students become adults, and raises public awareness of the importance of the refuges and the Refuge System to wildlife.

*Strategies to achieve the objective.*—We would maintain a Memorandum of Understanding with the Chesapeake Bay Foundation, Inc. (CBF). CBF would offer quality environmental education programs to approximately 700 gifted and talented students annually at their Karen Noonan Environmental Education Center on the Bishops Head Division. CBF would provide trained naturalists and environmental educators to spend 3 days with each student on refuge property studying various aspects of the Chesapeake Bay environment. Refuge staff would continue to be responsible for assisting in maintaining the 4-mile access road to the CBF Center, and be completely responsible for maintaining the dock at Bishops Head.

*Monitoring element.*—The number of hours.

**Goal 4.** Provide a site for conducting scientific research leading to the enhancement of wildlife and natural resource management.

**Objective 4.1.** Foster relationships with government agencies, conservation groups, and institutions of higher education and communicate the most critical research needs of the refuge.

*Basis of the objective.*—Sound scientific research is crucial to fulfilling the mission of the island refuges; it provides the key to sound resource management. Service policy encourages and supports appropriate research and management studies that provide additional scientific data upon which to base decisions regarding management of the Refuge System. Providing places to conduct research also provides students and teachers with the opportunity to practice the concepts of field research (4 RM 6).

*Strategies to achieve the objective.*—We would actively seek partnership opportunities, and would also consider unsolicited proposals for research in a variety of disciplines, including wildlife, public use, and cultural resources. All reports, surveys, and scientific papers generated would be made available to staff and catalogued for future reference. In addition to wildlife-oriented research, we might also permit the use of the refuge for other investigatory scientific purposes when we deem them compatible with refuge purposes, goals, and objectives. We would give priority to studies that contribute to the enhancement, protection, use, preservation, and management of native wildlife populations and their habitats (4 RM 6).

*Monitoring element.*—The number of research projects, and number of participants for each.

**Objective 4.2.** Provide facilities and equipment for use by researchers.

*Basis of the objective.*—Providing facilities and equipment would facilitate research by non-Service institutions in support of objective 4.1., above.

*Strategies to achieve the objective.*—Housing, equipment storage, and use of Service equipment would be provided at the discretion of the Project Leader, with priority given to research that furthers the goals and purposes of the refuge.

*Monitoring element.*—Inventory of facilities and equipment available for researchers.

**Complex-wide Programs.** The 1991 Station Management Plan also establishes the following programs.

### **Commercial Uses**

*Guiding Concept.*—Trapping muskrats and snapping turtles would be the only commercial uses on the Refuge Complex. We would manage them commensurate with wildlife conservation.

*Strategies.*—We would continue muskrat trapping on 6,752 acres of marshland, in accordance with the Furbearer Management Plan. Trappers would continue to bid on 15 marsh management units. The ability to recover bid costs by removing nutria at the rate of \$1.50 per nutria also would continue. Refuge staff would count muskrat houses annually. We would issue one Special Use Permit annually for trapping snapping turtles in Blackwater NWR impoundments.

## **Other Public Uses**

*Guiding Concept.*—We would allow, but would not promote, some other public uses that are not identified in public use objectives and are not identified as commercial uses.

*Strategies.*—Opportunities for the following uses would continue much as they have in the past.

- Boating would continue unrestricted year-round in navigable waterways under State jurisdiction (i.e., areas below mean high water), but would be limited to April 1 through September 30 on areas regulated by the Service (i.e., the interior of Blackwater NWR).
- Horseback riding and the use of horse-drawn carriages would continue, confined to paved roadways open to other types of vehicle traffic.
- Hiking would continue, confined to existing interpretive trails and the 6½-mile Wildlife Drive. No new trails would be developed in alternative A.
- We would not permit off-road vehicles.

## **Partnerships and Other Cooperation**

*Guiding Concepts.*—Conservation partnerships with other Federal, State, and local agencies, organizations, industry, and the general public can significantly contribute to conserving biological resources on the Refuge Complex, and help us provide opportunities for compatible, wildlife-dependent recreational uses.

Cooperation with other landowners is essential in addressing problems that either extend or originate beyond the boundaries of the refuge. However, conservation partnerships and cooperation are not limited to accomplishing refuge purposes. They can also help achieve wildlife conservation and environmental education goals outside refuge boundaries.

*Strategies.*—We would continue our existing partnerships. We would cooperate with other agencies, institutions of higher education, and private organizations and individuals.

## **Fire Management**

*Guiding Concepts.*—We would focus our fire management on ensuring the safety of firefighters and the public. We would commit ourselves to protecting human life, property, and other resources from unplanned fires. We would also use prescribed fires, as appropriate, to accomplish resource management and objectives and refuge maintenance objectives.

*Strategies.*—Our approved Fire Management Plan and its accompanying EA discuss specific strategies. Copies are available at Refuge Complex headquarters.

### **Cultural Resource Management**

*Guiding Concepts.*—The basic compliance requirements of the cultural resource laws described earlier would guide our management of cultural resources in alternative A. In practice, we would continue our present emphasis on complying with the National Historic Preservation Act. However, Refuge Complex staff have maintained a vital interest in traditional culture and archaeology. We would continue to cooperate with the Maryland and Virginia Historic Preservation Offices (HPO) and the Region 5 HPO.

*Strategies.*—Cultural resource management would remain a basic component of land management. Except as required for specific Federal projects (e.g., significant construction) within the Refuge Complex, no formal historical or archaeological review would occur in alternative A.

### **Monitoring and Research**

*Guiding Concepts.*—Wildlife population” monitoring would continue to focus primarily on waterfowl, shorebirds, other waterbirds and colonial nesters, bald eagles, peregrine falcons, DFS, deer populations, ospreys, furbearers, forest health, and invasive species. Habitat monitoring would continue to focus on overall wetland habitat acreage, forest type inventory, and SAV.

*Strategies.*—Under alternative A, the monitoring of wildlife, habitat, public use, and other uses would proceed as it has since 1991. Habitat monitoring would continue primarily on the amount and distribution of wetland habitat, aquatic vegetation surveys in impoundments in spring and summer, monthly water quality sampling, forest type inventory, and the effects of nutria on marsh vegetation. The U.S. Forest Service (USFS) would monitor aerial defoliation associated with gypsy moth infestations and control. Wildlife monitoring would continue to focus on accomplishing the surveys shown in the table below, “Biological surveys ongoing at the Refuge Complex.”

### **Facilities Maintenance and Safety**

*Guiding Concepts.*—To the extent of available funding, we would maintain the facilities on the Refuge Complex, including roads, structures, grounds, and equipment, in a clean, orderly, and energy-efficient condition that protects the health, safety, and convenience of refuge staff and the general public. We would survey and eliminate facilities and equipment that we determine are no longer needed, no longer safe, or too expensive to maintain.

*Strategies.*—Facility maintenance would continue much as it has in the past, mostly addressing only emergency needs. The existing maintenance backlog of \$6.93 million would continue to grow. The number of maintenance staff would remain inadequate for maintaining \$2 million in personal property and more than \$56 million in real property.

## Law Enforcement

*Guiding Concept.*—The dominant concept here is that the Service would enforce all laws and regulations under its jurisdiction. Although we would limit our law enforcement primarily to refuge lands, it goes well beyond enforcing the laws, regulations, and policies that pertain to achieving refuge purposes and goals, and includes State hunting, fishing, and boating regulations; safety regulations; and cultural resource laws.

*Strategies.*—Under alternative A, the lack of personnel and equipment that now hampers refuge law enforcement would continue. Only one collateral duty person now supports Refuge Complex law enforcement, with very limited support from Maryland and Virginia State game wardens, and Service agents. We would provide assistance to other Federal and state law enforcement agencies on certain off-refuge operations; particularly those concerning violations of the Migratory Bird Treaty Act or Archaeological Resources Protection Act. We would continue to post boundaries and distribute information and regulation leaflets.

## Budget and Administration

*Guiding Concepts.*—Administering the Refuge Complex includes managing staff, budget, and other resources. We will strive to maintain a level of staffing and funding sufficient to effectively and efficiently accomplish refuge purposes. In alternative A, we would not increase current staff, and only previously approved Refuge Operating Needs System (RONS) projects for minimum staffing requirements would be funded.

*Strategies.*—We estimate annual costs for managing the Refuge Complex in alternative A at \$1.9 million, including fire management, salaries, operating and maintenance costs, and revenue sharing payments.

**Table 1.** Ongoing biological surveys at the Refuge Complex

Survey	Schedule	Surveyor	Data Storage
<i>Habitat</i>			
Water quality	bi-monthly	refuge	refuge
GIS	continuous	refuge	refuge
Aquatic vegetation surveys (MSUs)	bi-annual (Jun & Sep)	refuge	refuge
Forest inventory	continuous	refuge	refuge
<i>Waterfowl</i>			
Aerial surveys	bi-weekly (Oct–Mar)	refuge	refuge
Ground waterfowl surveys	weekly	refuge	refuge
Midwinter inventory	annual (Jan)	MDDNR/refuge	MDDNR/refuge
Wood duck roost counts	bi-weekly (Aug–Oct)	refuge	refuge
Trapping and banding wood ducks	as requested	refuge	refuge
Trapping and banding black ducks	as requested	refuge	refuge
Goose collar observations	annual (Nov–Feb)	refuge	refuge

Chapter 2. Alternatives

<b>Survey</b>	<b>Schedule</b>	<b>Surveyor</b>	<b>Data Storage</b>
Mute swan production	bi-weekly (Jun)	MDDNR/refuge	MDDNR/refuge
<i>Colonial bird</i>			
Brown pelican nesting and banding	annual (Jun)	MDDNR/refuge	MDDNR/refuge
Rookery surveys	monthly (Jun–Aug)	MDDNR/refuge	MDDNR/refuge
<i>Big game</i>			
Deer spotlight (white-tailed or sika)	monthly (Oct–Mar)	refuge	refuge
Deer health checks	during quota hunts	refuge	refuge
Turkey broods	as seen (Jun–Aug)	refuge	refuge
Southeastern disease lab	every 5 years	refuge	refuge
<i>Furbearer</i>			
Muskrat transect count	annual (Nov)	refuge	refuge
Nutria population (mark and recapture)	annual (Dec)	refuge	refuge
Nutria exclosures	bi-annual (spring & fall)	USGS/MDDNR	USGS/MDDNR
Furbearer harvest summary	annual (Apr)	refuge	refuge
<i>Shorebird</i>			
Shorebird surveys	weekly	volunteers	refuge
<i>Mammal</i>			
Delmarva fox squirrel (benchmark)	annual (spring & fall)	refuge	refuge
<i>Raptor</i>			
Bald eagle roost counts	annual (Jan)	refuge	refuge
Midwinter bald eagle count	annual (Jan)	MDDNR/refuge	MDDNR/refuge
Aerial bald eagle nest and fledgling	monthly (Dec–Mar)	MDDNR/refuge	MDDNR/refuge
Osprey nest and fledgling and banding	monthly (May–Sep)	refuge	refuge
Barn owl nesting	bi-annual	refuge	refuge
<i>Breeding bird</i>			
Neotropicals (94 sites)	Jun–Jul	refuge	refuge
Christmas bird count	annual	volunteers/refuge	refuge
Wildlife disease (avian cholera)	as requested	MDDNR/refuge	MDDNR/refuge
<i>Contaminant</i>			
Environmental Site Assessment Level I	as requested	refuge	refuge
<i>Invasive or Exotic Species</i>			
Gypsy Moth	continuous	USFS & refuge	USFS & refuge

**Minimum Approved Staffing (current plus approved vacancies)**

Government staffing usually is expressed in full-time equivalents (FTEs). One permanent, full time position represents one FTE. One seasonal position working six months of the year represents 0.5 FTE. Term and temporary positions are generally 1.0 FTE or portion thereof. Minimum approved staff (current plus approved vacancies) are: 1261 Complex Administration Staff (seven, permanent); 1261 Blackwater NWR Staff (11, permanent); 9251 and 9263 Complex

Fire Program Staff (nine, permanent; and three temporary seasonals); and the 1261 Chesapeake Island Refuges Staff (three, permanent). See staffing tables, below.

**Table 2.** Refuge Complex minimum staff

<b>Position</b>	<b>Status</b>	<b>Grade</b>	<b>Fund</b>	<b>FTEs</b>
Project Leader	PFT	GS-14	1261	1
Deputy Project Leader	PFT	GS-13	1261	1
Supervisory Biologist	PFT	GS-13	1261	1
Outdoor Recreation Planner	PFT	GS-11	1261	1
Administrative Officer	PFT	GS-09	1261	1
Supervisory LE Officer	PFT	GS-09	1261	1
Budget Technician	PFT	GS-06	1261	1

**Table 3.** Blackwater refuge minimum staff

<b>Position</b>	<b>Status</b>	<b>Grade</b>	<b>Fund</b>	<b>FTEs</b>
Refuge Operations Specialist	PFT	GS-11	1261	1
Forester	PFT	GS-11	1261	1
GIS Biologist	PFT	GS-11	1261	1
Maintenance Mechanic Leader	PFT	WL-10	1261	1
Heavy Equipment Mechanic	PFT	WG-10	1261	1
Engineering Equipment Operator	PFT	WG-08	1261	1
Engineering Equipment Operator	PFT	WG-10	1261	1
Recreation Aid	PFT	GS-05	1261	1
Education Specialist	PFT	GS-05	1261	1
Administrative Support Assistant	PFT	GS-07	1261	1
Biologist	PFT	GS-07	1261	1

**Table 4.** Chesapeake Island refuges minimum staff

<b>Position</b>	<b>Status</b>	<b>Grade</b>	<b>Fund</b>	<b>FTEs</b>
Refuge Manager	PFT	GS-12	1261	1
Boat Operator	PFT	WG-09	1261	1
Student Career Experience Position	PPT	GS-07	1261	0.5

**Table 5.** Refuge Complex fire management minimum staff

<b>Position</b>	<b>Status</b>	<b>Grade</b>	<b>Fund</b>	<b>FTEs</b>
Fire Management Officer	PFT	GS-12	9251	1
Fire Control Officer	PFT	GS-09	9251	1
Admin. Support Assistant (Dispatcher)	PFT	GS-06	9251	1
Lead Forestry Tech.	PFT	GS-06	9251	1
Forestry Tech. (2)	PPT	GS-05	9251	1.5
Forestry Tech. (3)	SEAS	GS-04	9263	1.5
Rx Fire Specialist	PFT	GS-07	9263	1
Rx Fire Tech.	PFT	GS-06	9263	1
Wildfire Specialist	PFT	WG-10	9251	1

## **Alternative B. Conservation Biology for Trust Species Diversity (Preferred Alternative)**

### **Conservation Biology and Biological Diversity Management**

#### **Introduction**

Unlike alternative A, which focuses almost exclusively on Federal trust species, alternative B is based upon the tenets of conservation biology, and emphasizes biological diversity. It takes advantage of the emphasis in the NWRSA on conserving biodiversity through sound science. The NWRSA mandates change, and alternative B would bring this change to the Refuge Complex by maintaining biological diversity and environmental health, significantly improving the existing resource inventorying and monitoring program, and expanding the Refuge System to include new areas, important ecologically sensitive areas that require protection. This alternative also focuses on improving our ability to accommodate priority public uses, when they are compatible with refuge purposes and the mission of the Refuge System.

Conservation biology, while practiced for centuries, is a relatively new science derived from various other fields, including population biology, genetics, forest and wildlife management, ecology, economics, anthropology, and philosophy. The field of conservation biology focuses on the protection of biological diversity at all levels, including genes, populations, species, habitats, ecosystems, and landscapes, as well as the maintenance of ecological processes, such as natural selection, natural disturbance, and hydrologic flow. Current thinking within conservation biology differs from traditional resource conservation, in that it is driven not by utilitarian, single-species



issues, but by the desire to conserve the biological components and ecological processes within entire ecosystems.

Ecoregional planning (or reserve selection), a subset of the conservation biology field, involves working at large geographic scales to systematically determine areas of biodiversity significance and thus conservation importance. In contrast, site planning (or reserve design) focuses on the best methods to achieve conservation success at a particular site or area.

## **Blackwater National Wildlife Refuge—Alternative B**

### **Concepts Used for Developing Alternative B**

**Land Protection.**—On July 17, 1995, the Director approved a Preliminary Project Proposal to study protecting an additional 17,500 acres on Blackwater NWR, of which we acquired 2,186 acres by categorical exclusion. On July 25, 1995, the Director approved the study of an additional 16,000 acres on the Nanticoke River. See appendix J, “Land Protection Plan.”

For this alternative, we would continue to pursue the protection of those lands and waters through a variety of actions, including fee title acquisitions, easements, and cooperative agreements. When we have assembled an adequate block of acreage along the Nanticoke River, we would probably manage that area as another division of the Refuge Complex.

We would continue to identify within the focus area key private lands that would produce the greatest strategic gains in achieving our management goals and objectives outlined below. For example, we would prioritize the acquisition of forest lands in or near the core areas we have defined as providing optimal breeding habitat for forest birds. We would also acquire inholdings from willing sellers as opportunities arise. [See chapter 1, figures 1 and 2.]

**Fish, Wildlife, and Habitat Management.**—This alternative would significantly expand the Complex-wide Resource Inventory and Monitoring Program, and would emphasize the tenets of conservation biology and ecosystem processes in designing and implementing our management programs. Also, we would implement programs for optimizing biological integrity and ecosystem health in the context of refuge purposes. We would deploy a variety of active and passive management programs to accomplish habitat- and population-based goals and objectives, including intensively managed moist soil units (MSU); active intervention to address exotic, invasive, and injurious species; and landscape-level restoration.

**Public Use.**—Outreach is two-way communication between us and the public to establish mutual understanding and promote public involvement in improving joint stewardship of our natural resources. As in alternative A, one concept that would guide our outreach is that public awareness of the Service, its mission, and its role in wildlife conservation is needed for the American public to appreciate and support our effective management of the Refuge Complex and the refuges in it as a whole. To improve refuge management, we must build a strong base of public understanding and support, by educating people about these refuges, their purposes, and

goals in a clear refuge message. The following concepts would guide our management of public use in alternative B.

1. Promote the refuge message in providing visitors a more enjoyable experience and helping reduce visitor impacts on other wildlife areas.
2. Provide environmental education and training that incorporates the refuge message for teachers and students.
3. Increase opportunities to help the public to educate itself, such as printing an adequate quantity of brochures that incorporate the refuge message.
4. Provide compatible opportunities for wildlife observation, photography, hunting, and fishing.
5. Provide professionally produced interpretive information at appropriate locations.
6. Improve staff and volunteer training to enable them to provide the public quality interpretive experiences that convey the refuge message.
7. Maintain and improve visitor facilities to ensure that high quality, safe, enjoyable, and educational experiences of different levels and requiring different abilities are available.
8. Conduct effective outreach and work with State and local organizations to provide recreational facilities that enable visitors to enjoy the Refuge Complex without adversely affecting either wildlife or wildlife habitat.
9. Public uses will not interfere with important nesting or wintering seasons of listed species.
10. No public use activities will be permitted where public safety or trust resources are adversely affected.

We would improve existing opportunities, and develop more environmental education and interpretation and wildlife-dependent recreation, in conformance with “Fulfilling the Promise” and the Refuge System Administration Act. We would develop an environmental education manual and teachers’ workshops; build an environmental education center; remodel and enlarge existing structures dedicated to public use; modernize exhibits; and build information kiosks, observation sites and decks, interpretive trails, photo blinds, and an accessible fishing pier. We also would expand hunting, fishing, and other wildlife-dependent recreational opportunities.

In alternative B, we would expand outreach to build a stronger base of public understanding and support. We would develop better relationships with the media, local governments, and community organizations; participate in public events; work with the Friends of Blackwater; and install a travelers’ information radio station.

## Goals, Objectives, Strategies, and Monitoring Elements in Alternative B for Managing Blackwater NWR

**Goal 1.** Protect and enhance Service trust resources and other species and habitats of special concern.

**Subgoal 1.** Provide habitats to sustain 10 percent of each of Maryland's wintering waterfowl populations of Atlantic Population (AP) Canada geese, snow geese, and dabbling ducks (as measured by the Midwinter Waterfowl Inventory).

**Objective 1.1.1.** Monitor wintering waterfowl populations.

*Basis of the objective.*—Blackwater NWR is managed primarily for wintering waterfowl. Since 1955, 6 percent [SE = 0.6, n = 44] of Maryland's Canada goose, snow goose, and dabbling duck populations counted during the annual Midwinter Waterfowl Inventory have been on Blackwater NWR. To support the objectives of the NAWMP, the Chesapeake Bay Program Waterfowl Management Plan (2000), and Maryland's Canada Goose Management Program, the refuge must maintain a credible monitoring program to assess the efficacy of management actions and to determine the contribution of Blackwater NWR to Maryland's waterfowl populations.

*Strategies to achieve the objective.*—Blackwater NWR would continue to conduct three surveys of wintering waterfowl populations at three different spatial scales. The Midwinter Waterfowl Inventory (MWI) would be flown once annually, supplemented by bimonthly aerial surveys of the refuge and weekly ground counts of the impoundments, croplands, and adjacent river.

*Monitoring element.*—The percentage of AP Canada geese, snow geese, and dabbling ducks.

**Objective 1.1.2.** Restore emergent marsh on Blackwater NWR to 1933 coverage level by 2015

*Basis of the objective.*—Blackwater has lost more than 7,000 acres of emergent wetlands since its establishment as a national wildlife refuge in 1933. Most of this loss has occurred in the three-square brackish marsh (*Schoenoplectus americanus*) at the confluence of the Little Blackwater and Blackwater Rivers, but is also now progressing upstream and downstream. The unusually high rate of wetland loss is likely the result of several confounding factors, including sea-level rise, land subsidence, saltwater intrusion, severely modified hydrology, and excessive herbivory.

This emergent marsh once provided significant breeding habitats for blue-winged teal and American black ducks, and foraging habitats for wintering populations of geese and dabbling ducks. The open water that has displaced the lost wetlands is now used primarily by waterfowl as a disturbance-free rest area during migration and winter, and by resident populations of resident Canada geese as a safe place to molt during the summer. It has little value to diving ducks presumably because its shallow, flocculent bottom precludes high densities of submerged aquatic vegetation (SAV) and invertebrates.

*Strategies to achieve the objective.*—We would develop a comprehensive Habitat Management Plan by 2005 that would detail options for maintaining, restoring, and enhancing marsh habitats. Restoration strategies to be assessed would include plugging Stewart's Canal to reduce saltwater intrusion, modifying Shorter's Wharf Road to allow sheet flow, implementing recommendations from the Nutria Pilot Study to reduce nutria herbivory, implementing the Integrated Wildlife Damage Management Plan for resident Canada geese, maintaining the muskrat trapping and nutria rebate program, riprapping the pine islands, reducing sediment load run-off into the upper watersheds, using thin-layer soil deposition, and evaluating more substantive spoil deposition. Strategies for maintaining and improving floral composition would include the use of prescribed fire to affect regrowth vigor and species composition, the use of pesticides to control invasive flora, and replanting in conjunction with techniques such as thin-layer soil deposition.

*Monitoring element.*—Acreage of emergent marsh restored.

**Objective 1.1.3.** Manage a minimum of 420 acres in croplands on Blackwater NWR, thus reducing current cropland acreage by 25 percent by 2015.

*Basis of the objective.*—Due to wetland loss and degradation, natural food resources are inadequate to sustain (and certainly to increase) the current levels of waterfowl use on Blackwater NWR. Furthermore, very few “hot foods” (e.g., corn and sorghum, which are high in carbohydrates and energy) are available off-refuge; those that are, are consumed early. When birds have to travel long distances to seek food off the refuge in severe winter weather, their energy reserves are quickly depleted. Consequently, the refuge plants row crops and cool-season grasses or forbs each year, presently as forced-account, to sustain wintering migratory waterfowl during critical periods of nutritional and physical stress. High-protein cover crops of Ladino clover and buckwheat, over-seeded with winter wheat, receive heavy waterfowl use the entire winter. Sorghum and corn provide high carbohydrates during midwinter and periods of extreme weather when food sources generally are unavailable. Japanese millet is planted in low elevation fields and in some MSUs, where early flooding in the autumn is likely. Small acreages also are planted in sunflowers for migrating waterfowl and granivorous passerines (see alternative A for details).

The forest management portion of the Habitat Management Plan recommends the restoration of selected, formerly converted wetlands from agricultural use to forested habitats (i.e., reforestation). We would convert some formerly converted wetlands from agricultural use to MSUs, due to soil types with poor drainage characteristics (see objective 1.1.4., below). Consequently, the acreage under cropland management would be reduced by 25 percent. Contractual planting of corn and sorghum crops with force account planting of the cool season grasses and forbs is recommended as the preferred option in this alternative, because it minimizes labor and equipment on the part of the refuge while retaining the most nutritious composition of croplands to meet the seasonal needs of waterfowl. Cooperative farming is proposed as a second option, should funding not be available for contractual planting and force account responsibilities.

*Strategies to achieve the objective.*—The preferred option is to manage 420 acres of cropland by contractual planting of 100 to 120 acres in hot foods and force account planting, and maintaining

300 to 320 acres in cool season grasses and forbs. The croplands would be divided into one-quarter hot foods and three-quarters high-protein browse, consisting of Ladino clover, winter wheat, buckwheat, crimson clover, and annual rye. Small acreages of sunflowers also would be planted for granivorous passerines, particularly mourning doves. We would leave all crops unharvested for wintering waterfowl and other wildlife.

If funding were insufficient for that preferred option, we would implement cooperative farming on a 75- to 25-percent share of the crops produced. Additional strategies would include continuing to implement the Integrated Wildlife Damage Management Plan for resident Canada geese to reduce cropland damage; developing Farm Plans, including filter strips; controlling sediment erosion; using integrated pest management; using nutrient management planning; rotating crops; and using other best management practices described in alternative A. [Consult chapter 4, “Environmental Consequences,” and the Cropland Management Program for a more thorough description of the exact procedures and differences among cooperative farming programs and contractual or force account programs.]

Future cropland management for newly acquired lands will be evaluated on a tract by tract basis regarding the highest and best use consistent with the Habitat Management Plan.

*Monitoring element.*—Acres of crops, cool-season grasses, or forbs available for waterfowl at the onset of the fall migration (approximately 15 September).

**Objective 1.1.4.** Manage a minimum of 460 acres of impoundments on Blackwater NWR for moist soil management, thus increasing moist soil acreage by 25 percent by 2015.

*Basis of the objective.*—Native herbaceous vegetation adapted to germination in hydric soils (i.e., moist-soil plants) provide waterfowl with nutritional resources, including essential amino acids, vitamins, and minerals that occur only in small amounts or are absent in other foods. These elements are essential for waterfowl to successfully complete aspects of the annual cycle such as molt and reproduction. Moist-soil vegetation also has the advantages of consistent production of foods across years with varying water availability, low management costs, high tolerance to diverse environmental conditions, and low deterioration rates of seeds after flooding.

Moist soil management units (MSU) also promote invertebrate production. Invertebrates provide the critical protein-rich food resources required by pre-breeding and breeding female ducks, newly hatched waterfowl, and molting ducks and shorebirds. Due to the high value of MSU to waterfowl, shorebirds, and other water birds, additional MSU would be constructed on formerly converted wetlands with poor soil characteristics; i.e., poor drainage. Additionally, the existing MSU infrastructure would be improved to more effectively manage water levels.

*Strategies to achieve the objective.*—In addition to managing the MSU identified in alternative A, we would convert an additional 89 acres of PC wetlands to moist soil management. Electric pumps would be installed in pool 3 and pool 5 to facilitate flooding and drawdowns. Three water control structures would be installed between pools 3A–3B, 3B–3C, and 5A–5B. A water control structure would be installed to replace the 12" concrete pipe that now fills pool 4. Additional strategies include continued implementation of the Integrated Wildlife Damage Management

Plan for resident Canada geese. Management of moist soil management units would conform with the Water Management Plan and with the methodologies described in alternative A.

Future moist soil management units will be developed on newly acquired lands if they are appropriate for helping to achieve refuge purposes, goals, and objectives.

*Monitoring element.*—Acres of MSU that have >75-percent cover of vegetation that produces good waterfowl foods (see Martin and Uhler 1951) at the onset of migration (15 September).

**Objective 1.1.5.** By 2005, determine existing American black duck production and preferred habitat types.

*Basis of the objective.*—The American black duck is a National Species of Special Emphasis. It ranks on the Watch List in the Partners-in-Flight Mid-Atlantic Coastal Plain Bird Conservation Plan (1999) and is a species of emphasis in the Chesapeake Bay Program Waterfowl Management Plan (2000). American black ducks bred in high densities at Blackwater in the 1930s, but, in more recent years, the perception is that both pair densities and brood production have been low. It is not apparent what proportion of the breeding population is nesting in emergent vs. palustrine forested wetlands. There is a clear need to develop an initiative for American Black Ducks, with the explicit goal of implementing an integrated approach to research and management of American black ducks on the Refuge Complex.

*Strategies to achieve the objective.*—The black duck initiative would seek collaborative efforts among these stake holders (and others) to develop funding for studies to assess black duck productivity, nest predation rates, and habitat use on the Refuge Complex. Strategies would likely involve nest monitoring, brood surveys, and a radio telemetry study of nesting females. Subsequent management to maintain and enhance black duck production would be based on recommendations from these studies and others identified in the Black Duck Atlantic Coast Joint Venture Plan and the Chesapeake Bay Program Waterfowl Management Plan 2000.

*Monitoring element.*—Partnership and funding for the initiative for American black ducks, and continued participation in the Midwinter Waterfowl Inventory.

**Objective 1.1.6.** Maintain natural nesting habitats for wood ducks by 2015

*Basis of the objective.*—The wood duck is a National Species of Special Emphasis. Blackwater has historically contributed to local and regional populations of wood ducks by maintaining 5,000 acres of palustrine wetlands.

*Strategies to achieve the objective.*—The refuge would continue to maintain 5,000 acres of palustrine forested wetlands; this acreage would increase as new lands are acquired. Silvicultural treatments (including contract sales and TSI) specifically would retain 2 to 5 snags of at least 12" DBH per acre to ensure a good distribution of natural cavities on the refuge. We would eliminate the existing wood duck nest boxes, except for 15 that we would maintain for environmental education along the Wildlife Drive. Fall brood surveys and roost counts would continue as in alternative A.

*Monitoring element.*—Acreage of palustrine forest maintained.

**Objective 1.1.7.** Determine the regional significance of the lesser snow goose population by 2008.

*Basis of the objective.*—The lesser snow goose (*Anser c. caerulescens*) is primarily a migrant in the mid-continental and Pacific flyways (Bellrose 1976). However, a relatively small proportion of the continental population migrates south in the fall to the Chesapeake Bay, Currituck Sound, and adjacent waters of the Atlantic Coast. An unusually high proportion of this regional population at Blackwater NWR is the blue phase, suggesting a genetically distinct population. Blackwater NWR has been a traditional wintering site for a significant portion of this population since 1934–35. Based on aerial surveys over the past decade, 2500–3500 lesser snow geese have routinely wintered on Blackwater NWR, with counts as high as 6,500 geese during peak migration. Other than the occasional vagrant, all other refuges on the mid-Atlantic coastal plain support greater snow geese (*Anser c. atlantica*). It is apparent that the population at Blackwater NWR is unique from both a continental and regional perspective, and may contribute to the genetic diversity of the continental lesser snow goose population.

*Strategies to achieve the objective.*—We would develop a study of the lesser snow goose population at Blackwater NWR with the two primary objectives of determining (via satellite telemetry) the migration corridor and breeding grounds, and determining the genetic uniqueness (by contrasting genetic markers) of this population. The importance of this study is that confirmation of a genetically distinct sub-population of lesser snow geese would clearly demonstrate the need to revise current USFWS plans to reduce snow goose (regardless of subspecific status) populations in Region 5.

*Monitoring element.*—Generate funding and complete the study identified above; implement subsequent recommendations.

**Objective 1.1.8.** By 2009, develop programs to prevent the loss or degradation of habitats and develop programs and actions to restore and enhance waterfowl habitats within the Nanticoke protection area.

*Basis of the objective.*—Although waterfowl habitats in the Nanticoke watershed are considered to be in relatively good ecological health, several factors are adversely affecting these wetlands' functions and values. With economies based in agriculture, forestry, fisheries, and tourism, the Nanticoke watershed has not yet experienced the adverse impacts from development in the intensity felt in other tributaries of the Chesapeake. However, due to poor land use practices, some habitat degradation has been documented, such as sedimentation, eutrophication, conversion, drainage, and channelization.

*Strategies to achieve the objective.*—We would restore wetland functions and values by restoring riparian systems, replanting degraded wetlands with native plant species, re-establishing SAV beds, controlling exotic or invasive species, and (where appropriate) using structural devices to restore natural hydrology and control salinity. We would assess the effects of hydrological and

water quality changes by establishing a water quality monitoring program to evaluate the effects of upstream sources of pollutants on division resources.

Hydrological modeling may be considered for the Nanticoke River and its tributaries to determine the potential changes in habitat conditions over time from the compounding effects of land subsidence, sea-level rise, and saltwater intrusion. Eutrophication of the system is occurring, and any efforts to address the effects of excessive nutrients would require extensive coordination and planning with partners and stakeholders. Also, the effects of channeling and other hydrological modifications on the Nanticoke River's main stem and its tributaries need to be inventoried and mapped.

Another strategy is to determine the management options for formerly converted wetlands. Reforestation of prior converted (PC) forested wetlands and other drained wetlands would play a crucial role in establishing and restoring waterfowl habitats. However, some areas would be transformed into intensively managed moist soil systems, or maintained in cropland. Our Resource Inventory and Monitoring Plan and Habitat Management Plan may identify other restoration and enhancement opportunities.

*Monitoring element.*—Seasonal acreage of each wetland habitat type; miles of restored riparian forests; acreage, number and type of restoration activities; acres of SAV beds planted.

**Subgoal 2.** Provide habitats that support Neotropical migratory songbirds, emphasizing forest interior dwelling (FID) species.

**Objective 1.2.1.** Establish, manage, and enhance a minimum of seven mature forest cores on Blackwater NWR that are 400 acres or more in size by 2015.

*Basis of the objective.*—Blackwater NWR now contains much of the large contiguous tracts of forested land remaining on the Delmarva Peninsula. Twenty-five species of forest interior dwelling (FID) birds potentially breed in the mid-Atlantic coastal plain (see “A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area,” June 2000). Twenty of the 25 species are Neotropical migrants: species that nest in temperate North America and winter in Central and South America. The cerulean warbler, veery, and black-throated green warbler were eliminated from this list because they are unlikely to be breeding on Blackwater NWR (H. Armistead, D. Dawson, J. McCann, pers. comm). Consequently, 22 of these FIDs are potential breeders on Blackwater NWR, and 20 species have been documented during the breeding forestbird survey in the past 5 years (see chapter 3, table 12, “Twenty-two FIDs that potentially breed on Blackwater NWR”).

Robbins, et al. (1989:28) suggested that, ideally, management should provide the highest probability of providing for the least common species in the forest ecosystem. Partners In Flight recognizes eight of the FID species as “globally significant” (PIF score >21). Eleven of the 22 FIDs are highly area-sensitive; that is, they seldom occur in small, heavily-disturbed or fragmented forests. These species are most vulnerable to forest loss, fragmentation, and overall habitat degradation and, consequently, the ones that the Refuge Complex has chosen to target.



Most are rare or uncommon on the Maryland coastal plain and many have highly specialized breeding habitat requirements. In fact, two of these species (broad-winged hawk and brown creeper) were only recently recognized as breeders on the Maryland coastal plain (Robbins and Blom 1996). According to “A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area” (June 2000), a forest tract is considered to be at least marginal FIDS habitat if either one of two conditions is satisfied: (1) at least four of the 22 species are present with a probable or confirmed breeding status or, (2) at least one of the 11 area-sensitive species is present with probable or confirmed breeding status.

Based on Robbins, et al. (1989) and the literature reviewed in Bushman and Therres (1988), a minimum patch size of 400 acres of mature forest provides potential breeding habitat for at least five of the 11 highly area-sensitive FIDs identified in chapter 3, table 12: Kentucky warbler, worm-eating warbler, hooded warbler, American redstart, and barred owl. In addition to those five area-sensitive species, 400 acres would provide potential breeding habitat for 10 other FID species, or, 15 species. This minimum habitat objective ensures that forested habitat on Blackwater will exceed the definition of marginal FID habitat established in “A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area” (June 2000). Conversely, an ideal patch size of 865 acres would provide potential breeding habitat for all 11 area-sensitive species, and all but one (northern parula) of the more tolerant FID species.

The overarching goal of the forest management program at Blackwater NWR (to be expanded to include additional acquisitions) will be to maintain and increase the size of contiguous, mature forest cores from a minimum of 400 acres to as large as 865 acres. Management strategies will include reforestation, strategic land acquisition, regrowth of cut over areas, timber stand improvement of existing stands, and regeneration cuts. The latter will, in most cases, target forest stands that are exhibiting signs of declining health; to a lesser extent, regeneration cuts will also be used to influence species and age class diversity. Silvicultural prescriptions for different forest types will follow those outlined by the FIDS and Forestry Task Force (June 1999), unless they specifically conflict with habitat requirements of the DFS.

*Strategies to achieve the objective.*—Using digital ortho-photography, we would identify large contiguous forested or previously forested tracts of land within the approved LPP for Blackwater NWR. Acquiring the most recent and technologically advanced aerial imagery of lands within and around Refuge Complex lands and maintaining and managing a state of the art Geographic Information System would prove invaluable in protecting and managing trust resources and their habitats.

The most effective strategy for establishing all seven proposed mature forest cores by 2015 or earlier would be to continue to acquire land within the approved LPP for Blackwater NWR. The acquisition of large contiguous tracts of mature forest would be the highest priority, along with privately owned tracts of land, directly adjacent to or within established cores. Acquiring large contiguous tracts of cleared land or immature forest would remain vital to the establishment of additional cores.

Reforestation of a minimum of 120 acres of prior converted (PC) forested wetlands and other non-forested lands (based on current landownership) would play a crucial role in creating and

eventually expanding cores. Many large contiguous forest patches which are not yet large enough to be considered cores can be enhanced or increased by restoring adjacent agricultural or timber harvested lands back to mature forested habitats. Natural regeneration of cut-over areas is preferred, however, areas lacking natural regeneration, will be planted with a mix of native tree species which once dominated the site. PC areas adjacent to or within large contiguous forest patches or potential cores would be the highest priority for reforestation.

Aside from the actual planting, additional techniques associated with reforestation may include site preparation, weed control and subsequent thinning. Site preparation for the purpose of improving seed germination or planting efficacy may consist of soil scarification, prescribed burning, herbicide application and bedding. The control of undesirable vegetation (weeds) prior to or following tree planting or natural regeneration may be accomplished through application of approved selective herbicides, prescribed fire, or a variety of mechanical and manual methods. The reforestation of abandoned or unnecessary roads or the partial closure of the canopy over essential refuge roads, where applicable, would also aid in the establishment and enhancement of core areas.

Following more detailed inventories, a wide array of forest management practices will be utilized to help maintain or improve the quality or condition of all forest habitats, with special emphasis on establishing or maintaining large contiguous patches of mature trees, as well as a diversity of species. In order to ensure the long term existence of core areas, stand replacement or regeneration must be an ongoing management objective. A common characteristic of mature and over mature forest stands on Blackwater is generally a closed canopy and, as a result, a sparse understory. Also due to the closed canopy and lack of sunlight, there exists little or no natural regeneration of preferred tree species such as oak.

Therefore, we will use a variety of regeneration harvests to stimulate the germination of stored seeds or sprouting of root stocks for the purpose of replacing over-mature and stagnant trees within a stand. Supplemental planting may also be required in some areas. Harvesting methods which are performed for the purpose of eventual stand replacement include, but are not limited to, single tree selection, group selection, shelterwood, and strip and patch clearcuts. The specifics on when and where these activities will be performed cannot fully be determined until more detailed forest inventories are performed on a stand by stand basis. Chapter 4 goes into more detail about prescriptions and their timing. We would develop annual work plans for detailed management prescriptions, such as timber harvesting, timber stand improvement techniques (TSI), and planting.

TSI techniques, such as release cuttings, thinning, and prescribed fire, will also be used to maintain or enhance the growth and vigor of trees within the cores. TSI aims at reducing competition for resources, and targets undesirable and suppressed individuals for removal, thus improving the overall growing conditions for more preferred species. The resulting enhanced growing conditions will ensure forest stands reach the prerequisites for becoming core habitats at a much earlier stage. TSI will also be utilized to establish and maintain desired vertical structure, age class diversity, stem density and species composition.

Protecting these core areas and all other forested habitats from natural and anthropogenic forces is of utmost importance. Insect pests and diseases can have devastating impacts on forest habitats and significantly diminish the integrity of core areas. Blackwater NWR will continue to cooperate with the USFS to monitor for and manage forest insect pest populations, specifically gypsy moths. Integrated pest management strategies, such as annual egg mass surveys and aerial defoliation detection surveys, will continue to be performed by the USFS, with supplemental surveying and monitoring conducted by the forestry staff.

We would maintain a GIS-based monitoring and tracking system jointly with the USFS. We would implement control measures, such as the aerial application of biological insecticides such as Bt (*Bacillus thuringiensis*) or Gypcheck, based on survey results, recommendations, and funding (see objective 2.1.3, below). Performing TSI would also help to improve the health of the forest by reducing stress, therefore reducing its susceptibility to insect pest and disease outbreaks. We would implement more periodic ground and aerial surveys to monitor for additional insect or disease outbreaks. Once detected, the refuge would seek additional assistance from the USFS.

Wildfire prevention will play a vital role in the long term viability of respective cores. All wildfires which occur on or near refuge lands would be promptly contained and extinguished. Prescribed burning would be conducted on a periodic basis in areas of hazardous fuel loadings and in areas which have a high probability of ignition; i.e., road shoulders.

*Monitoring element.*—The number of 400-acre mature forest cores established by 2015.

**Objective 1.2.2.** Increase the size of four of the seven cores to a minimum of 865 acres by the year 2025.

*Basis of the objective.*—Same as objective 1.2.1., plus the fact that a minimum core size of 865 acres would encompass at least 9 of the 11 area-sensitive FIDs that potentially breed on Blackwater NWR. These species will serve as both indicator and umbrella species for a wide range of forest benefits. When sufficient habitat is protected to sustain a diversity of forest birds, other important components and microhabitats of the forest will be encompassed and be protected. These may include the small, forested streams and headwaters critical for fish populations and the vernal pools necessary for the survival of amphibians.

*Strategies to achieve the objective.*—As soon as cores are identified and delineated, the primary management focus would be to increase the size of the core to the optimal minimum size of 865 acres, which would provide potential habitats for at least 9 of the 11 area-sensitive FIDs. Remote sensing and GIS would again be used to identify potential areas and methods for expanding the cores. The primary focus will be on lands which are directly adjacent to, or within, the established core. Many of these lands are privately owned and will require acquisition. Acquiring parcels which are already forested and meet the minimum core criteria of being dominated by mature trees is the fastest and most effective means of increasing core size.

Lands that are already part of the refuge, but do not meet certain minimum core criteria, consist of prior converted wetlands (agricultural), recently harvested timberlands, salt killed areas, and

immature stands. Prior converted forested wetlands that are critical to the expansion and enhancement of a core would be reforested and managed for the purpose of becoming part of a core. Those forested areas, which are now salt-stressed or highly susceptible to salt water intrusion, were not considered as part of existing or future cores.

We have designated a minimum of 120 acres of PC wetlands we now own to be reforested as soon as we can acquire funding. We will assess and intensively manage recently harvested areas to promote the establishment of preferred species. Our preferred method is natural regeneration; however, in areas where natural regeneration is inadequate, supplemental planting would be used. Subsequent weed control and thinning may be used on all reforested or regenerated areas. Any salt-killed areas which have an impact on the expansion of core areas would be assessed for their potential for restoration. Adjacent or interior immature forest stands would be managed to improve the growth, vigor, and mast production of desired tree species to ensure a high quality addition to the core. Such management may include release cuttings, thinning, prescribed fire, and integrated pest management.

*Monitoring element.*—The number of mature forest cores which are a minimum of 865 acres by the year 2025.

**Objective 1.2.3.** Improve the quality of all cores by increasing their effective area by 20 percent within 10 years after they are established.

*Basis of the objective.*—Eleven of the 22 Mid-Atlantic Coastal Plain FID species listed in chapter 3, table 12, are highly area-sensitive and, consequently, just as sensitive to edge effects. An edge is the area where a forest meets a clearing. The forest edge is home to a number of other birds which may compete with the FIDs for food or even feed upon the FIDs eggs. Therefore, a 100-meter buffer was delineated from the core edge towards the interior of the core to determine the actual area within the core which can be considered habitats for area-sensitive FIDs. This variable is known as the “effective area” or “functional habitat”.

*Strategies to achieve the objective.*—The effective area of a core can be enhanced in various ways. The most obvious method is to increase the overall size of the core. However, this is only true if the parcels added to the core are shaped so that “effective area”, not just area, is being added to the core. For example, a linear-shaped tract which is 200 meters or less in width would provide no additional effective area to the core, regardless of its overall size due to the influence of the 100-meter buffer associated with the edge. Another method is to ensure that non-core inholdings within an established core are managed in a way that they would eventually become part of the core. Gaps within cores significantly decrease the effective area due to the additional edge habitat they create. Once again these gaps may exist in the form of agricultural fields, timber harvests, areas of mortality, young forest stands or oversized roadbeds.

The methods for reclaiming these lands are similar to those in the previous objectives, and include reforestation, regeneration, and timber stand improvements. The actual shape of the core area also significantly influences the effective area. The optimal shape for maximizing effective area is one with the lowest perimeter-to-area ratio (i.e., a circle). By strategically acquiring, reforesting, and managing adjacent parcels of land to decrease perimeter length, by smoothing

out the boundary, and by forcing the shape away from being linear, a core's effective area would be increased.

*Monitoring element.*—Percent increase of effective area in each core.

**Objective 1.2.4.** Maintain or improve mean species richness of desired tree species within cores by 10 percent within 15 years after they are established.

*Basis of the objective.*—Maintaining a diverse mix of native pine and hardwood tree species would ensure that the needs of a much wider variety of FIDs and other wildlife are met. A diversity of tree species provides a greater mix of canopy structures available to FID species. A mix of both hard and soft mast-producing trees can ensure a nearly year-round food source for many species of wildlife. Species diversity also reduces the potential for host specific insect pests or diseases to wipe out an entire core. Due to the existence of the DFS, we would focus primarily on promoting the growth and dominance of loblolly pine and hard mast-producing species, such as oaks and beech.

*Strategies to achieve the objective.*—Desired composition and diversity of tree species within forest stands will be accomplished primarily by implementing a wide variety of silvicultural techniques, including but not limited to, timber stand improvements, regeneration harvests, prescribed fire, and herbicide application. The common term “timber stand improvement” (TSI) unambiguously covers all intermediate cutting operations that require financial investment and do not involve removal of useful material. Intermediate cuttings are treatments conducted to modify or improve the growth of an existing crop of trees, but not to replace it with a new one. They involve the selective removal of suppressed, undesirable, or overcrowded vegetation to allow for the expansion of the crowns and root systems of desired trees.

Specific examples of these treatments include crop tree release, thinning, and improvement cuttings. A variation of these methods consists of the selective killing of undesirable trees by girdling them, injecting them with systemic herbicides, or aerially applying broadleaf-specific herbicides such as Arsenal™. These methods not only free up growing space and resources, but also provide nesting and feeding habitats for a variety of wildlife, primarily birds. The girdling of selected trees and allowing the dead snags to persist directly supports the Refuge Complex objectives for providing quality wood duck habitats.

Timber harvesting techniques which are aimed at replacing the existing stand with a new one can prove extremely effective in managing for desired species composition and diversity. These harvest methods include, but are not limited to, seed tree, single tree and group selection, shelterwood, and strip or patch harvests. Salvage and sanitation cuts may be performed in areas impacted, or potentially impacted, by devastating insect or disease outbreaks. Post-harvest management, such as site preparation and weed control, is essential for ensuring the regeneration and establishment of desired species.

Prescribed fire is also an effective means of altering or managing the species composition within a forest stand during the early stages of development. Prescribed burning would be performed in

applicable stands at early stages of development, while most tree species are still susceptible to injury by fire.

*Monitoring element.*—Ratio of species richness of desired tree species 15 years following core establishment as compared to establishment date.

**Objective 1.2.5.** Develop forest management techniques for FIDS by 2006.

*Basis of the objective.*—Identifying forest management techniques which not only enhance the quality and health of the forest, but also provide more direct benefits to FIDs and other Neotropical migratory songbirds will compliment and provide additional justification for the objectives and strategies outlined in the step-down forest management plan.

*Strategies to achieve the objective.*—Implementing forest management practices and careful monitoring will identify management techniques and resulting conditions which are most beneficial to FIDs. By implementing the Resource Inventory and Monitoring Program and closely monitoring Neotropical migrant and FID populations each year, we will better understand their distribution and the main limiting factors for each species. Tying species occurrence to plant community type is essential for assessing species-specific habitat requirements and determining appropriate management needs.

The term “adaptive management” applies to assessing the impacts of all forest management activities to determine any positive or negative impacts to faunal populations with emphasis on FIDs and DFS. Since little information is available that addresses specific forest conditions and preferred management strategies, the efficacy of forest management practices as it relates to FID and DFS populations would be assessed. Conflicts between management techniques would also be evaluated. In order to adequately achieve this objective, a research component, which measures the response of trust resources, should be applied to a variety of forest management practices. We would initiate the following research:

1. The effects of prescribed fire on DFS populations and avian communities in mid-Atlantic coastal plain forested habitats;
2. The effects of selective harvesting techniques on DFS and FIDS; and,
3. The effects of timber stand improvement techniques on DFS and FIDS.

*Monitoring element.*—The number of research studies implemented.

**Subgoal 3.** Provide habitats to support a diversity of migrating shorebirds and marsh and water birds.

**Objective 1.3.1.** Manage a minimum of 200 acres of MSU to provide foraging substrate for shorebirds during the spring migration by 2005.

*Basis of the objective.*—Blackwater NWR is too far inland to be an important stop-over site for migrating shorebirds. However, as many as 4,000 individuals and 26 species have been recorded in the freshwater impoundments and adjacent estuarine mudflats during peak spring migration. Several of the *Calidris* “peeps” (primarily semi-palmated and least sandpipers) and the yellowlegs (*Tringa spp.*) migrate through in the spring; dunlin are the most abundant wintering species; and spotted sandpiper, common snipe, and killdeer are the most common breeding shorebirds at Blackwater NWR. The U.S. Shorebird Conservation Plan (2000) and the draft Northern Atlantic Regional Shorebird Plan (2000) rank several of those shorebirds as species of at least moderate concern, due to declining populations at national and regional levels. Both plans recommend more intensive and coordinated manipulation of impoundments on public lands for the benefit of migrating shorebirds. Properly managed, MSU can provide high densities of benthic invertebrates for foraging shorebirds during the spring migration. When spring high tides in the marshes coincide with shorebird migration, the exposed bottoms and relatively shallow water in the MSU can attract large flocks of foraging shorebirds.

*Strategies to achieve the objective.*—Expose 15 percent of pool bottoms weekly beginning on April 15 and continuing through May 31 (6 weeks). Ensure that 50 percent of the bottoms of these pools would be exposed at peak shorebird migration, which generally occurs during the first week in May. Refuge staff would continue ground counts of shorebird populations at weekly intervals during the spring migration and at biweekly intervals during other times of the year. Data would be rolled up into the International Shorebird Survey maintained at the Manomet Center for Conservation Sciences.

*Monitoring element.*—Percentage of pool bottom exposed.

**Objective 1.3.2.** Maintain and enhance 15,000 acres of estuarine emergent marsh for nesting, foraging, and resting shorebirds by 2009.

*Basis of the objective.*—Blackwater NWR has lost nearly 7,000 acres of emergent wetlands since its establishment in 1933. Most of this loss has occurred in the three-square brackish marsh at the confluence of the Little Blackwater and Blackwater Rivers, but is also now progressing up and downstream. The unusually high rate of wetland loss is likely the result of several confounding factors, including sea-level rise, land subsidence, saltwater intrusion, severely modified hydrology, and excessive herbivory. Open water that has displaced the lost wetlands is now used primarily by waterfowl as a disturbance-free rest area during migration and winter, and by resident populations of Canada geese as a safe place to molt during the summer. Its depth precludes use by shorebirds other than phalaropes.

Restoring emergent marsh would enhance the significance of these wetlands to migrating shore, marsh, and water birds. Emergent marsh provides breeding habitat for several species, primarily

spotted sandpiper, willet, and common snipe. At low tides, these habitats provide shallow pools and mudflats for a number of migrants, most commonly greater and lesser yellowlegs, semipalmated sandpipers, least sandpipers, white-rumped sandpipers, dunlins, semipalmated plovers, and killdeer.

*Strategies to achieve the objective.*—Strategies include restoring the marsh to its 1933 coverage level by implementing the current Refuge Complex Fire Management Plan and proposed Habitat Management Plan, minimizing human disturbance of wintering shorebird populations by prohibiting public entry and boating from October 1 through April 1, and evaluating the effect of the current prescribed fire program on nesting shorebirds. It would be necessary to identify large areas of mudflat and shoreline that are exposed at low tide, and to initiate a new boat survey to evaluate the significance of these sites to spring migrants. A study would need to be developed to estimate the breeding densities of shorebirds (and other marsh birds) by floral community type; this could be conducted in conjunction with the ongoing study of prescribed fire effects on marsh flora.

*Monitoring element.*—Acres of estuarine emergent marsh and tidal mudflats; boat survey of spring migrant populations at selected sites; nesting densities in marsh exposed to different fire regimes.

**Objective 1.3.3.** Manage pool 3C (22 acres) to provide roosting habitats for marsh and water birds by 2005.

*Basis of the objective.*—Impoundment systems support several species of marsh and water birds on the refuge. Properly managed, MSU can provide excellent habitats for anurans and fish, important prey items for marsh and water birds. At least 12 anuran species are known to occur in these impoundments during spring and summer (see chapter 3, table 25, “Anuran species at Blackwater NWR”). Fish can become a concentrated food source for egrets and herons during spring drawdown.

*Strategies to achieve the objective.*—We would continue to manage pool 3C for thermal cover and nocturnal roosting.

*Monitoring element.*—Surveys to determine acreage maintained in thermal cover.

**Subgoal 4.** Provide habitats to support a diversity of raptors.

**Objective 1.4.1.** Provide habitat for forest interior dwelling raptors by 2005.

*Basis of the objective.*—Red-shouldered hawks (*Buteo lineatus*), broad-winged hawks (*Buteo platypterus*), and barred owls (*Strix varia*) are raptors that require large forest tracts (>250 acres) and are known to breed on the Maryland coastal plain (Robbins and Blom 1996). The draft “Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area” considers these raptors to be highly area-sensitive species. The Partners in Flight draft “Mid-Atlantic Coastal Plain Bird Conservation Plan” specifically recommends that populations



of these species and of Cooper's hawks be monitored. The forests that the refuge maintains are some of the most extensive and contiguous that remain on the Maryland coastal plain.

*Strategies to achieve the objective.*—We would maintain and enhance large stands of contiguous mature forest by implementing the draft Forest Management Plan; continue strategic land acquisition to reduce the patchiness of existing forest and increase total forest acreage; continue the annual breeding forest bird survey; and, consider designing a tape play-back survey for nocturnal raptors, especially barred owls.

*Monitoring element.*—The number of forested tracts >250 acres.

**Objective 1.4.2.** Provide marsh habitat for raptors by 2005.

*Basis of the objective.*—Blackwater NWR provides almost 7,000 acres of estuarine emergent marsh. Ospreys, northern harriers, and peregrine falcons are dependent on this habitat for at least part of their life needs, and all are considered priority species in the Partners in Flight draft “Mid-Atlantic Coastal Plain Bird Conservation Plan” (1999).

*Strategies to achieve the objective.*—Strategies include minimizing disturbance in the marsh by prohibiting public entry and boating from October 1 through March 31, implementing restoration tasks in the proposed Marsh Management Plan, and continuing strategic land acquisition to mitigate for marsh loss.

*Monitoring element.*—Acreage of marsh.

**Objective 1.4.3.** Provide artificial nest structures and evaluate their importance by 2005.

*Basis of the objective.*—Blackwater NWR has provided artificial nesting structures for a number of bird species of concern, including 10 nest boxes for barn owls (*Tyto alba*) and 30 nest platforms for 30 ospreys. Now that populations of these species recently have recovered, the need for continuing this program is questionable. These artificial structures require annual maintenance, periodic monitoring, and control of exotic species (house sparrows, European starlings) that displace targeted native species.

However, the deployment of artificial nests or nest substrates still may prove beneficial to some species. The hacking towers on Smith, South Marsh, and Spring Islands have fledged many peregrine falcons since their construction. Similarly, artificial nest platforms may increase the productivity of American black ducks nesting in the frequently inundated black needlerush marsh on Martin NWR (M. Haramis, USGS, pers. comm.). Artificial nesting structures also have value as a medium for public education.

*Strategies to achieve the objective.*—The reproductive contribution of the existing osprey platforms to local and regional populations needs to be evaluated. We would need to contrast the annual estimates of platform occupancy and subsequent production with state and regional estimates of osprey populations. We would maintain the existing osprey platforms on the refuge until we have completed that evaluation. Also, a study to evaluate the efficacy of using artificial

structures to enhance black duck nesting on the Refuge Complex would be developed under the proposed American Black Duck Initiative.

*Monitoring element.*—Occupancy rates; fledgling rates; wood duck fall brood survey; completion of the American Black Duck Initiative.

**Subgoal 5.** Accomplish applicable recovery plan objectives and other management activities for Federal-listed species.

**Objective 1.5.1.** Accomplish all recovery tasks that are delegated to the refuge for DFS by 2015.

*Basis of the objective.*—The main thrust of the recovery program for DFS is protecting occupied habitats and re-establishing populations in previously occupied areas. Comprehensive DFS population or habitat surveys on Blackwater NWR have been limited to two benchmark sites. The refuge has significantly more forest habitat that is known to be occupied by DFS.

*Strategies to achieve the objective.*—The first strategy would be to complete a more detailed assessment of potential DFS habitats and conduct, at a minimum, presence or absence surveys to ascertain the percentage of occupied versus potentially occupied habitats. Preferably, more extensive ‘mark recapture’ studies would be conducted in all forested habitats, in order to determine current population status and possible trends. We would accomplish this as part of the Complex-wide Resource Inventory and Monitoring Program.

We would also evaluate these recovery tasks:

1. Describe habitat use and requirements of populations within their current natural ranges;
2. Develop an integrated habitat protection strategy using remote-sensing procedures and geographic information systems;
3. Define and field test applications for the Habitat Suitability Index model; map available habitat;
4. Protect DFS and its habitats;
5. Monitor current and potential threats to the DFS or its habitat;
6. Devise and implement a habitat management scheme;
7. Determine the effects of timber management and other land use practices on DFS;
8. Develop and refine prescriptive habitat management for DFS;

9. Develop and implement guidelines for habitat management on public lands occupied by DFS; and
10. Monitor the outcome of prescriptive habitat management.

**Objective 1.5.2.** Establish, manage, and enhance seven mature forest cores of 400 acres or more for DFS by 2015.

*Basis of the objective.*—The primary basis is to significantly improve the likelihood of down-listing or delisting the species. For the reclassification of the DFS from endangered to threatened, ecological requirements and distribution within the natural range must be fully understood, the seven benchmark populations must be stable or expanding for at least 5 years, and 10 new colonies must be established within the historical range.

The DFS will be considered for delisting when, besides having met the reclassification criteria, the following elements have been achieved.

1. Five post-1990 colonies are established outside the remaining natural range.
2. Periodic monitoring shows that 80 percent of translocated populations have persisted over the full period of recovery, and at least 75 percent of these populations are not declining.
3. Mechanisms that ensure perpetuation of suitable habitat at a level sufficient to allow desired distribution are in place within all counties in which the species occurs.
4. Mechanisms are in place to ensure protection and monitoring of new populations, to allow for expansion, and to provide interpopulation corridors to permit gene flow among populations (USFWS 1993).

By protecting occupied and potentially occupied habitat within the DFS historical range and providing additional distribution data, the refuge would significantly contribute to this effort. Although beliefs vary on the preferred forest cover types, age, and tree species composition, it is widely agreed that DFS appear to persist in larger densities in “mature” forests with a sparse understory. In combination with objective 1.5.3, below, the refuge’s forested lands should accelerate de-listing by assuring the long-term availability of habitats needed to maintain natural populations and to assure the long-term continuance of a stable or expanding population throughout a significant portion of the DFS historic range.

*Strategies to achieve the objective.*—One main thrust of the recovery program for DFS is to protect occupied habitats. Blackwater NWR continues to maintain or enhance habitats that support the largest naturally occurring remnant populations of DFS. Strategies include acquiring land; remote sensing to identify areas of mature forest; establishing mature forest cores, as in Goal 1, Subgoal 2, Objective 1; reforesting PC wetlands and recently cleared timber lands; implementing silvicultural prescriptions; and, integrated pest management. Since the habitat requirements for FIDs are much more restrictive than those of DFS, we are assuming that any

land protection or management strategies to enhance FID populations would also, directly or indirectly, benefit DFS.

*Monitoring element.*—The number of 400-acre mature forest cores established by 2015.

**Objective 1.5.3.** For DFS, maintain an average stand diameter of 15 inches (38.1 cm) DBH, or greater, of upper canopy trees within all core areas, as well as on an additional 10 percent of the remaining forested habitat, by 2020.

*Basis of the objective.*—Forest stands characterized by an average tree diameter of 15 inches, or greater, will exceed the currently accepted theory articulated in the recovery plan (USFWS 1993) and more recent activities by the DFS Recovery Team, on what constitutes “optimal habitat.” Forest stands with an average overstory tree diameter of 15 inches (38.1 cm), or more, will provide adequate cover and reproductive habitats. The optimum tree canopy closure for DFS is from 20 to 60 percent. Optimal understory closure occurs when the shrub-crown closure is 30 percent or less (Allen 1982, and Tesky 1993). Habitat Suitability Index models indicate that sites where DFS were present contained a higher percentage of large [12-inch (>30-cm) DBH] trees (DFS Recovery Plan 1993).

*Strategies to achieve the objective.*—Acquiring tracts of forest land adjacent to existing cores or large enough to become cores would be instrumental in achieving this objective. As additional lands containing large trees are added to cores, portions of the cores which are exhibiting signs of declining health and vigor may be harvested to make room for new vigorous trees, while still maintaining an average DBH of 15 inches (38.1 cm) for upper canopy trees. All harvest and regeneration methods, excluding clearcutting, may be implemented within the core areas at any time, as long as those methods do not result in the creation of gaps in the forest canopy greater than 30 feet (10 m) (Draft Guidance: a Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area, Oct 1999). If removing forest products results in gaps greater than 30 feet (10 m), the acreage on which the harvest occurred would be excised from the core until the canopy had sufficiently closed.

Within established core areas, applying silvicultural prescriptions would be required in order to achieve this objective. These prescriptions would primarily consist of the various types of timber stand improvement techniques and several harvest methods. Timber stand improvements would focus on improving growing conditions for the preferred tree species assemblage (specifically, nut and seed-producing species, such as oaks and pines).

Timber stand improvements include, but are not limited to, release cuttings, mechanical thinning, chemical thinning, crown thinning, low thinning, and improvement cuts. The various harvest methods employed would focus on regenerating the stand while at the same time retaining a significant percentage of large healthy hard and soft mast-producing trees. Growth rates of the remaining trees would ultimately be enhanced by the reduction in stand density and competition. The various harvesting methods to be employed within the cores may consist of single tree and group selection, shelterwood, and strip and patch clearcuts.

Protection of these core areas from insect pests and diseases would be essential for achieving this objective. Poor and declining health is the cause of most insect and disease outbreaks, and can result in large-scale tree mortality, cover-type conversions, invasions of exotic species, or loss of habitats. Continued coordination with USFS will be required to monitor and manage forest pest populations, specifically, gypsy moths. We will implement integrated pest management strategies, as needed.

*Monitoring element.*—Average DBH of upper canopy trees for each core in 2020.

**Objective 1.5.4.** For DFS, improve the quality of an additional 1,500 acres of forested habitats outside the core areas by 2015.

*Basis of the objective.*—An additional 1,500 acres of existing forested habitats, which do not meet the minimum requirements to be included in a core due to juxtaposition or age structure, will be managed more exclusively for DFS and forest health. Management of these areas for FIDs would not be pursued until they become or are included within core lands. Most of these lands are in need of forest management to improve overall forest health, species diversity, age class diversity, and mast production. Proper management will also reduce the susceptibility of these habitats to insect and disease outbreaks.

*Strategies to achieve the objective.*—Where applicable, an extensive list of silvicultural techniques will be utilized to improve the health and quality of these forested habitats. In order to most effectively improve the health and quality of forest habitats, management strategies would consist of performing a wide array of timber stand improvements, regeneration techniques, or harvest methods. Timber stand improvements will consist of all previously described release cuttings, thinning, and also, prescribed fire.

Timber harvesting methods may include clearcutting, seed tree harvests, single tree and group selection, strip and patch clear-cut, shelterwood cuts, salvage cuts, sanitation cuts, and other forest management practices that focus on improving site conditions for natural regeneration or establishing planted trees. These methods may include various types of regeneration harvests, site preparation and the control of undesirable vegetation through the use of prescribed fire, as well as mechanical and chemical methods. Integrated pest management strategies will be employed to monitor and control forest pest populations.

*Monitoring element.*—The overall health of the forest as it relates to tree growth and wildlife benefits. Some post-management variables which may be measured include growth rates and mast production of preferred tree species, understory density, regeneration and presence or absence of disease or insect pest populations.

**Objective 1.5.5.** Establish an additional 2 miles of 50-foot-wide forest corridors to connect disjunct forested patches by 2015.

*Basis of the objective.*—Forested corridors are necessary to aid DFS in traveling from one forest patch to another, and provide safe access to additional breeding and feeding habitat. This

connectivity will reduce forest fragmentation and its associated detriments to wildlife populations on the refuge.

*Strategies to achieve the objective.*—Reforestation of PC wetlands will be the initial strategy implemented to create forest corridors between disjunct forest patches. We will assess all our currently owned and newly acquired PC wetlands to determine their suitability for establishing additional corridors. Reforestation of cut-over areas and abandoned or unnecessary roadbeds would also be targeted. We would continue to strategically acquire land, focusing primarily on land that contributes to combating the fragmentation of refuge forested habitats.

*Monitoring element.*—Miles of additional forest corridors, as compared to the present.

**Objective 1.5.6.** Maintain the 1996–2003 average of nesting and wintering bald eagles on Blackwater NWR by 2005.

*Basis of the objective.*—The Chesapeake Bay population of American bald eagles (*Haliaeetus leucocephalus*) is Federal-listed as threatened. As the most significant nesting area north of Florida on the Atlantic Coast, Blackwater NWR has played a major role in recovering this species. Nesting pairs on the refuge have increased from 3 in 1978 to as many as 14 in 1997, and almost 300 eaglets have been produced in the past 15 years. Nests on Blackwater NWR have been the source for several translocation efforts in New Jersey and elsewhere. Also, Midwinter Bald Eagle Surveys during the past 5 years indicate that at least 150 bald eagles now winter on Blackwater NWR.

*Strategies to achieve the objective.*—Winter roost sites and nest sites would continue to be monitored and protected from human disturbance following the guidelines in the recovery plan (USFWS 1990) and “Bald Eagles in the Chesapeake: A Management Guide for Landowners” (National Wildlife Federation 1985). We would maintain an inviolate sanctuary encompassing 11,270 acres of water and marsh, by prohibiting public entry and boating from October 1 through April 1. Refuge biological staff would continue to support two annual surveys sponsored by the Maryland DNR: the Midwinter Bald Eagle Survey in January; and aerial nest surveys December–March. Staff would continue to conduct periodic roost counts, and investigate the status of suspected new roost sites. Blackwater NWR would also continue to be a translocation source for other states as needed. Management recommendations in the delisting package would be implemented as applicable.

*Monitoring element.*—The numbers of nesting and wintering bald eagles as determined by aerial surveys and the Midwinter Bald Eagle Survey.

**Objective 1.5.7.** Determine the occurrence of the Federal-listed swamp pink, sandplain gerardia, and sensitive joint-vetch on Blackwater NWR by 2006.

*Basis of the objective.*—Swamp pink (*Helonias bullata* L.; G3/S2), Federal-listed as threatened in 1988, is an obligate wetland perennial that occurs along streams and seepage areas in freshwater swamps and other wetland habitats. Swamp pink is known to exist in areas of Dorchester and Wicomico Counties and, possibly, may exist on Blackwater NWR.

The sensitive joint-vetch (*Aeschynomene virginica*; G2/S1) is an annual legume that occurs in fresh to slightly brackish tidal river systems. We need to discover whether sensitive joint-vetch occurs on Blackwater NWR. It was Federal-listed as threatened in 1992, due to its limited distribution. On the Eastern Shore, extant populations of *A. virginica* occur on Manokin Creek in Somerset County, and historic populations (before 1910) have occurred on the Nanticoke River in Wicomico County. Where *A. virginica* has been found in Maryland, it has been associated with *Echinochloa sp.*, *Spartina cynosuroides*, *Polygonum sp.*, *Juncus sp.*, and *Hibiscus moscheutos*, although the substrates have been sparsely vegetated; “e.g., muskrat “eat-outs” (USFWS 1995). These habitat conditions certainly exist on riparian areas of Blackwater NWR.

The sandplain gerardia (*Agalinis acuta*) was listed as endangered in 1991. In Maryland, one population on protected state lands occurs on the western shore. The Nature Conservancy identifies this species as potentially occurring in the focus areas (Nanticoke River Bioreserve Strategic Plan, 1998), but no comprehensive surveys for this species have been conducted.

*Strategies to achieve the objective.*—As part of the Complex-wide Resource Inventory and Monitoring Program, we would aggressively search for Federal- and State-listed flora, particularly swamp pink and sensitive joint-vetch, within the boundaries of Blackwater NWR. We would contract experts from the State Heritage Program or from universities to conduct botanical surveys. The conservation and management of any listed species that are identified would follow applicable tasks identified in USFWS recovery plans (USFWS 1991, 1995), and would be closely coordinated with the State Heritage Program.

*Monitoring element.*—Completion of the baseline inventory or botanical surveys.

**Subgoal 6.** Restore, protect and enhance habitats for anadromous and interjurisdictional fish species.

**Objective 1.6.1.** Inventory anadromous and estuarine or inland interjurisdictional fisheries on the Blackwater River and tributaries by 2006.

*Basis of the objective.*—The Blackwater River watershed historically provided nursery and spawning habitat for striped bass (*Morone saxatilis*), white perch (*Morone americana*), river herring (*Alosa pseudoharengus*, *A. aestivalis*), American eel (*Anguilla rostrata*), hickory shad (*Alosa mediocris*), American shad (*Alosa sapidissima*), and gizzard shad (*Corosoma cepedianum*). Other species of concern likely to occur in the Blackwater River watershed include mud sunfish (*Acantharchus pomotis*; G5/S2) and black-banded sunfish (*Enneacanthus chaetodon*; G4/S1). Turbid waters, due to marsh loss and frequent saltwater intrusion in recent years, have greatly reduced the quality of aquatic habitats. A fishery resource inventory is required to determine current status and abundance of species.

*Strategies to achieve the objective.*—We would conduct an initial survey to determine the occurrence and relative abundance of these species in the Little Blackwater and Blackwater Rivers. This survey would be conducted in cooperation with USFWS Fisheries Resource Office and other partners. The focus would be anadromous species, coastal migratory fishes identified in the Atlantic Coastal Fisheries Cooperative Management Act of 1993, and those species for which

the Fisheries Management Workgroup of the Chesapeake Bay Program has developed fishery conservation plans. Based on the outcome of this inventory, monitoring of selected populations may be warranted.

*Monitoring element.*—Completion of survey.

**Objective 1.6.2.** Restore natural hydrology of the Upper Blackwater to pre-1980 conditions by 2005.

*Basis of the objective.*—The Blackwater River historically was more typical of tidal rivers on the Eastern Shore, with cattail (*Typha sp.*) marshes in the upper watershed changing to *Spartina alterniflora*-dominated saltmarsh at the mouth. Salinity levels varied from 0 ppt at the headwaters to 20 ppt near the mouth at Fishing Bay. However, in recent years, salinity in the upper reaches of the Blackwater River has exceeded 20 ppt, due to saltwater intrusion from Stewart's Canal. Loggers built this canal in the 1840s to allow barge access from Slaughter Creek to forests on Parson's Creek Neck and Piney Swamp. In the past two decades, salt water has more frequently breached the marsh that separates Stewart's Canal and Goose Dam from Moneystump Swamp at the headwaters of the Blackwater River. Increasing salinity and subsequent wetland loss have severely degraded freshwater fisheries and the value of the Blackwater River as spawning habitat for anadromous species.

*Strategies to achieve the objective.*—A marsh management plan would be developed to restore the freshwater system to the upper reaches of the Blackwater River. Strategies would include using clean dredged material to restore marsh between Blackwater River and Parsons Creek, the construction of a flap gate on the Slaughter Creek drainage, continued control of nutria, and other tasks identified in subgoal 1, objective 2. We may consider restocking the freshwater and anadromous fisheries, pending the outcome of post-restoration fisheries surveys. Similarly, it may be necessary to replant or reseed freshwater wetland plants after natural hydrology has been restored.

*Monitoring element.*—Survey fisheries (see objective 1) and salinity or water quality (see objective 3) before and after restoration.

**Objective 1.6.3.** Establish a long-term program to monitor salinity and other water quality parameters at selected sites in the Blackwater and Little Blackwater Rivers by 2005.

*Basis of the objective.*—Since 1996, the refuge routinely has monitored salinity and other parameters to document the water quality degradation that may be contributing to marsh loss on Blackwater NWR. The current protocol involves discrete sampling of salinity, temperature, pH, dissolved oxygen, and hydrogen sulfide at ten sites on the Blackwater and Little Blackwater Rivers every 2 weeks. However, because many factors such as tidal variation and storm events confound the interpretation of these data, this monitoring regime poorly describes long-term trends and fails to accurately quantify the magnitude and extent of saltwater intrusion.

Also, it is critical that the refuge have a reasonable data base from which to assess the effects of implementing restoration tasks identified for marsh management. A more rigorous monitoring



program is needed that would not only provide more meaningful background levels of water quality parameters, but also allow continuous sampling to capture extreme saltwater intrusion events.

*Strategies to achieve the objective.*—Real-time monitoring equipment, capable of sampling diel variation in salinity and other water quality parameters (salinity, temperature, pH, DO, H<sub>2</sub>S, conductivity, light penetration and turbidity), would be deployed at four permanent water quality sites: on Blackwater River below Stewart's Canal or Goose Dam; at the confluence of the Little Blackwater and Blackwater Rivers; at the mouth of the Blackwater River near Fishing Bay; and on the Little Blackwater River adjacent to the boathouse. Monitoring of these sites would provide adequate background data from which to assess changes in salinity (and other parameters) after implementing restoration tasks identified in the Marsh Management Plan. Additionally, a permanent tide gauge on the Little Blackwater River adjacent to the Blackwater Field Station would be established.

*Monitoring element.*—The number of monitoring stations established..

Objective 1.6.4. By 2009, initiate water and sediment quality and contaminant assessments on the Nanticoke River and its tributaries.

*Basis of the objective.* According to the Maryland Department of Natural Resources, nitrogen levels in the Nanticoke River are among the worst of all tidal tributaries in Maryland. A recent report by the State of Delaware adds that the most significant water quality problems in the Nanticoke River include bacterial contamination and eutrophic conditions (e.g., nutrient over-enrichment). The possible sources of this nitrogen are many: both natural and human-generated. Septic systems, agricultural crops, lightning, livestock or poultry operations, and decaying plant materials have all been documented as releasing or contributing factors to eutrophication. The future health of the Nanticoke watershed and its wildlife is largely related to the amount of nutrients entering the ground and surface water.

*Strategies to achieve the objective.*—We would establish a series of permanent real-time water quality stations throughout the division. We would periodically monitor benthos, physical, and chemical parameters at fixed stations in the river and its tributaries. We would collect data to document and assess nutrient loading and other potential adverse impacts from land use changes and practices. To the extent possible, we would use water quality data and monitoring results from other agencies. If warranted, we would collect samples for pesticide or herbicide analyses, and periodically monitor selected sites for trace element concentrations in water sediment or biological tissues.

The Service would collect additional data on bacteria contamination. If nutrients continue to be of concern, we would pursue source identification and work with appropriate entities to identify measures to reduce concerns with nutrient or bacteria transport into or through division habitats. The Service would monitor contaminant concentrations in sediment and biological tissues to evaluate contaminant risk in wetland and aquatic systems and associated fish, wildlife and plants. Measures to reduce or manage risks would be developed if warranted.

Refuge staff would cooperate to the extent possible in the broader Chesapeake Bay Program initiatives addressing water quality issues, including participation in the Lower Shore Tributary Strategy Team. Equipment would be acquired and partnerships would be established with other agencies to more effectively assess water quality impacts to species and their habitats.

*Monitoring element.*—Establishment of water quality stations, water quality monitoring protocols, and development of hydrological models, if appropriate; extent of mapping and assessments of hydrological modifications; analysis of solids, ions, nutrients, trace elements, and bacteria.

**Objective 1.6.5.** Implement recommendations of Little Blackwater River contaminants monitoring study by 2008.

*Basis of the objective.*—Animal feed operations (AFOs), particularly poultry farms, and the application of their wastes as fertilizer are known to contribute excessive nutrients, trace metals, and estrogenic compounds to surface and ground waters of the Blackwater watershed. Although fewer than a dozen commercial poultry operations and only one large hog farm exist within the Little Blackwater River, Buttons Creek, and Transquaking River watersheds, the amount of manure produced from these livestock is staggering: 1,000 chickens produce one ton of manure. Excessive nutrient loading from leachate and runoff from fields on which the manure is applied can contribute significantly to algal blooms, decreased water clarity, anoxia, and reduced SAV.

Eutrophication from AFO activities has also been linked to outbreaks of *Pfiesteria piscicida*, a dinoflagellate which has caused fish kills on the nearby Chicomicomico River. Our Chesapeake Bay Field Office is now studying the contribution of commercial poultry and swine operations to phosphate, nitrate, trace metal, and estrogenic compound levels in the Little Blackwater River. Their final report will address the need for long-term contaminants monitoring and specific management recommendations.

*Strategies to achieve the objective.*—We would need to pursue implementing the recommendations at the conclusion of this study through the RONS and other sources of funding.

*Monitoring element.*—Contingent on study recommendations.

**Goal 2.** Maintain a healthy and diverse ecosystem with a full range of natural processes, natural community types, and the full spectrum of native plants and animals to pass on to future generations of Americans.

**Subgoal 1.** Control, eradicate, or manage injurious, invasive, and exotic species

**Objective 2.1.1.** Eradicate nutria populations on Blackwater NWR by 2015.

*Basis of the objective.*—Executive Order No.13112 (Feb. 1999) directs all Federal agencies to prevent and control introductions of invasive species in a cost-effective and environmentally sound manner. Blackwater NWR has lost more than 7,000 acres of estuarine marshes since the

1940s. Several factors compound that loss, including sea-level rise, land subsidence, saltwater intrusion, modified hydrology, and excessive herbivory by the introduced nutria (*Myocastor coypus*).

Nutria, indigenous to southern South America, were introduced in Maryland in 1943. High population densities (over 50,000), high reproductive rates, and unique behavioral attributes make herbivory by this rodent species problematic. A 3-year study (Mike Haramis, USGS–BRD Patuxent Wildlife Research Center) of 342 fixed vegetative plots within 57 quarter-acre experimental units clearly demonstrates that nutria “eat-outs” into the root mat are degrading the marsh’s ability to maintain itself.

*Strategies to achieve the objective.*—In January 2003, we implemented the National Strategy and Standard Operating Procedures for Managing Invasive Species as contained in part 1, dated August 31, 2001. In 1997, 23 organizations formed the Nutria Partnership to deal with this problem. Partners include Blackwater NWR, Chesapeake Bay Field Office (USFWS), Patuxent Wildlife Research Center (USGS–BRD), MD Cooperative Fish and Wildlife Research Unit (USGS–BRD), MD Department of Natural Resources, MD Department of the Environment, UM–ES, UM–College Park, Tudor Farms, Ducks Unlimited, National Fish and Wildlife Foundation, Friends of Blackwater, the American Aquarium and Zoological Association, the MD Fur Trappers Association, the MD and DE Chapter of the Wildlife Society, and the Salisbury Zoo.

In FY 2000, the partnership implemented the “Marsh Restoration: Nutria Control Plan” in Maryland. That was a 3-year pilot project to develop control techniques, study population demographic and reproductive response, and develop marsh restoration techniques. The eradication program began in 2002, and will continue until eradication has been achieved. We would also continue the nutria trapper rebate program at Blackwater NWR; this program has removed almost 58,000 nutria from the refuge in the past 15 years.

*Monitoring element.*—Surveys to determine the success of the eradication program.

**Objective 2.1.2.** Reduce the resident Canada goose population to its 1989 level by 2006.

*Basis of the objective.*—The resident Canada goose population on Blackwater NWR increased from an estimated 350 in 1989 to more than 5,000 in 2000. During that same interval, the resident Canada goose population in Maryland increased from 25,000 to 90,000. The direct and indirect results of this population explosion are adversely affecting the primary purpose for which the refuge was established.

Exclosures constructed by refuge staff in the spring of 1999 clearly demonstrated that resident geese were seriously impacting the natural marsh vegetation at Blackwater NWR. Studies conducted by Haramis and Kearns in the Patuxent Marshes, Maryland; May and Kangas in Kenilworth Marsh, Washington, D.C., and Nichols on the Maurice River, New Jersey substantiated similar destruction of natural marsh vegetation by resident Canada geese. A study at Bombay Hook NWR also demonstrated that resident geese are significantly affecting natural vegetation in moist soil impoundments. These findings are consistent with observations at

Blackwater NWR, which not only suggest that resident geese are impacting moist soil vegetation, but that they are causing significant damage to natural marshes and agricultural crops planted to provide forage for migrating and wintering waterfowl. Increasing damage has been documented by refuge staff during the past 10 years throughout the refuge.

Also, resident Canada geese concentrate around the remaining water in impoundments during summer drawdowns. The resulting concentrations of fecal droppings in these stagnant pools, when the temperatures are high, create excellent mediums for degraded water quality, and increase the potential for fecal-borne human and avian diseases. The National Wildlife Health Research Center (NWHRC) found that 16 percent of 37 resident geese sampled in 1998 and 32 percent of 90 resident geese sampled in 2000 from Blackwater NWR were DVE-positive (duck virus enteritis, or duck plague). There is also increased concern regarding the transmission of diseases, such as cryptosporidiosis, giardiasis, chlamydiosis, and West Nile virus. Because of these potential problems, Region 5 funded investigations by NWHRC and the New Jersey Division of Fish, Game, and Wildlife in 1999 to evaluate threats to human health posed by resident Canada geese in Rhode Island, New Jersey, and Virginia.

*Strategies to achieve the objective.*—The primary strategy would be to implement the approved Integrated Wildlife Damage Management Plan for reducing current refuge population levels and mitigating the impacts of resident geese. (Contact headquarters for a copy of the EA.) That plan includes using nonlethal scare techniques, such as pyrotechnics, propane cannons, eagle effigies, reflective tape, balloons, and flags; and using perimeter fencing to exclude geese from certain areas. Lethal components of the plan include nest and egg destruction, live capture with humane euthanasia by certified processors, and selectively killing individuals to reinforce nonlethal methods.

Another possible strategy is a late spring hunt after migrant populations have moved through the area. Conservation measures similar to those for late season snow goose hunting would have to be authorized by the USFWS and the Atlantic Flyway Council before spring hunting is allowed. The Migratory Bird Treaty Act does not permit hunting Canada geese after 15 March.

*Monitoring element.*—Summer ground surveys for waterfowl.

**Objective 2.1.3.** Eradicate the mute swan population on Blackwater NWR by 2010.

*Basis of the objective.*—Mute swans (*Cygnus olor*) are exotic birds that escaped into the Chesapeake Bay in 1962, and now number approximately 4,000. Mute swans destroy SAV beds and disrupt nesting colonial waterbirds. The island refuges harbor most of the mute swans on the Refuge Complex, but Blackwater NWR also sustains a few pairs. Maryland DNR began controlling mute swan populations in 1993, and requested refuge assistance in 1995.

The State initially authorized Blackwater NWR to take both eggs and swans. However, due to legal action and public outcry, all permits have been canceled. The Service and the State are developing legislation to allow swan control. Most waterfowl and wetland biologists in the Chesapeake Bay region advocate a return to a more aggressive method for controlling mute swan populations. This is consistent with a directive by the USFWS Directorate to all Regional

Directors to support the recommendations of the Atlantic Flyway Council regarding mute swans (see below).

*Strategies to achieve the objective.*—In 2001, Blackwater NWR staff participated on an interagency Mute Swan Task Force to develop a management policy for the State of Maryland. The Service will continue to work with the State and USDA to develop legislation and permitting authority to authorize (sic) the refuge to take both eggs and swans to achieve the eradication goal. The refuge may or may not comply with recommendations made by the task force. Also, the refuge may or may not comply with the recommendations of the Atlantic Flyway Council, which endorses the following actions.

1. State wildlife agencies, if they do not already have the authority, should seek to gain authority over the sale and possession of mute swans and their eggs.
2. The sale of mute swan adults, young or their eggs should be prohibited.
3. States should seek to eliminate all importing and exporting of mute swans without a special purpose permit issued by the state wildlife agency.
4. Mute swans captured due to nuisance complaints, sickness, or injury should be removed from the wild or be euthanized.
5. Egg addling programs where feasible should be encouraged.
6. Both state and Federal wildlife agencies should institute programs to prevent the establishment of, or eliminate, mute swans.
7. States should seek to make the mute swan an unprotected species if this is not already the case.
8. States should strive to manage mute swan populations at levels that would have minimal impacts on native wildlife species or habitats.

*Monitoring element.*—Survey in summer to determine the success of the eradication program.

**Objective 2.1.4.** Control gypsy moth populations on Blackwater NWR by 2006.

*Basis of the objective.*—Control of gypsy moth populations is required to protect mixed hardwood and hardwood forests, which are essential for supporting endangered DFS, FIDS, and other wildlife. Epidemic gypsy moth populations have plagued Blackwater NWR since 1993, primarily due to the large number of host tree species, the lack of forest management, and declining forest health conditions. Acquiring lands that are already infested with gypsy moths or other forest pests adds to the problem. Many times, lands that are added to the refuge need immediate treatment to prevent the total loss of wildlife habitat. We may need to implement more detailed property assessments, in order to detect insect and disease infestations. Any such findings should reduce the price we pay for those lands.

*Strategies to achieve the objective.*—Since 1993, Blackwater NWR has participated in, and benefitted from, the USFS Forest Pest Management Program. This program alone is responsible for protecting thousands of acres of prime DFS habitat. Although the program provides funding and expertise to assist the refuge in controlling our gypsy moths, it may someday disappear. In that event, we would become responsible for providing funding to ensure the protection of these vital habitats from the many potential insect and disease outbreaks. The refuge will continue to coordinate with the USFS to monitor gypsy moth populations and provide recommendations for control. At a minimum, USFS will continue to conduct annual gypsy moth egg mass surveys to determine population densities, recommend control treatments, assist with the acquisition of forest pest management funding, conduct post treatment aerial defoliation surveys and prepare annual reports.

Refuge personnel will continue to provide USFS personnel with up-to-date GIS data to inform them of new land acquisitions and the location of additional forest lands to be surveyed. Refuge forestry personnel will assist with annual egg mass surveys, the preparation of funding proposals and pesticide use proposals, and the administration of control treatments. The current preferred methods for controlling gypsy moth populations will continue to be aerial application of Bt (*Bacillus thuringiensis*) or Gypcheck, which are both viable biological insecticides. The susceptibility of forested habitats to gypsy moth and other forest pest infestations will be minimized by improving the overall health of forests on the refuge as outlined in previous objectives.

*Monitoring element.*—Gypsy moth population status as determined by USFS annual surveys and monitoring. Intensified monitoring to assess the effects of management on stands' susceptibility to gypsy moth infestations, and to assess the threats to non-target species.

**Objective 2.1.5.** Eradicate Phragmites in the MSU, and reduce Phragmites below 2000 levels elsewhere.

*Basis of the objective.*—Over the past several decades, populations of common reed (*Phragmites australis*) along the Atlantic Coast have dramatically increased in both freshwater and brackish wetlands. At present, convincing and decisive evidence for the status of *P. australis* as native, introduced, or both, is not available (Blossey and McCauley 2000). Phragmites seeds profusely, and spreads vegetatively, by a vigorous system of rhizomes and stolons. Its monotypic stands have replaced diverse wetland plant communities with, and have changed basic ecosystem processes.

Dense Phragmites stands decrease native biodiversity and impact the quality of wetland habitat, particularly for waterfowl. Phragmites, however, may serve to abate wave-induced shoreline erosion. Refuge staff have conducted limited (<60 acres annually) aerial- and hand-spraying with the aquatic formulation of glyphosate along the edges of impoundments and the forest-marsh ecotone, but funding in the past has been inadequate to control Phragmites over more extensive reaches of the marsh.

*Strategies to achieve the objective.*—Phragmites control measures would include the use of herbicides, mowing, discing, dredging, and burning. Biological control agents specific for

Phragmites are being investigated at Cornell University, and would be used if feasible. The most widespread and successful approach on refuges is the application of glyphosate late in the growing season, followed by prescribed burning or mechanical removal of dead stalks. One reason for the reliance of chemical control is that habitat management methods such as burning, cutting, mowing, and disking actually encourage the spread of Phragmites.

Holding water within managed impoundments for sufficient durations to kill Phragmites is not a viable option because these systems require annual drawdowns to encourage the growth of moist soil plants. Drawdowns in the absence of chemical control can also increase the spread of Phragmites. Specific strategies to control Phragmites would be developed as part of the proposed Marsh Management Program. Classified hyperspectral imagery data (collected in summer 2000) would be used to estimate the current coverage of Phragmites.

*Monitoring elements.*—The number of acres of Phragmites treated. Evaluate treated areas to determine the degree of control, the response of natural vegetation, and how the treatments affect the use of the treated areas by wildlife.

**Objective 2.1.6.** Control purple loosestrife, johnsongrass, and Canadian thistle wherever they appear on Blackwater NWR by 2006.

*Basis of the objective.*—Purple loosestrife (*Lythrum salicaria*), an exotic plant that was first observed on Blackwater in 1996, is a wetland invader that competes with beneficial native plants. Control on the refuge has involved digging up the plants and spot applications of glyphosate (Roundup®).

Johnsongrass (*Sorghum halepense*) is listed as a noxious weed by the State of Maryland. This species, a product of introgression with *S. bicolor*, forms weedy hybrids with cultivated sorghum and is poisonous to mammals. Refuge staff have spot-treated Johnsongrass with glyphosate in refuge fields as required by Maryland law.

The State of Maryland lists Canadian thistle (*Cirsium arvense*) as a noxious weed. This species is poisonous to mammals. Refuge staff have spot-treated Canadian thistle with glyphosate (Roundup®), as required by Maryland law.

*Strategies to achieve the objective.*—These three injurious species are associated primarily with the moist soil management units and croplands. All three can be successfully controlled with the spot application of glyphosate. However, constant vigilance is required on the part of refuge staff to maintain the advantage of early detection. It may be necessary to consider the use of biological control agents developed by the Plant Protection Section (Maryland Department of Agriculture). Of the three species, agents have been identified only for Canadian thistle; these include several insects (*Cassida rubiginosa*, *Ceutorhynchus litura*, *Cleonis piger*, *Rhinocyllus conicus*, *Urophora cardui*, *Larinus planus*), and two diseases (*Puccinia punctiformis*, *Pseudomonas syringae* pv. *tagetis*). The refuge would continue the current policy, established in 1989, of no insecticides in its farming program.

*Monitoring element.*—The occurrence of individual plants.

**Subgoal 2.** Protect, enhance, and restore natural diversity of communities, sensitive species, and associated ecosystem processes in the Blackwater and Nanticoke watersheds.

**Objective 2.2.1.** By 2010, develop specific inventory, assessment, and management programs for rare, sensitive, and declining species; species of special concern; and rare and unique community types.

*Basis of the objective.*—In the Nanticoke watershed, the Maryland and Delaware Natural Heritage Programs have documented more than 200 plant species and almost 70 animal species categorized as biologically significant: e.g., TNC designations G1 through G5, and S1 through S3. For a complete list, see appendix E, “Rare Species in the Nanticoke River Watershed.” The Nature Conservancy has identified high quality examples of several globally and nationally unique types of communities, including Xeric Dunes, Atlantic White Cedar Swamps, Coastal Plain Ponds, (e.g., Carolina Bays or Delmarva Bays), Rich Woods, Coastal Plain Bogs, and Wet Meadows.

The Maryland program has designated two Maryland Natural Heritage Area sites within Blackwater NWR: the Upper Blackwater River and Gum Swamp. Numerous rare, threatened or endangered plants or animals occur within the Blackwater River watershed. In addition to migratory birds, Blackwater NWR has a clear mandate to protect, manage, and restore habitats that support listed species.

*Strategies to achieve the objective.*—The most important need is development and implementation of the Resource Inventory and Monitoring Program, to help determine the occurrence and distribution of floral and fauna on the Refuge Complex. We would arrange contracts with experts at the Heritage Program, USGS–BRD, or universities, for surveys of listed species and species that are uniquely difficult to detect. We would implement the appropriate tasks identified in existing recovery plans for Federal- and State-listed species. The development of the Habitat Management Plan will provide opportunities to evaluate the effects of management practices (e.g., TSI, prescribed fire) on species of concern.

*Monitoring element.*—Species occurrence. The acres of habitat under Service protection and management; the approved Habitat Management Plan; the mapping and assessment of hydrological modifications within the watershed; and, the number of surveys, censuses, and inventories funded, underway, or completed.

**Objective 2.2.2.** Provide and manage habitats for State-listed resident and migrating butterflies by 2008.

*Basis of the objective.*—At least four State-listed lepidopteran species likely occur on Blackwater NWR; they are known to occur on the Delmarva peninsula, and their host plants grow on the refuge. Larvae of two endangered species, the frosted elfin (*Incisalia irus*; G3/G4/S1) and regal fritillary (*Speyeria idalia*; G3/S1) feed on wild indigo (*Baptisia tinctoria*) and violets (*Viola spp.*), respectively. Larvae of two threatened species, the rare skipper (*Problema bulenta*; G2/G3/S1) and king's hairstreak (*Satyrium kingi*; G3/G4/S1) feed on *Spartina cynosuroides* and



horse-sugar (*Symplocos tinctoria*), respectively. The need to document the occurrence of lepidopterans on the refuge should be apparent.

*Strategies to achieve the objective.*—We would document the occurrence and distribution of lepidopterans as part of the Refuge Complex Resource Inventory and Monitoring Program, or, alternatively, contract it as a discrete survey to a university or the Heritage Program. Both the draft Forest Management Plan and the proposed Marsh Management Plan would consider strategies to improve the distribution and abundance of host species used by State-listed species.

We would need to evaluate the crops we now grow for use by waterfowl as host species for lepidopteran larval and adult forms. For example, clover (*Trifolium spp.*), which is a protein source for migrating geese, hosts alfalfa butterflies (*Colias eurytheme*). Black willow (*Salix nigra*), which provides thermal cover for wintering dabbling ducks, hosts mourning cloaks (*Nymphalis antiopa*). Similarly, hackberry (*Celtis occidentalis*), which may be planted on dredge spoil to create roost sites for colonial waterbirds, hosts hackberry butterflies (*Asterocampa celtis*). Clearly, opportunities exist to modify existing management activities to more fully benefit nontarget lepidopterans. Successfully implementing the resident Canada goose control program would minimize grazing on clover, and allow this host plant to flower. Establishing a demonstration butterfly garden at the Visitor Center would not only serve an educational purpose, but also permit incidental observations of visiting butterfly species to be used to supplement inventory data.

*Monitoring element.*—Inventory program, contracted survey.

**Objective 2.2.3.** Maintain and restore hydrology and water quality as appropriate by 2008.

*Basis of the objective.*—Blackwater NWR maintains one of the most extensive and intact estuarine systems remaining on the Eastern Shore. However, many are concerned about the loss of 7,000 acres of emergent wetlands since 1933, the effects of sea-level rise and salt water intrusion on palustrine forested wetlands, nutrient runoff from wastes produced by animal feed operations, and the degradation of water quality and freshwater or anadromous fisheries on the upper reaches of the Blackwater River due to saltwater intrusion from Stewart's Canal. These are significant environmental quality issues that negatively affect ecosystem processes and associated biota.

*Strategies to achieve the objective.*—We would develop and implement restoration tasks to be identified in the Habitat Management Plan. Implement management recommendations stemming from the ongoing CBFO study to evaluate the contribution of commercial poultry and swine operations to phosphate, nitrate, trace metal, and estrogenic compound levels in the Little Blackwater River.

*Monitoring element.*—Measurement of salinity and other water quality parameters.

**Objective 2.2.4.** By 2006, develop a Habitat Management Plan to address the issues of marsh loss and marsh management.

*Basis of the objective.*—The need to develop a Habitat Management Plan (HMP) is critical, because of the significant loss of marsh, the emphasis on marsh restoration, the need to preserve community diversity, the increasing numbers of invasive and exotic species, the large number of threatened and endangered species, and the contribution of the refuge estuarine wetlands to the Bay ecosystem. Blackwater NWR sustains the northernmost expanse of three-square bulrush. Blackwater NWR also continues to maintain tremendous wetland diversity; more than 30 percent of its land is within two Maryland Natural Heritage Area sites, the Upper Blackwater and Gum Swamp. Federal-listed sensitive joint-vetch (*Aeschynomene virginica*; G2/S1) and State-listed rare skippers (*Problema bulenta*; G2/G3/S1) almost certainly occur within the estuarine marshes of Blackwater. To protect, restore, and enhance this diversity, a comprehensive Habitat Management Plan must be developed.

*Strategies to achieve the objective.*—Restoration strategies may include plugging Stewart's Canal to reduce saltwater intrusion, modifying Shorter's Wharf Road to allow sheet flow, implementing recommendations from the Nutria Pilot Study to reduce nutria herbivory, implementing the “Integrated Wildlife Damage Management Plan” for resident Canada geese, maintaining the muskrat trapping and nutria rebate program, riprapping the pine islands, reducing sediment load run-off into the upper watersheds, and thin-layer placement of dredged material. Strategies for maintaining and improving floral composition may include the use of prescribed fire to affect regrowth vigor and species composition, the use of pesticides to control invasive flora (in particular, purple loosestrife and Phragmites), and replanting in conjunction with techniques such as thin-layer dredged material placement. The development of the Habitat Management Plan must be superseded by implementation of the Complex-wide Resource Inventory and Monitoring Program, and by vegetation classification of hyperspectral imagery to the community level.

The proposed Habitat Management Plan also must include a significant monitoring component due to the dynamic history of the marsh and the planned restoration strategies. LIDAR technology could be used to create fine-resolution Digital Elevation Models (DEMs); this would be the basis for an accurate elevation base map of the refuge, critical for making predictions and assessments of various restoration strategies. Relative Elevation Modeling (REM) would allow the refuge to predict the ability of wetlands to build vertically at a pace equal to sea-level rise. Landscape modeling of habitat change would link the refuge GIS data and wetland ecosystem process models; this would help to predict the impacts of restoration efforts at specific places on the refuge and to target critical areas for intensive management. The current rates of wetland elevation change and sedimentation need to be monitored; this is essential if the refuge is to understand current accretionary dynamics and the impact of different management practices.

*Monitoring element.*—Completion of a baseline flora inventory, classification of hyperspectral imagery, and approval of the Habitat Management Plan. Although not a prerequisite for completion of a Habitat Management Plan, the funding and completion of a DEM and REM for the Refuge Complex would contribute significantly to the technical merit and prioritization of restoration strategies outlined in the Habitat Management Plan.

**Objective 2.2.5.** By 2015, protect, restore, and conserve riparian habitat as lands are protected.

*Basis of the objective.*—The functions of riparian areas include water quality improvement, aquatic habitat, stream shading, flood attenuation, shoreline stabilization, and groundwater exchange. Loss of these systems allows for a more direct contribution of non-point source pollutants to receiving waters. The pollutant removal functions associated with wetlands and riparian area vegetation and soils combine the physical process of filtering and the biological processes of nutrient uptake and denitrification (Lowrance, et al., 1983; Peterjohn and Correll, 1984).

Riparian forests, for example, have been found to contribute to the quality of aquatic habitat by providing cover, bank stability, and a source of organic carbon for microbial processes such as denitrification (James, et al., 1990; Pinay and Decamps, 1988). Riparian forests have also been found to be effective at reducing instream pollution during flood flows (Karr and Gorman, 1975; Kleiss, et al., 1989). As importantly, restoration of the riparian areas would minimize disturbances to wildlife and provide additional breeding, feeding and sheltering areas.

*Strategies to achieve the objective.*—We would seek all opportunities to restore, conserve, manage, and protect riparian systems through a combination of land acquisition, forging partnerships, using existing resource management and related plans, and a significant inventorying or monitoring effort to initially assess status and trends.

Management strategies in this alternative would involve restoration, manipulation to achieve desired future conditions, or protecting existing habitat functions and values. Invasive species management, primarily *Phragmites australis*, would be incorporated.

*Monitoring element.*—Amount (acres) and quality (composition, structure) of available habitat and wildlife responses; number of miles of riparian habitat acquired or restored; implementation of the division Resource Inventory and Monitoring Plan; acquisition and maintenance of current remote sensing and GIS layers; approval of Forest Management Plan.

**Objective 2.2.6.** By 2020, protect, enhance and restore current and historical Coastal Plain Atlantic-white cedar swamps along the Nanticoke River.

*Basis of the objective.*—Atlantic white cedar has been classified as globally rare or threatened throughout its historic range and given a G-3 ranking by The Nature Conservancy. Therefore restoration and management of this vegetative alliance are high priorities within the Fish and Wildlife Service and other Federal land management agencies.

*Strategies to achieve the objective.*—Determine the historical distribution of Atlantic-white cedar within the Nanticoke River watershed with particular emphasis on distribution on division lands. Assess alterations in land use patterns to determine effects if any on the current distribution of Atlantic-white cedar. Assess alterations in hydrology which may have impacted site conditions and soil properties to the point which they no longer support this vegetation community. Join forces with the Atlantic white cedar Alliance, TNC, other Federal, state and local agencies, academia and NGOs to develop and implement restoration and management strategies. Specific

restoration and management strategies may include but are not limited to restoring the hydrology on a site by site basis to mimic natural conditions, harvesting hardwoods and pines from lands which were historically dominated by cedar and regenerating these sites through planting or natural seed sources where mature cedars are present and controlling competing vegetation in regenerating cedar stands.

*Monitoring element.*—A detailed GIS that displays the historical and present-day distribution of Atlantic white cedar within the Nanticoke River watershed. A data set that includes information on the current status of existing cedar stands and incorporates restoration needs into the Forest Management Plan for the Nanticoke protection area.

### **Goal 3.** Create the most complete network of protected lands within the Chesapeake Bay watershed.

#### **Subgoal 1.** Strategic growth and protection of Blackwater NWR

**Objective 3.1.1.** By 2020, protect an additional 31,314 acres described in our approved LPPs.

*Basis of the objective.*—Protecting that land would contribute to the resource conservation goals of a variety of international, national, and regional initiatives, including RAMSAR, IBA, NAWMP, and the National Wetlands Priority Conservation Plan. Protection supports objectives of the Management Plan for Canada Geese in MD, the Chesapeake Bay Waterfowl Policy and Management Plan, and workgroup recommendations by the Chesapeake Bay Program Living Resources Subcommittee. The protection and improvement of habitats in this area are seen to be critical steps in the North American Waterfowl Management Plan, which specifically recommends protection of 53,500 acres and the improvement of an additional 5,000 acres in the Blackwater–Nanticoke protection area by the year 2000.

The Nanticoke River is listed in the Emergency Wetlands Resource Act Regional Concept Plan, and is a landscape project supported by The Chesapeake Bay Estuary Program. The Nature Conservancy has recognized the lands within our Nanticoke protection LPPs as a bioreserve and a Last Great Place; the State has designated the Nanticoke River as a Wild and Scenic River. The Nature Conservancy has developed the “Nanticoke River Bioreserve Strategic Plan” (1998) which outlines the biological significance of the watershed and its threats. More than 23 Natural Heritage sites lie within the project, which also contains the largest contiguous forest remaining on the Delmarva Peninsula.

*Strategies to achieve the objective.*—We would seek opportunities to conserve, manage, and protect lands through a combination of land acquisition; easements; forging partnerships with State agencies, land trusts, and other landowners; and, developing agreements with other entities holding title or other rights or interests in land in targeted areas of the watershed. The use of hyperspectral imagery to remotely identify significant habitats and the use of LIDAR to evaluate the potential effects of sea-level rise may help greatly in prioritizing our land protection. The use of GIS to delineate the effective areas of existing and proposed forest cores would also help in

strategic protection. We will develop an MOU with National Park Trust to facilitate and accelerate Complex-wide land protection.

Appendix J, “Land Protection Plan,” describes the concepts of the Service land acquisition program and its acquisition priorities, the relationship of land protection to achieving goals and objectives in national and regional habitat plans for trust resource species, collaborative science-based conservation planning, alternative approaches to land acquisition, the role of landscape-level biological planning in developing priorities, the benefits to specific conservation targets (species and ecosystem types), how proposals promote biological integrity, the review of Comprehensive Environmental Response Cleanup Liability Act responsibilities and issues, recreational guidelines and improved access issues for additional wildlife dependent recreational activities, and operational and maintenance costs.

*Monitoring element.*—Annual acres protected; acquisition and analyses of remote sensing or GIS layers.

**Objective 3.1.2.** By 2005, continue to assist partners in developing a landscape protection plan.

*Basis of the objective.*—Population growth, fragmentation, and other, related land use changes must serve as an important backdrop in our CCP. These forces ultimately result in fundamental changes to fish, wildlife, and plant populations and to ecosystem processes; they affect land acquisition efforts; they create logistical problems in land management, maintenance, and law enforcement; and, they produce significant recreational demands and pressures on the Refuge Complex. The collective efforts of many different agencies, entities, and non-governmental organizations already are protecting and conserving many unique and important habitats, communities, and species in the watershed.

The salient issue is what role should the Refuge Complex (and each refuge) play as part of the emerging, larger, interconnected system of protected lands within the watershed. The Service alone cannot acquire or otherwise conserve the resources within the Blackwater River watershed. The success of management and conservation of biological diversity and efforts to maintain or restore the integrity and health of ecosystems and communities will rely upon partnerships.

*Strategies to achieve the objective.*—We would assist in developing Maryland’s GreenPrint Program; participate in implementing the Chesapeake 2000 Agreement; work with local, state, and regional government acquisition or easement initiatives on strategic partnerships to maximize and coordinate land protection; acquire, restore, or otherwise protect forested corridors to connect refuge land with other protected land; participate in the Chesapeake Bay and Susquehanna River Ecosystem Land Protection Plan; and, develop an MOU with National Park Trust to facilitate and accelerate Complex-wide land protection. We would assist the Maryland Wildlife and Heritage Service with the development of its comprehensive Wildlife Diversity Conservation Plan, whose purpose is to identify the important places on the Maryland landscape where conservation is needed to sustain wildlife diversity and the actions necessary to conserve this diversity, focusing on fish and wildlife species of greatest conservation need.

*Monitoring element.*—The number of acres and the quality (composition, structure) of available habitat protected and managed; and, the number of partnerships and initiatives created.

**Goal 4.** Develop and implement quality scientific research, environmental education, and wildlife-dependent recreation programs that raise public awareness, and are compatible with refuge purposes.

**Subgoal 1.** Encourage and provide opportunities for research by other agencies, universities, and other institutions, especially, research that relates to the mission, management, and objectives of Blackwater NWR.

**Objective 4.1.1.** Foster relationships with government entities, conservation groups, and institutions, communicate the most critical research and management needs of the refuge, and provide at least five research opportunities by 2010.

*Basis of the objective.*—One of the important purposes of Blackwater NWR is priority scientific research, which we define as studies that contribute to the enhancement, protection, uses, preservation, and management of native wildlife populations and their habitats in their natural diversity (4 RM 6). The Service encourages and supports research that provides additional data upon which to base decisions on managing units of the Refuge System (4 RM 6). We need to provide opportunities for research and management-applied studies, which are crucial to sound resource management.

One of our objectives is to provide students and others with the opportunity to learn the concepts of field research (4 RM 6). Providing research opportunities to universities, colleges, and other institutions will enhance the education of students pursuing wildlife, archaeological, or other degrees (see subgoal 2, below). The information they provide the refuge on wildlife-habitat relationships and other topics will further environmental education and interpretation and wildlife conservation.

*Strategies to achieve the objective.*—We would actively seek partnership opportunities, and consider unsolicited proposals for research in a variety of disciplines, including flora and fauna, public use, and cultural resources. All reports, surveys, and scientific papers generated would be made available to refuge staff and cataloged for future needs.

We would communicate to the institutions above, the priority information gaps that we seek to fill, e.g., the effects of human activities on wildlife and habitats, and habitat needs of species of special concern, with priority given to studies that contribute to the enhancement, protection, use, preservation, and management of native wildlife populations and their habitats in their natural diversity (4 RM 6). We would also permit the refuge to be used for other investigatory scientific purposes, when such use is compatible with the purposes, goals, and objectives of the refuge. Priority would be given to research studies that contribute to the enhancement, protection, uses, preservation, and management of native wildlife populations and their habitats in their natural diversity (4RM 6).

We would specifically create new and innovative partnerships with U.S. Geological Survey and the Fish and Wildlife Cooperative Research Units (University of Maryland Eastern Shore and others) to achieve information needs and to evaluate management actions. Refuge staff will identify research needs, collaborate with researchers where and when appropriate and feasible, provide facilities and support as defined in objective 4.1.2., and routinely author and co-author publications.

*Monitoring element.*—The number of published research projects supporting refuge objectives.

**Objective 4.1.2.** Maintain refuge facilities, equipment, and lands for potential use by researchers, interns, students, and other conservation partners by 2006.

*Basis of the objective.*—Providing facilities and equipment facilitates research, as housing and travel costs can be significant components of research budgets.

*Strategies to achieve the objective.*—Housing, equipment storage, and use of Service equipment would be provided at the discretion of the Project Leader, with priority given to research that furthers the goals and purposes of the refuge. We would seek partnerships with the Friends of Blackwater to purchase new facilities or renovate existing ones.

*Monitoring element.*—Inventory of facilities available for researchers, listing of habitats used during research.

**Subgoal 2.** Provide opportunities for environmental education and interpretation that meet the needs of users.

*Basis of the subgoal.*—The Refuge System Administration Act and the National Wildlife Refuge System Improvement Act of 1997 direct us to provide opportunities for the priority general public uses of the Refuge System. Environmental education and interpretation are two of the six priority public uses. These uses advance public awareness, understanding, and appreciation of the functioning of ecosystems and the benefits of their conservation to fish, wildlife, and people. This ultimately contributes to the mission of the Refuge System.

**Objective 4.2.1.** Complete and distribute an environmental education manual by October 2005.

*Basis of the objective.*—Only one environmental education program is now available at the refuge. The refuge cannot meet the requests by school groups and scout, church, and 4-H groups. An environmental education manual would provide programs and activities for schools and other groups while increasing public understanding of wildlife needs, ecosystems, conservation, and habitat management for wildlife and, ultimately, the public use goal of the refuge.

*Strategies to achieve the objective.*—Refuge staff would edit and print section 1 of an environmental education manual by October 2006, section 2 by October 2008, and section 3 by October 2010. The manual would be distributed to schools and feedback gathered 1 year after each section is published.

*Monitoring element.*—The number of schools, teachers, and students that visit the refuge; assessment of how the manual meets their needs and expectations.

**Objective 4.2.2.** Annually provide two on-refuge teacher training programs.

*Basis of the objective.*—Many teachers do not have the background in environmental education and wildlife to teach the activities in the manual. Teacher workshops would enable them to learn how the activities should be conducted, what to expect to find at the refuge, and would provide background information for preparing the students for the various activities. A well-trained teacher would provide the necessary background for refuge environmental education, and focus on the importance of the refuge in wildlife habitat management, enhancing the refuge's ability to meet its environmental education goals.

*Strategies to achieve the objective.*—We would conduct two teacher workshops each year.

*Monitoring element.*—The number of teachers attending workshops; teacher assessment of the education manual; effectiveness of the training.

**Objective 4.2.3.** By 2010, develop specialized programs and provide the 15 types of environmental education programs identified in the environmental education manual for 150 groups of students.

*Basis of the objective.*—Refuges are learning laboratories, and Service programs are designed to show students and teachers the value of fish and wildlife resources. There is now only one refuge-specific environmental education program available for teachers, 4-H clubs, scouts, home schoolers, college students, and others. The refuge has not been able to meet the requests for special programs for all these groups. With 15 environmental education programs geared toward each of the different types of groups and their needs, the refuge would provide the programs requested.

*Strategies to achieve the objective.*—We would develop environmental education programs that can meet requirements of boy scouts, girl scouts, 4-H clubs, home school groups, college programs, programs for adults, and special event programs to be available when needed by 2010.

We would implement the environmental education manual and refuge activities for elementary-age visiting groups by October 2006; for middle school groups by October 2008; and high school groups by October 2007.

We would develop three changeable environmental education activities for the refuge web page by January 2008, and alternate programs every 6 months.

*Monitoring element.*—The number of environmental education programs and students per year, and assessment of how well the environmental education program and manual meet their needs and expectations.



**Objective 4.2.4.** Develop adequate facilities and equipment for environmental education study compatible with wildlife management purposes of the refuge by 2012.

*Basis of the objective.*—No facilities are adequate for providing environmental education programs year-round. Building such a facility would greatly enhance the capability of the Refuge Complex to administer its environmental education program, and, ultimately, achieve the public use goal of the refuge.

*Strategies to achieve the objective.*—We would purchase the Robbins property to construct an environmental education outdoor classroom, and purchase equipment and materials to use for environmental education. We would build a contact station for the Nanticoke protection area along Route 50 on a site yet to be determined; and by 2015, we would build an outdoor classroom facility.

*Monitoring element.*—Completed construction of the facilities and purchase of equipment; and the number of visitors or groups using each facility or location.

**Objective 4.2.5.** Increase interface with the education community, non-government organizations, universities, and other state and Federal agencies by 2008.

*Basis of the objective.*—No staff are available for coordinating volunteer services, even though we recognize the crucial link between public awareness and effective management of the Refuge System. The Volunteer and Community Partnership Act requires us to develop guidance for refuge education programs to further the mission of the Refuge System and the purposes of individual refuges. The Act encourages cooperative efforts with state and local education authorities and partners to develop and implement these programs.

*Strategies to achieve the objective.*—We would develop five shared education programs and activities with other environmental education centers (Horn Point EE Center, Karen Noonan EE Center, Pickering Creek EE Center, and universities) by October 2012; foster opportunities for the participation of students, co-ops, SCEPS, interns, and SCAs; participate in community and other government-agency-sponsored events; expand our participation in the envirothon for high schools; develop an MOU with Henson Scout Camp and the 4-H Camp Thendera to work together on environmental education and interpretive programs and events; and, develop an envirothon for middle and elementary schools.

We will improve communications by planning and conducting workshops and meetings with other environmental education interests (the education community, non-government organizations, and other agencies); share information and ideas; and, assist with environmental education activities. We would continue to work with the Nanticoke Watershed Alliance on special programs involving environmental education and outreach; and expand our volunteer network and friends groups.

*Monitoring element.*—The number and types of partnerships developed, number of programs established, and number of participants in these programs.

**Objective 4.2.6.** Provide qualified educators and volunteers to conduct environmental education and interpretation programs by 2008.

*Basis of the objective.*—The System must have professional public use planners and specialists in recreation, interpretation, and education to provide the American people with more and better opportunities to enjoy compatible wildlife-dependent experiences on refuges. Trained professionals would be able to educate the public in a manner that visitors of all ages can enjoy while learning about wildlife, their environment, conservation, and refuge management.

*Strategies to achieve the objective.*—In addition to the supervisory ORP and the permanent full-time Recreation Aid or Park Ranger (position vacant since 1989), we would hire a permanent full-time ORP to recruit and train interns and at least 30 volunteers a year, and assist with the environmental education program. We would hire two additional permanent full-time ORPs and one additional ORP for the Nanticoke protection area. We would provide trained professionals and volunteers the opportunity to attend appropriate environmental education training.

*Monitoring element.*—The number of trained professionals, volunteers, and students providing environmental education.

**Objective 4.2.7.** Provide 100,000 hours of interpretation to enhance visitors' knowledge of wildlife and refuge management, while providing an enjoyable refuge experience by 2015.

*Basis of the objective.*—Refuges are the front yards of the Refuge System, and provide people the opportunity to experience its diverse environmental education and interpretation activities at first hand. Refuges provide visitors with an understanding and appreciation of fish and wildlife ecology and help people understand their role in the environment through interpretation programs and facilities. The refuge now provides 26,000 hours of interpretation annually. The refuge Visitor Center, self-guided Wildlife Drive, and associated interpretation trails (one self-guided) provide visitors some knowledge of wildlife and refuge management and an enjoyable refuge experience. However, the Visitor Center is in poor condition, short of space, understaffed, and its exhibits are outdated. We cannot meet the increasing number of requests for more activities, programs, demonstrations, and special events. Programs will need to be created to specifically target the Nanticoke protection area resources. Improving facilities, staffing, and programs would greatly enhance our capability to administer interpretation programs, and ultimately achieve the wildlife-dependent education and recreation goals of the refuge.

*Strategies to achieve the objective.*—By 2006, we would remodel and expand the Visitor Center to include a larger multipurpose room for 150 people; a second-floor observation area with observation telescopes; an environmental education area; new office space for four ORPs or Park Rangers, seasonal or temporary staff, interns, and the volunteer program; sales outlet space for FOB; fire-safe storage for historical items; and, a larger exhibit area.

We would update present kiosk information panels and provide two more kiosks by 2008: one at the entrance to the new Wildlife Drive location, and one at the Nanticoke River contact station to provide interpretive information on Nanticoke protection area resources. We would provide a panel in the Woods Trail kiosk explaining the history of the steam engine; construct trailheads

with kiosks at new hiking, canoeing, and biking trails by October 2005; install interpretive signs in new hiking, biking, and canoeing areas and other areas as needed; and, catalog and store all slides, photos, and historical items.

The refuge would serve as an NPS Gateways Site. We would install an indoor interactive computer console in the Visitor Center by October 2006; install an outdoor interactive computer console by 2012; install a live action monitor of eagle and osprey nests with educational exhibits by 2007; produce a new refuge film in 2010; a Nanticoke film by 2012; and, purchase new videos applicable to the refuge for use in the Visitor Center and Nanticoke Contact Station.

We would develop new, updated exhibits for the Visitor Center and Nanticoke Contact Station, which would be open every day but Christmas Day and Thanksgiving Day; revise the Mammals and Wildlife Drive Guide leaflets to FWS standard format; produce a self-guided Woods Trail leaflet, Nanticoke leaflet, volunteer leaflet, and exotic species leaflet by October 2010; produce an endangered species leaflet and entrance fee leaflet by October 2012; and, produce other leaflets as needed.

We would construct a ¼-mile bicycle trail from the Wildlife Drive to Key Wallace Drive. In partnership with the highway department, we would build a 3-mile bike path from the Wildlife Drive to Hip Roof Road. We would build a butterfly garden by October 2006; establish a habitat demonstration area by October 2007; and, provide bat housing in silos at Hog Range.

*Monitoring element.*—The number, type, and location of facilities or activity, and the response by refuge visitors (the number of hours, number and type of visitors or groups using each facility, location, or activity).

**Subgoal 3.** Provide opportunities for compatible wildlife-dependent recreation.

*Basis of the subgoal.*—The NWRSA directs us to provide six priority wildlife-dependent recreational uses in the Refuge System: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. By providing the public with opportunities for those uses, we would increase public awareness, understanding, and appreciation of ecosystem functions and the benefits of ecosystem conservation to fish, wildlife, and people. Ultimately, these will contribute to the mission of the Refuge System.

**Objective 4.3.1.** By 2010, increase the opportunities for wildlife observation and photography.

*Basis of the objective.*—During scoping meetings, the public requested that we increase wildlife observation and photography opportunities. Achieving this objective would provide the public with the opportunity to view the relationships among resource management, wildlife and habitat, and people.

*Strategies to achieve the objective.*—By October 2006, we would redesign the Wildlife Drive to start from the Visitor Center and finish at its present entrance, to give visitors a better wildlife observation experience, and enable them to get information and assistance from staff and volunteers at the Center before entering the drive. We would convert the Pool 5 section of the

drive to non-motorized use, to allow a separate area for pedestrians and bicyclists that would not conflict with motorists, thereby improving visitor safety. We would also build a new parking area for visitors who wish to bike or hike.

By October 2015, we would build a wildlife observation trail from Route 335 to Smithfield Road (Gum Swamp Trail), with parking facilities. We would install benches along all wildlife observation trails to allow visitors to rest and enjoy wildlife.

By January 2010, we would replace the observation tower with an accessible deck over wetlands and an elevated observation platform at water's edge at the junction of the Little Blackwater River and Blackwater River, to be used for environmental education programs and by visitors to view the wetlands.

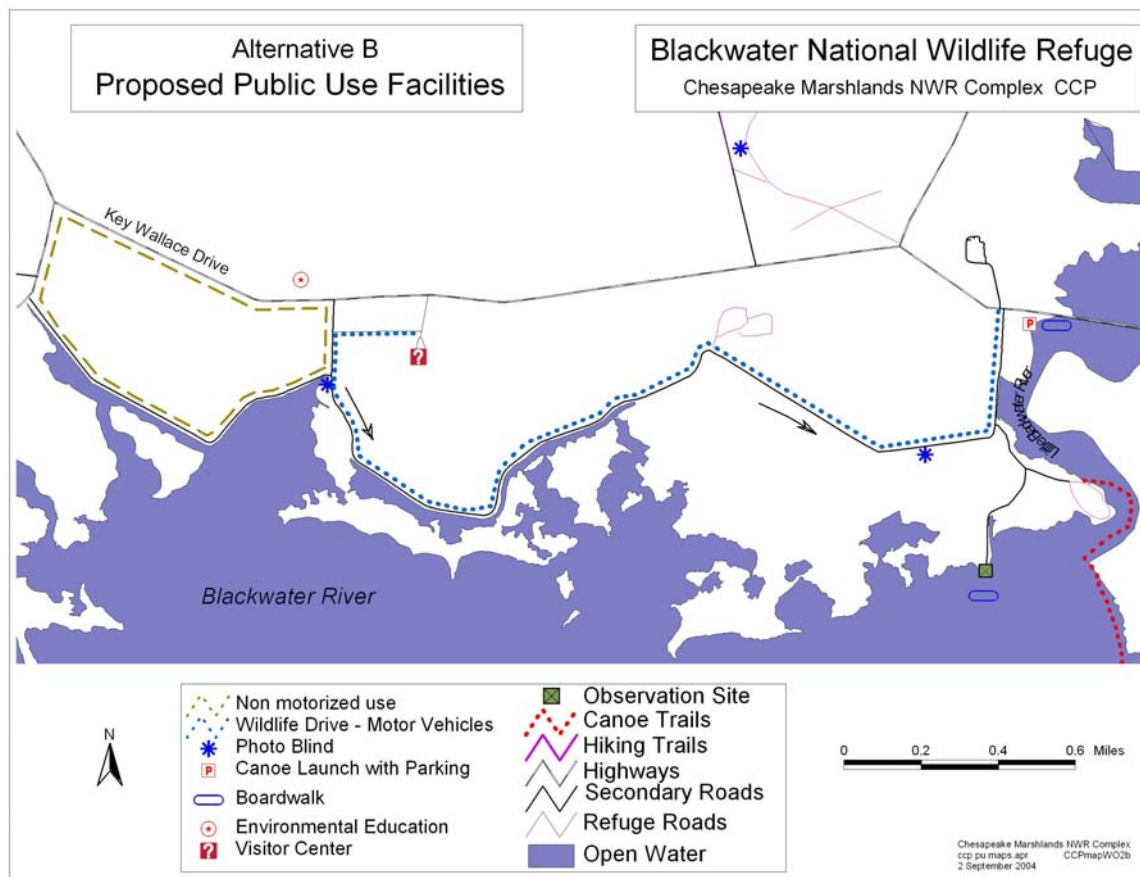


Figure 4. Alternative B: Proposed public use facilities (color plate)

By January 2010, we would install six observation and photo blinds and provide a photography program for the public for each season of the year.

By 2007, we would build a second-floor observation deck and install observation telescopes at the Visitor Center.

By 2015, we would build a wildlife observation trail and observation tower on the Nanticoke.

*Monitoring element.*—The number, type, and location of facilities constructed, and the response of refuge visitors, by season: the number of visitors using each of the facilities—biking trails, hiking trails, observation decks and platform, observation tower, and photo blinds (see figures 4 and 5, “Alternative B: Proposed public use facilities”).

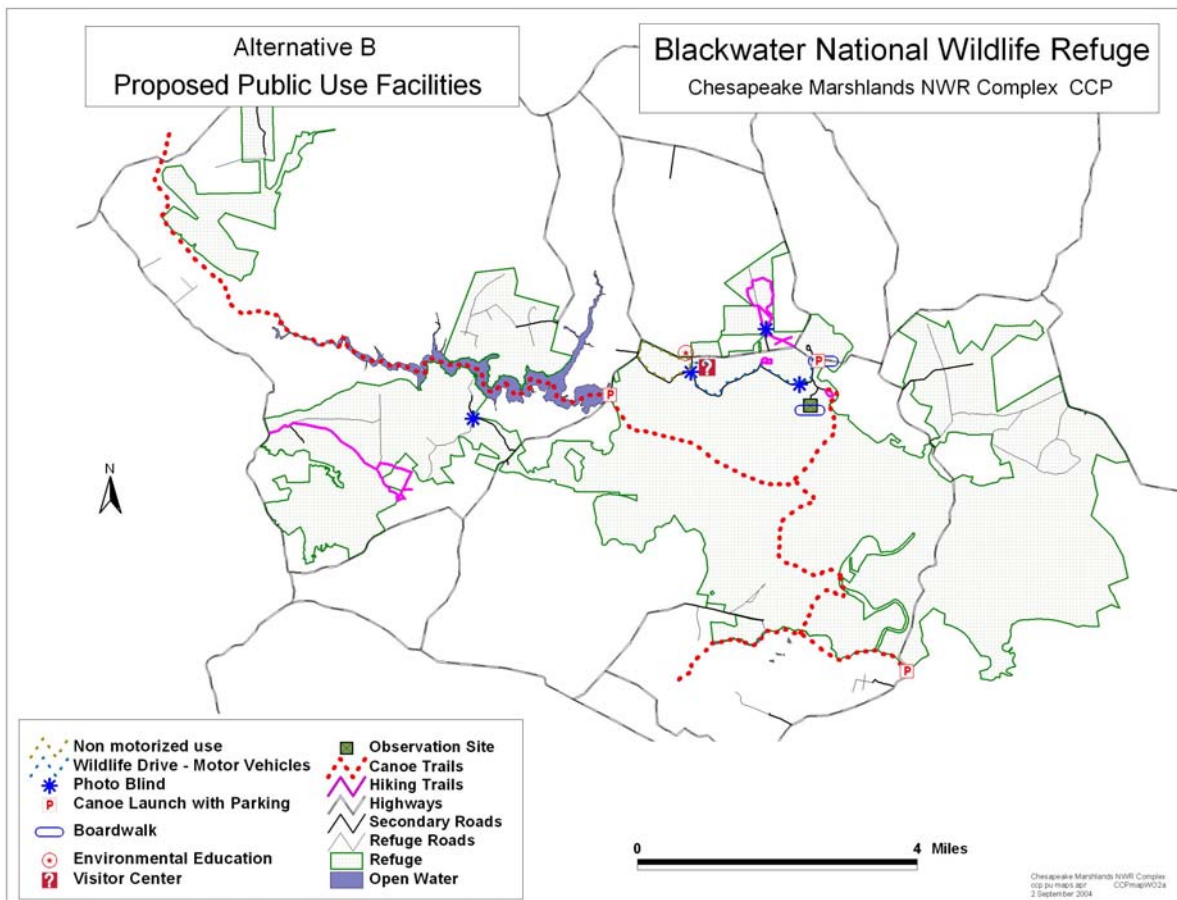


Figure 5. Alternative B: Proposed public use facilities (color plate)

**Objective 4.3.2.** Provide increased fishing opportunities by 2015.

*Basis of the objective.*—The demand for safe, adequate fishing opportunities is increasing.

*Strategies to achieve the objective.*—By January 2005, expand areas closed to boating, using State regulations. By 2006, in partnership with the State of Maryland, we would build a canoe

access ramp and controlled parking area at the Route 335 bridge, and encourage the Friends of Blackwater or a concessionaire to provide canoe and kayak rentals.

By January 2007, we would mark river channels on Blackwater River, and, by January 2012, we would build an accessible boardwalk or pier, kiosk, designated fishing and crabbing area, and parking area on the Little Blackwater near Key Wallace Bridge.

By 2015, we would construct a canoe access ramp with controlled parking area, and build an accessible boardwalk or pier near the Nanticoke River.

By January 2015, we would map waterways for public safety, monitor canoeing and boating activities, provide interpretive fishing, crabbing, and boat safety programs, develop National Fishing and Boating Week activities for the public, and develop signs and printed materials explaining Blackwater NWR rules and regulations to visitors.

*Monitoring element.*—The number, type, and location of facilities constructed, and response of refuge visitors, by season (number of visitors using each of the facilities—pier, canoe ramp, parking).

**Objective 4.3.3.** Provide additional opportunities for high quality hunting experiences.

*Basis of the objective.*—The need to provide hunting opportunities compatible with the resource is increasing. At our scoping meetings, the public recognized hunting as a traditional, family-oriented form of recreation, important in developing an appreciation for fish and wildlife, and recommended more opportunities for big game, small game, and waterfowl hunting.

*Strategies to achieve the objective.*

**Big game hunting.**—We would open 10,430 acres of existing refuge land to big game hunting, and open additional acreage as we acquire it.

Beginning the last Saturday in September and ending the third Saturday in January, we would permit big game hunting for sika and white-tailed deer for a minimum of 51 days: 43 days of archery hunting; 2 days of muzzleloading rifle or shotgun hunting; 2 days of youth-only shotgun hunting; and 4 days of shotgun hunting; all within State seasons and in conformance to State weapons and bag limits.

During the archery seasons, hunters would walk in from existing, designated parking areas, and all vehicle access would be prohibited. During firearms seasons, vehicles would be restricted to designated roadways. There would be no off-road vehicles or ATV use allowed during any hunting season. There would be no access allowed by boats during any of the big game hunting seasons. The first section of the Wildlife Drive would be closed the first 2 days of the shotgun hunt, leaving the second part open for public use.

We would provide hunting opportunities to a minimum 3,000 hunters annually, on a first-come, first-served, mail-in system (non-quota for the archery season, but “with quotas” for the firearm

hunts). Hunters would be restricted to zoned areas for safe distribution, with a ratio of no more than 1 hunter per 20 acres, although some areas may have only 1 hunter per 40 acres. Staff and volunteers will operate check stations during muzzleloader and shotgun hunts to obtain deer age, sex, species, and weight data. We would require hunters who kill deer during the archery season to have them checked at a Maryland DNR-certified checking station.

Before July 1, we would prepare and submit for review an annual hunt plan. We would publish summaries of the biological information in the refuge Annual Narrative Report. Administrative fees would be charged for the permits. Senior citizens would receive a 50-percent discount on those fees. We would use those fees to hire a hunt coordinator and maintain parking areas and signs.

One area of the refuge would be designated for certified wheelchair bound big game hunters. Hunt leaflets, regulations, and maps would be prepared and published annually, and distributed to hunters. Refuge-specific regulations would be published annually in the Federal Register and codified in Title 50, Part 32. We would maintain a hunter data base to facilitate mailing and distributing information. Blackwater NWR would continue the same precautions for threatened and endangered species and migratory waterfowl as in alternative A. Hunting would be regulated in time and space to eliminate conflicts with endangered species and other public uses, and to ensure compatibility with refuge purposes. Annual spotlight surveys, harvest data, herd health conditions, and available habitat would continue to ensure that the deer hunt program remains biologically sound.

Deer hunting to maintain herd numbers within acceptable levels would continue to provide opportunities to utilize a renewable resource. We would adjust refuge hunting seasons each year to take into consideration changes indicated in herd quality by biological monitoring (APCs, antler size, reproductive rates, etc.).

**Forest game hunting.**—By April 2006, we would open the refuge to turkey hunting in accordance with State regulations (see figure below, “Alternative B: Proposed turkey hunt areas”). The refuge would be open to hunting on Tuesdays and Saturdays for 4 weeks during the State season (April 18 to May 16) on a quota basis. Turkey hunting would require a permit issued to 14 hunters per day (112 hunters), determined by a lottery system.

The hunt would take place on approximately 7,485 acres in 10 areas (Areas B1, D, M2, N, R, S, T, U1, U2, and U3), located where public use would not occur, as specified in the Annual Hunt Plan. Scout days would be authorized the day before each hunt day. We would open new areas as they are acquired whenever hunting would not conflict with public use or endangered or threatened species (bald eagle), and would not have a negative impact on other wildlife and habitat resources or public safety. Hunting on newly acquired lands would conform to existing regulations. We would complete a compatibility determination before the hunt begins.

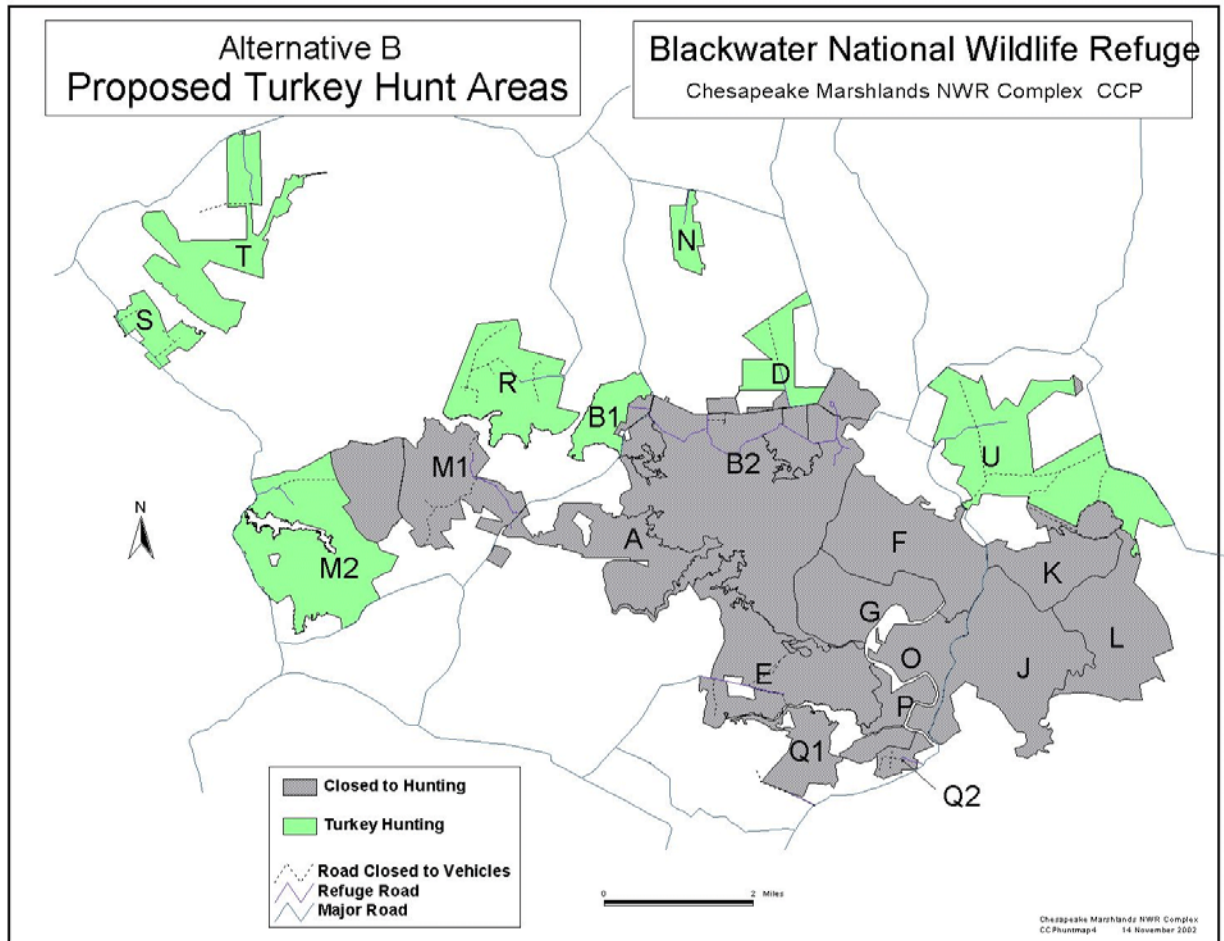


Figure 6. Alternative B: Proposed turkey hunt areas (color plate)

**Waterfowl hunting.**—By 2007, we would open Blackwater NWR to spring hunting of resident Canada geese (March 15 through April 15), according to the Annual Hunt Plan based on the “Integrated Wildlife Damage Management Plan for Control of Resident Canada Geese,” if consistent with the Service EIS on managing these injurious resident waterfowl. Hunting would occur in areas that would not conflict with public use or endangered and threatened species (bald eagle), and would not have a negative impact on other wildlife and habitat resources or public safety (see figure below, “Alternative B: Resident Canada goose hunt areas”). We would close the hunt areas to boating access by non-hunters during the hunting season.

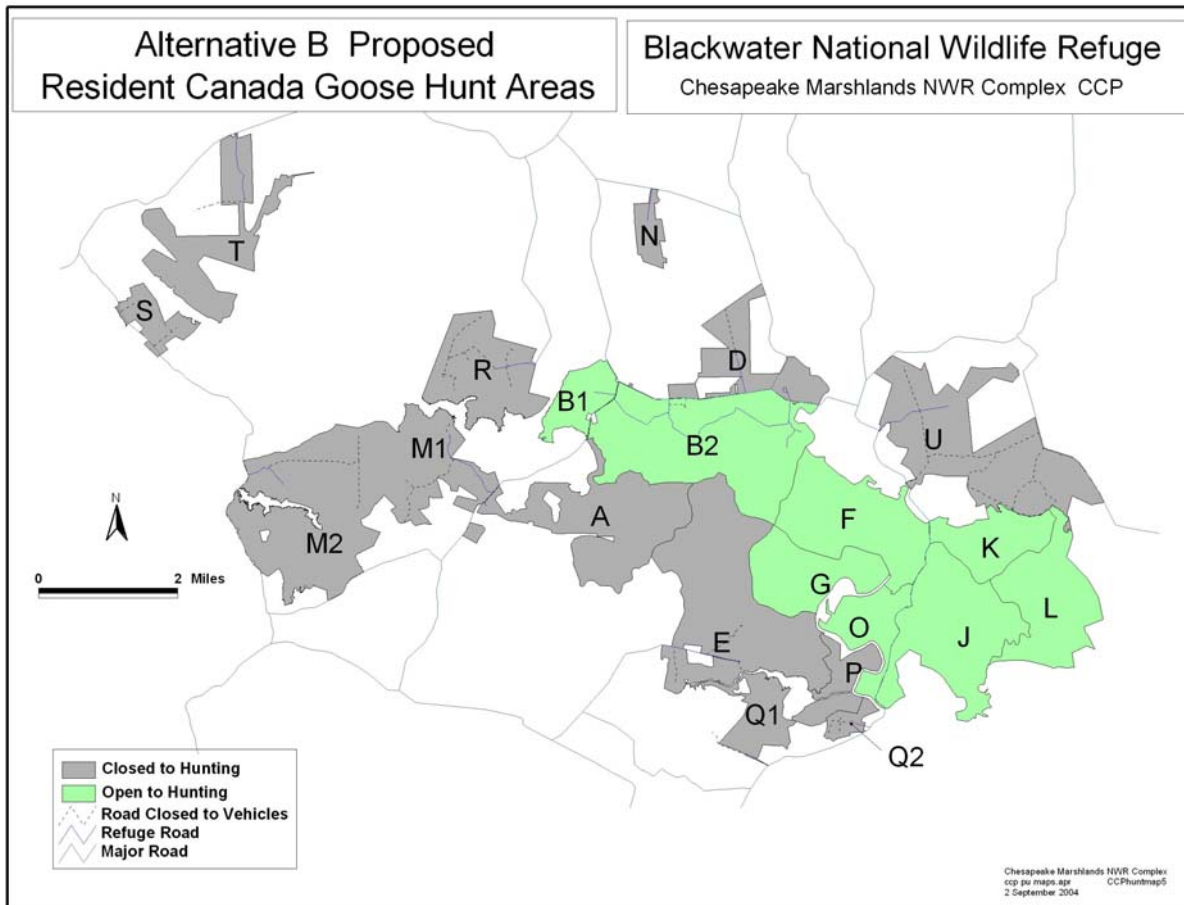
Resident goose hunting would require a permit determined by a lottery system issued for 30 blind sites constructed by the hunter within 100 yards of a numbered post. The blind sites would be located in areas B1, B2, G, F, J, K, L, and O, on approximately 8,300 acres of marsh (3,731 acres), fields (70 acres), and open water (4,500 acres). Thirty permits per day (27 days) would be issued providing 810 recreational waterfowl hunting opportunities. New areas would be evaluated and considered as they are acquired whenever hunting would not conflict with public use areas or endangered and threatened species (bald eagle), would not have a negative impact on other wildlife and habitat resources, or adversely affect public safety. Retrievers would be permitted.



By 2010, waterfowl hunting in accordance with State seasons, species, bag limits, and hunting methods, would be permitted on 40 percent of all new acquisitions. This proposed hunting opportunity would continue to maintain approximately 23,000 acres as an inviolate sanctuary for wintering and migrating waterfowl.

We would hire a full-time Refuge Law Enforcement Officer to enforce hunting regulations, in addition to other duties. The Friends of Blackwater would hire a full-time Hunt Coordinator to prepare updated mailing lists, regulations, maps and applications; mail out information, process applications, collect and record money; and, maintain the hunt areas, conduct the hunts, and collect and prepare records of hunt statistics.

*Monitoring element.*—The number and type of hunting experiences, and response of refuge visitors (number and type of visitors or groups participating in each hunt).



**Figure 7.** Alternative B: Proposed resident Canada goose hunt areas (color plate)

**Subgoal 4.** Enhance and increase outreach activities.

*Basis of the subgoal.*—In recognizing the crucial link between public awareness and effective management of the Refuge System, and in order to build a stronger base of public understanding,

support, and activism beyond that portion of the American public who visit refuges, the Service has supported nationwide strategies, including the 100-On-100 Outreach Campaign, the National Outreach Strategy: A Master Plan for Communicating in the U.S. Fish and Wildlife Service, the NWRSA, the Cooperative Alliance for Refuge Enhancement (CARE), the Volunteer and Community Partnership Act, and the Challenge Cost-Share Program. Enhancing and increasing outreach activities support this subgoal.

**Objective 4.4.1.** Increase public knowledge of the Refuge Complex and each refuge's existence, location, and activities. (See "Strategies," below, for completion dates.)

*Basis of the objective.*—Many people, including numerous local residents, are unaware of the refuge, its mission, and what it does. Increasing public knowledge of the refuge's existence, location, and activities would encourage more people to visit the refuge and become aware of the importance of refuge habitat management, wildlife, and conservation, to supporting the mission of the Service.

*Strategies to achieve the objective.*—We would install two travelers' information radio stations on Route 5: one near Cambridge by January 2005, and one near the Nanticoke River in Vienna by 2010. We would participate in local events, such as the Bay Country Festival, 4-H Fairs, Waterfowl Festival, Shad Festival, and other events as they develop; work with Dorchester County Tourism, South Dorchester Folk Museum, Harriet Tubman Organization, and other community organizations in events and activities as they are developed; and , develop ecotourism programs at the Hyatt Regency conference center by October 2010.

We would develop better personal relationships with the media, develop a refuge monthly or weekly activity report for local newspapers and radio stations, and continue to work with Friends of Blackwater to seek funding, develop programs, produce projects, expand the cooperative sales outlet, plan and conduct public events, promote national projects and other activities as they develop, and respond to all public inquiries.

We would involve more people from the community in the Volunteer Program, participate in the development of watershed-wide cooperative outreach groups of Dorchester, Caroline, Somerset, and Wicomico Counties; continue to participate in the Nanticoke Watershed Alliance and Lower Shore Tributary Strategies Team; and develop an envirothon for middle and elementary schools by 2015.

*Monitoring element.*—The number of types of activities involving the communities, and the number of participants in each.

**Subgoal 5.** Ensure the compatibility of all public use.

*Basis of the subgoal.*—The Service is responsible for ensuring the compatibility of all public uses, in conformance with the Refuge Recreation Act of 1962 and the Refuge Administration Act of 1966, which place into law the concept that all refuges will be closed to all recreation uses, until we have determined that the proposed uses are compatible with a refuge's establishing purpose(s), and that sufficient funds are available to administer those uses.

**Objective 4.5.1.** Provide public use opportunities that are compatible with the wildlife, resources, and purposes of Blackwater NWR by 2005.

*Basis of the objective.*—The NWRSA (1997) calls for the Refuge System to provide increased opportunities for families to experience compatible, wildlife-dependent recreation.

*Strategies to achieve the objective.*—Determine the compatibility of all new recreational uses.

*Monitoring element.*—The number of compatible determinations.

**Objective 4.5.2.** Provide adequate housing for interns and students (researchers and public use) by 2007.

*Strategies to achieve the objective.*—By 2005, we would set up and renovate a mobile home purchased by the Friends of Blackwater for intern and researcher residence.

By 2007, we would renovate and convert the old headquarters building to intern housing.

**Objective 4.5.3.** Develop adequate facilities and equipment. (See “Strategies,” below, for completion dates.)

*Strategies to achieve the objective.*—By 2006, we would remodel and expand the Visitor Center to include a larger multipurpose room for 150 people; a second-floor observation area; and environmental education area; new office space for five ORPs or Park Rangers, temporary staff, interns, and volunteers; sales outlet space for FOB; and a larger exhibit area. We would construct a contact station on the Nanticoke River.

We would build two outdoor classrooms: one near the Wildlife Drive by 2007, and one at the Nanticoke River by 2015; and, purchase equipment and materials to use in environmental education.

By October 2007, build an improved loop hiking trail from Route 335 to Smithfield Road, with a parking area for visitors who wish to hike, and a parking area for visitors who wish to bike.

By January 2010, we would replace the observation tower that was removed in 1990 with an accessible deck and elevated observation platform over wetlands to water’s edge at the junction of the Little Blackwater River and Blackwater River, and build three observation and photo blinds.

By January 2007, we would redesign the Wildlife Drive to start from the Visitor Center and finish at its present entrance, and convert the second part of the Wildlife Drive to a bike trail, which would connect with a bike trail to be built along Route 335 to Hip Roof Road by the MD Highway Department and Dorchester County.

**Goal 5.** Ensure that the staffing, facilities, resource protection, and infrastructure necessary for implementing this CCP are developed.

**Objective 5.1.** By 2006, obtain base funding necessary to maintain minimum staffing and operational support of the refuge.

*Basis for the objective.*—The proposed Refuge Complex staffing chart (see appendix G) identifies this refuge’s minimal staffing level for basic resource inventory and monitoring to ensure the use of the best science in management decisions. Additional biological and maintenance staff are needed to maintain intact and diverse ecosystems, recover endangered species, and monitor populations status and trends. Law enforcement officers are necessary to ensure the safety of visitors and for resource protection.

Critical needs exist in the public use programs to respond to expected high levels of visitation and demands for opportunities for visitors to experience and appreciate wildlife. Existing equipment inventories are insufficient to effectively support existing or additional staff. Clearly, implementing this alternative would require staff to effectively perform all identified public use, management, inventory, and maintenance programs identified in this alternative.

*Strategies to achieve the objective.*—We would obtain congressional, national, and regional support for base funding for approved RONS projects; obtain local community support for implementing programs during the transition period, including expanding the use of volunteers and interns to accomplish programs and projects; and, seek opportunities for collaborative funding projects with partners.

*Monitoring element.*—Achieved base funding level necessary to maintain minimum staffing and operations.

## **Chesapeake Island Refuges—Alternative B**

### **Concepts Used for Developing Alternative B**

**Land Protection.**—Alternative B would expand potential management responsibilities at the island refuges through Cooperative Management Agreements and Memorandums of Understanding. We would welcome management agreements with the State of Maryland and the U.S. Navy for Bloodsworth, Adams, and Northeast Islands (U.S. Naval Reservation lands), and South Marsh Island (the MD DNR Wildlife Management Area).

**Fish, Wildlife, and Habitat Management.**—This alternative would expand the Complex-wide Resource Inventory and Monitoring Program, and would place special emphasis on the tenets of conservation biology and ecosystem processes in the design and implementation of our management programs. Programs would also be in place for optimizing not only Federal trust species, but also biological integrity and ecosystem health in the context of refuge purposes. A

variety of active and passive management programs would be deployed to accomplish habitat-based and population-based goals and objectives, including the continued extensive use of artificial nest structures, habitat creation, predator controls, active intervention to address exotic, invasive, and injurious species, and landscape-level habitat restoration.

**Public Use.**—Our management of public use on the island refuges would be guided by the following concepts. As with our approach at Blackwater NWR, the island refuges’ public use program would promote the refuges, Refuge Complex, and Refuge System conservation messages, to help reduce the impacts on other wildlife areas and inform visitors about the importance of closed areas for wildlife. The island refuges would provide environmental education for the visiting public and training for teachers and students; develop compatible opportunities for wildlife observation, photography, hunting, and fishing; develop a friends group and volunteer program; develop extensive environmental education and interpretation facilities, programs, and activities and wildlife-dependent recreational facilities, programs, and activities to conform with “Fulfilling the Promise” and the Refuge System Administration Act. Public uses will not interfere with important nesting or wintering seasons of listed species. No public use activities will be permitted where public safety or trust resources are adversely affected.

## Goals, Objectives, Strategies, and Monitoring Elements in Alternative B for Managing the Chesapeake Island Refuges

**Goal 1.** Protect and enhance Service trust resources and other species and habitats of special concern.

**Subgoal 1.** Provide habitats to sustain 5 percent of each of Maryland's wintering waterfowl, as follows: Atlantic Population (AP) Canada goose, and dabbling duck population, as measured by the Midwinter Waterfowl Inventory.

**Objective 1.1.1.** On a broad scale, protect, restore, and enhance a mix of wetland habitat types throughout the island marshes by 2020.

*Basis of the objective.*—This objective supports the goals of the Atlantic Coast Joint Venture (ACJV), the North American Waterfowl Management Plan, 1989 Chesapeake Bay Program Waterfowl Populations Objective (as updated in 2000). The ACJV project has specifically identified Martin NWR. Under NAWMP, four priority waterfowl species associated with the island refuges benefit from the important estuarine emergent and submergent habitats: black duck, mallard, northern pintail, and blue-winged teal. Other than the midwinter waterfowl survey, standard protocols and surveys are lacking throughout the island refuges. Waterfowl law enforcement activities have been restricted to Martin NWR, and little is known about possible illegal hunting on the remaining satellites. Emergent wetland and SAV habitats are being impacted by erosion and poor water quality.

*Strategies to achieve the objective.*—We would initiate standard protocols and annual winter surveys throughout the island refuges by the year 2004; record habitat types for waterfowl concentration areas; incorporate them into a GIS data base; note signs of hunting and assess illegal hunting; and, determine and implement specific actions through an operational plan.

We would implement a summer water quality monitoring program following the protocols established by the “Chesapeake Bay Program Submerged Aquatic Vegetation Management Plan,” and use the data collected to target SAV restoration sites and delineate areas where erosion- induced turbidity is limiting SAV resurgence. Mute swan feeding impacts to SAV beds can be assessed during water quality sampling, and specific actions determined. Mute swan control would follow the recommendations of the Mute Swan Task Force.

Management strategies in this alternative include wetland creation or restoration, SAV restoration, erosion control, mute swan management, invasive plant species management (primarily *Phragmites australis*), and law enforcement. Significance of boat traffic, disturbance, and the need for a sea duck sanctuary would be assessed. Proposed management activities for the island refuges would be more specifically addressed in the island refuges Habitat Management Plan.

*Monitoring element.*—Amount (number of acres) and quality (composition, structure) of available habitat and present wintering waterfowl populations. Annual water quality sampling related to suitability for SAV. Existing and proposed management prescriptions would be monitored to determine vegetation and waterfowl response.

**Subgoal 2.** Restore, protect and enhance habitats for black duck production.

**Objective 1.2.1.** Create an American Black Duck Initiative for the island refuges that would include a determination of existing black duck production, the factors affecting production, and the preferred nesting and brood habitat types by 2010.

*Basis of the objective.*—This objective also supports the goals of the Atlantic Coast Joint Venture, the North American Waterfowl Management Plan and the 1989 Chesapeake Bay Waterfowl Management Plan (updated 2000). Although many of the islands are thought to be locally important as black duck production areas, little quantitative data is available. Predator effects at both tree hammock and emergent marsh sites requires evaluation. Predation may be causing black ducks to nest in less than optimal habitats (e.g., black needlerush) which are prone to flooding. Habitat use during brood rearing, fall migration, and winter is presently unknown.

*Strategies to achieve the objective.*—Create an integrated approach to black duck research and management (Black Duck Initiative) for the island refuges. The initiative would focus research on questions regarding black duck production management. An initial strategy would be to determine black duck predator occurrence on the island refuges. Additional surveys would be conducted to determine present black duck nesting habitat use. An experimental predator removal program would be initiated to assess black duck productivity both before and after removal, and to document any changes in nesting habitat use.

Black duck habitat use during brood rearing, fall migration, and winter would be evaluated through a telemetry study. Nesting black duck females would be fitted with radio transmitters and tracked through the Summer, Fall, and Winter to determine habitat use and dispersal. In addition, experimentation with providing artificial nesting substrates in black needlerush and black duck nesting response would be undertaken.

Management strategies in this alternative could involve habitat restoration or manipulation. We would evaluate converting former dredged material disposal sites dominated by Phragmites to more desirable vegetative communities to promote black duck nesting, as well as creating nesting hammocks in needlerush dominated wetlands as a management alternative. We would protect breeding habitat through erosion control.

*Monitoring element.*—Amount (acres) and quality (composition, structure) of preferred nesting habitat and present breeding black duck population. Proposed management prescriptions (habitat manipulation, predator control) would be monitored to determine breeding black duck response.

**Objective 1.2.2.** Determine to what extent predators are limiting production of ground-nesting waterbirds by 2010.

*Basis of the objective.*—Preferred nesting habitat on the island refuges for ground-nesting waterbirds (e.g., black ducks, rails, and terns) occurs on the comparatively few upland hammocks scattered throughout predominately emergent wetland habitats (primarily on Martin NWR and Spring Island Satellite). Because hammocks can be easily targeted by mammalian predators such as red foxes and Norway rats, ground-nesting species may be driven into less desirable nesting habitats (e.g., black needlerush marsh). Birds forced into emergent marsh nesting then become susceptible to egg predation by fish crows and gulls. At present little is known as to the extent of predation, significance relative to production, or which predator species are the main culprits.

*Strategies to achieve the objective.*—A study would be designed by 2010 to assess gull, crow, Norway rat, and red fox populations and associated predation problems. The study would use black duck and clapper rails as the study species and compare control areas vs. areas where potential predators are removed. Effects on nest site selection and nest success would be compared between control and predator removal treatment sites. The study would also employ telemetry to assess bird movements during brood rearing, fall migration, and winter. Funding for a biotechnician and graduate students is included in this alternative.

*Monitoring element.*—Predator populations, and water bird nest site selection, production, and seasonal movements.

**Subgoal 3.** Restore, protect, and enhance habitats for designated species of Neotropical migrants identified for protection in the Partners In Flight Plan.

**Objective 1.3.1.** Determine suitable breeding habitat and population status for Henslow's sparrow, seaside sparrow, and sharptail sparrow by 2007.

*Basis of the objective.*—This objective generally contributes to the goals and objectives of the Region 5 priority list for the Partners In Flight Plan. Island and headland wetland habitats, particularly those occurring on Martin NWR and the Bishops Head Division, which includes Spring Island, have been identified as potential key areas for breeding Henslow's sparrow, seaside sparrow, and sharptail sparrow. Although suitable habitat occurs, present breeding use is unknown.

*Strategies to achieve the objective.*—The initial strategy would be to determine breeding bird distribution and habitat use on the three targeted refuge units. A baseline breeding bird survey, and subsequent annual survey would be established by the year 2007. Vegetation and hydrology data would be collected to determine preferred nesting habitat types. Data collected would be incorporated into a GIS breeding habitat mapping product. Based on data collected and a GIS assessment of existing conditions, objectives and more specific actions would be determined, and an operational plan prepared.

Management strategies in this alternative could involve habitat restoration, habitat manipulation, and protecting existing habitat values. Significance of human disturbance and predation on bird production would be assessed. Protection of breeding habitat would be provided through erosion control and invasive species management (primarily *Phragmites australis*).

*Monitoring element.*—Amount (number of acres) and quality (composition, structure) of available habitat and present breeding bird populations. Existing and proposed management prescriptions would be monitored to determine breeding bird response.

**Objective 1.3.2.** Provide suitable stop-over and resting habitat for Neotropical migrants and raptors on the forested islands by 2007.

*Basis of the objective.*—This objective also contributes to the goals and objectives of the Region 5 priority list for the Partners In Flight Plan. Martin NWR and the Watts Island and Barren Island Divisions have been identified as potential key migration and stop-over areas for migratory passerines, and raptors. In addition, large numbers of monarch butterflies are purported to use these offshore forested and shrub habitats. Although the islands are known to be used during migration, to what extent they are used is unknown.

*Strategies to achieve the objective.*—The initial strategy would be to determine Neotropical migrant distribution and habitat use on the three targeted refuge units. A baseline Spring and Fall Neotropical migrant survey and subsequent annual surveys would be established by the year 2007. Vegetation data would be collected to determine preferred habitat types and use by various species. Data collected would be incorporated into a GIS Neotropical migrant habitat mapping product. Based on data collected and a GIS assessment of existing conditions, objectives and more specific actions would be determined, and an operational plan prepared.

Management strategies in this alternative could involve habitat restoration, habitat manipulation, and protecting existing habitat values. Significance of human disturbance would be assessed. Protection of Neotropical migrant habitat would be provided through erosion control and forest pest management.



*Monitoring element.*—Amount (acres) and quality (composition, structure) of available habitat and present Neotropical migrant populations. Existing and proposed management prescriptions would be monitored.

**Subgoal 4.** Protect, enhance and create island habitats for colonial waterbirds.

**Objective 1.4.1.** Create 25 acres of colonial waterbird nesting habitat by 2010.

*Basis of the objective.*—With the exception of great blue heron and least tern, all heron and larid colonies occur on island sites. Most of the islands composing the island refuges have limited amounts of upland topography which can support vegetation suitable for shrub and tree nesting wading birds. Former dredged material disposal areas on Martin NWR exhibit elevations suitable for shrub and tree species growth, however Phragmites colonization precludes such species establishment. Many existing rookeries on Martin NWR occur on former dredged material disposal sites, which were naturally vegetated by desirable tree and shrub species before the expansion of Phragmites. More recent dredged material disposal sites have been colonized by monotypic stands of Phragmites, and do not represent nesting habitat.

*Strategies to achieve the objective.*—Through the use of aerial photography and interpretation, existing stands of Phragmites would be delineated and then ground-surveyed to determine suitability for tree and shrub establishment (e.g., elevations > highmarsh zone). We would use glyphosphate or another herbicide approved for estuarine applications to control Phragmites, with subsequent burning to remove dead, standing vegetation. After that, we would plant native shrub and tree species, such as hackberry, bayberry, and eastern red cedar.

Management would include preventive herbicide treatment and control around existing rookeries where Phragmites has invaded, but has not yet taken over the plant community. In addition, opportunities for creating additional tree and shrub hammocks through the beneficial use and placement of clean dredged material would be assessed. Wetland restoration and erosion control opportunities would prioritize sites where existing rookeries are in jeopardy from erosion.

*Monitoring element.*—Acreage and quality of shrub and hammock habitat suitable for colonial waterbird nesting.

**Objective 1.4.2.** Determine to what extent predators are limiting production of ground-nesting waterbirds by 2010.

*Basis of the objective.*—Preferred nesting habitat on the island refuges for ground-nesting waterbirds (e.g., black ducks, rails, and terns) occurs on the comparatively few upland hammocks scattered throughout predominately emergent wetland habitats (primarily on Martin NWR and Spring Island Satellite). Because hammocks can be easily targeted by mammalian predators, such as red foxes and Norway rats, ground-nesting species may be driven into less desirable nesting habitats (e.g., black needlerush marsh). Birds forced into emergent marsh nesting then become susceptible to egg predation by fish crows and gulls. At present, little is known about the extent of predation, its significance to production, or which species are the main predators.

*Strategies to achieve the objective.*—A study would be designed by 2010 to assess gull, crow, Norway rat, and red fox populations and associated predation problems. The study would use black duck and clapper rails as the study species and compare control areas to areas where potential predators have been removed. The effects on nest site selection and nest success would be compared between control and predator removal treatment sites. The study would also employ telemetry to assess bird movements during brood rearing, fall migration, and winter. This alternative includes funding for a biotechnician and graduate students.

*Monitoring element.*—Predator populations, and water bird nest site selection, production, and seasonal movements.

**Subgoal 5.** Provide habitats to support a diversity of migrating and nesting shorebirds, gulls, terns and allied species.

**Objective 1.5.1.** Protect, enhance and create foraging and nesting habitat for a diversity of migrating shorebirds, gulls, terns and allied species by 2012.

*Basis of the objective.*—The island refuges' habitats primarily comprise emergent estuarine wetlands, SAV beds, and upland shrubs and forest. Shorebird use, either for nesting or foraging, is concentrated in the less prevalent intertidal flats, beach, and bay dune habitats that fringe the islands. Many of these shorebird areas are being impacted by erosion, and as much as 50 feet a year of beach habitat is being lost.

Maryland DNR has an existing shorebird banding and brown pelican color marking program which includes colonies on the island refuges. This program needs to be expanded, with the Service taking a more active role.

*Strategies to achieve the objective.*—The USACOE maintains boating channels close to the island refuges. Maintenance dredging for navigation purposes often generates sandy dredged material suitable for intertidal flat, dune, and beach creation. Given the lack of suitable upland disposal sites in this portion of Chesapeake Bay, there is an opportunity to provide placement sites for purposes of shorebird habitat restoration.

The management strategy in this alternative would be to designate sites for beneficial uses of dredged material aimed at shorebird habitat creation or restoration. This can be done in conjunction with sites that are prioritized for erosion control. Habitat restoration would be funded through the USACOE, in consultation with the refuge. Habitats to be created would benefit other species such as nesting diamondback terrapins.

In addition to habitat restoration, this alternative includes generating funding to hire a biologist to work with the Maryland DNR banding and color marking program. Additional responsibilities of this position would include monitoring of these and other restoration programs on the refuge.

*Monitoring element.*—Shorebird population dynamics and distribution, fish and wildlife use, vegetation response, dredged material movement and topography changes over time, and invasive plant management.

**Subgoal 6.** Provide habitats to support estuarine habitat associated raptors.

**Objective 1.6.1.** Evaluate the efficacy of the artificial nesting program for raptors by 2008.

*Basis of the objective.*—Martin NWR, Spring Island, and Watts Island have played a pivotal role in the recovery of the formerly listed peregrine falcon (endangered), delisted in 1999. Four artificial nesting structures have fledged 56 peregrine falcons since 1986. Scientists involved in peregrine recovery have questioned the continued construction of peregrine nesting structures anywhere on the Delmarva peninsula. Translocations now are restricted to the Maryland and Virginia Piedmont, which, unlike Delmarva, are considered the species' former range.

Osprey populations plummeted in the 1950s due to eggshell thinning associated with the uptake of the pesticide DDT. Following the ban on DDT, osprey populations throughout Chesapeake Bay dramatically rebounded. Although natural nesting sites are limited on some of the refuges and divisions of the Refuge Complex and on Spring Island, this is not the case for most of the refuge or the watershed.

The installation and maintenance of osprey nesting platforms at Martin NWR has created the region's largest concentration of nesting osprey. Since 1980, the osprey have produced 850 fledglings. Ospreys readily use other structures: for example, channel marks or towers. Barn owls are another species of concern in Maryland that readily uses artificial nesting structures.

*Strategies to achieve the objective.*—We would maintain the existing peregrine falcon and osprey nesting structures on Martin NWR, Spring Island, and Watts Island; evaluate the existing natural nesting habitat on the other islands and determine whether an expansion of the artificial nesting structure program is justified in view of expanding osprey populations; evaluate whether to expand or simply maintain the peregrine falcon nesting structure program; and, evaluate the need for artificial structures for barn owls.

*Monitoring element.*—The population trends of ospreys, peregrine falcons, and owls within the range of the island refuges.

**Subgoal 7.** Accomplish applicable recovery objectives for Federal-listed species as outlined in recovery plans.

**Objective 1.7.1.** Conduct surveys and evaluate the feasibility of reestablishing a northeastern beach tiger beetle population by 2010.

*Basis of the objective.*—The northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) occurred historically in great swarms on beaches along the Atlantic Coast, from Cape Cod to central New Jersey, and along Chesapeake Bay beaches in Maryland and Virginia. Only two small populations remain on the Atlantic Coast. The subspecies occurs at more than 50 sites in the Chesapeake Bay region.

The tiger beetle is most vulnerable to disturbance in the larval stage, which lasts 2 years. Larvae live in vertical burrows, generally in the beach intertidal zone, where they are sensitive to destruction by high levels of pedestrian traffic, ORVs, and erosion control projects that allow the beach to become vegetated. Population recruitment seems to be hampered by a lack of both undisturbed beaches and of nearby populations as a colonizing source. Although suitable habitat appears to be available on Martin NWR and Watts Island, the occurrence of tiger beetles is unknown.

*Strategies to achieve the objective.*—The initial strategy would be to have all the islands with suitable habitat surveyed for tiger beetles; contracting university experts to conduct the survey would be necessary. If tiger beetles are found, we would implement management actions under the guidelines of the “Northeastern Beach Tiger Beetle Recovery Plan” (USFWS 1994), working with the Tiger Beetle Recovery Team. An opportunity may arise to create new tiger beetle habitat using sand generated by USACOE dredging projects in the vicinity of the islands. We would also assess the potential for translocating tiger beetles to natural and created beaches.

*Monitoring element.*—Monitor known populations and any additional populations that are discovered; evaluate human impacts.

**Objective 1.7.2.** Protect, manage, and conserve the existing bald eagle population by 2005.

*Basis of the objective.*—The bald eagle population in Chesapeake Bay has been Federal-listed as endangered since 1978. Eagle nesting occurs on Smith, Watts, and Barren Islands, and has been continuous on the islands in recent years. This success has been the result of protecting nests from human disturbance during the nesting season.

*Strategies to achieve the objective.*—We would continue to implement the guidelines in the “Bald Eagle Recovery Plan” (USFWS 1990). Regardless of the proposed delisting of the bald eagle, management at the island refuges would continue to focus on maintaining the existing eagle nesting sites and protecting them from disturbance.

*Monitoring element.*—The number of nesting bald eagles as determined by aerial surveys.

**Subgoal 8.** Restore, protect and enhance habitats for anadromous and interjurisdictional fish species.

**Objective 1.8.1.** Inventory anadromous and estuarine and inland interjurisdictional fisheries on the island refuges by 2010.

*Basis of the objective.*—The marshes of the islands are permeated with tidal creeks, which provide spawning, or feeding habitat for an abundance of finfish. The adjacent shallow and deeper waters support an extensive fishery stock, and commercial fishing industry. This productivity, in large part, is related to the extensive SAV beds associated with the island refuges. However, many colonial waterbirds nesting on the islands travel daily to the mainland for feeding. Why the birds elect to travel to the mainland, or whether forage fish stocks are less plentiful on and around the islands, is unknown.

*Strategies to achieve the objective.*—Our initial strategy would be to design jointly with our Fisheries Resources Office an inventory or study that would compare the waterbird forage base on mainland sites with island sites, in conformance with the Complex-wide Resource Inventory and Monitoring Plan. Using the study’s findings, we would define more specific actions regarding fish habitat management on and around the island refuges; and, implement the recommendations of the “Submerged Aquatic Vegetation Policy for the Chesapeake Bay and Tidal Tributaries” (Chesapeake Bay Program). Goal 2, below, covers SAV policy recommendations in more detail.

*Monitoring element.*—Approval of inventory plan.

**Subgoal 9.** Restore, protect, and enhance habitats for blue crab.

**Objective 1.9.1.** Where applicable, implement recommendations of the 1997 Chesapeake Bay Blue Crab Fisheries Management Plan by 2005.

*Basis of the objective.*—Tangier Sound is one of the most important soft-crab- and peeler-crab-producing areas in the Chesapeake Bay. The brackish waters associated with the island refuges exhibit this high production because of the extensive SAV beds within the interior tidal guts and surrounding shallow waters. Blue crabs (*Callinectes sapidus*) use the SAV beds during postlarval settlement, juvenile development, overwintering, and for protection during molting and soft shell phases of all size classes. In Tangier Sound SAV beds are composed of eel grass (*Zostera marina*) and widgeon grass (*Ruppia maritima*), and fall within the salinity range of invading postlarvae. Juvenile crab density is approximately 30 crabs per square meter in SAV, as compared to only one crab per square meter in unvegetated habitat.

*Strategies to achieve the objective.*—The SAV Workgroup of the Chesapeake Bay Program Living Resources Subcommittee recommended strategies for SAV protection and restoration to benefit blue crab postlarval settlement. The recommendations apply to the segment of the Chesapeake Bay that includes Tangier Sound. The island refuges would implement recommendations of the Chesapeake Bay Program Submerged Aquatic Vegetation Policy for the Chesapeake Bay and Tidal Tributaries. Goal 2, below, covers specific recommendations included in this policy.

*Monitoring element.*—Water quality parameters that would result in the restoration of SAV.

**Goal 2.** Maintain a healthy and diverse ecosystem with a full range of natural processes, natural community types, and the full spectrum of native plants and animals to pass on to future generations of Americans.

**Subgoal 1.** Control, eradicate, or manage injurious, invasive, and exotic species.

**Objective 2.1.1.** Eradicate the mute swan population on the island refuges by 2006.

*Basis of the objective.*—Mute swans are exotic, non-migratory birds that escaped into the Chesapeake Bay in 1962, and have reached an estimated population of 4,000. They are protected under Federal and State laws. On the island refuges, they are injurious to SAV and, because of their aggressive territorial behavior, displace nesting native colonial waterbirds. In 1993, mute swans destroyed the only black skimmer colony in the Chesapeake Bay and the State-listed least tern colony on Barren Island.

*Strategies to achieve the objective.*—The refuge would continue to participate on the Maryland Governor's Task Force on Mute Swan Management, and would support the mute swan management actions endorsed by the Atlantic Flyway Council, including:

4. State and provincial wildlife agencies, if they do not already have authority, should seek to gain authority over the sale and possession of mute swans and their eggs.
5. The sale of mute swan adults, young, or their eggs should be prohibited.
6. States should seek to eliminate all importing or exporting of mute swans without a special purpose permit issued by the state wildlife agency.
7. Mute swans captured due to nuisance complaints, sickness, or injury should be removed from the wild or be euthanized.
8. Egg addling programs, where feasible, should be encouraged.
9. Both state and Federal wildlife agencies should institute programs to prevent the establishment of or eliminate mute swans.
10. States and provinces should seek to make the mute swan an unprotected species if this is not already the case.
11. States should strive to manage mute swan populations at levels that would have minimal impacts on native wildlife species or habitats.

The island refuges have zero tolerance for mute swans, and would take appropriate actions to keep swans from becoming established on refuge lands. However, refuge staff do not control swans on State-owned waters.

*Monitoring element.*—Aerial surveys to determine overall and nesting distribution.

**Objective 2.1.2.** Reduce Phragmites below year 2000 levels by 2010.

*Basis of the objective.*—Phragmites (*Phragmites australis*) is a large, coarse perennial grass 1.5–4 m in height. While primarily found in brackish and freshwater wetlands where it grows at and above mean high water, the plant is also common in moist uplands and the dune systems of Atlantic coast barrier islands. Phragmites seeds profusely and spreads vegetatively by a vigorous system of rhizomes and stolons. Once established, the plant forms dense stands and may invade adjacent areas, crowding out more desirable wetland species and reducing the overall species diversity of the affected system. Some question whether phragmites is native, or whether a native and a more invasive exotic genotype exists. Phragmites often establishes itself in areas modified by human activity. A particular problem is its colonizing dredged spoil disposal areas.

*Strategies to achieve the objective.*—The primary strategy would follow management prescriptions recommended for creating colonial waterbird nesting habitat (goal 1, subgoal 4, objective 1). Where funding allows, we would also delineate, target, and control other areas where Phragmites occurs.

*Monitoring element.*—Phragmites distribution and trends

**Subgoal 2.** Protect, enhance, and restore natural diversity of communities and associated ecosystem processes on the island refuges.

**Objective 2.2.1.** By 2010, develop specific inventory, assessment, and management programs for species and community types identified as rare, sensitive, declining, or of special concern.

*Basis of the objective.*—The island refuges have a clear mandate to protect, manage, and restore habitats that support Federal- and State-listed rare or threatened species, and species of special concern. At present, we know very little about the occurrence of such species on the island refuges.

*Strategies to achieve the objective.*—Our most important need is to develop and implement the Complex-wide Resource Inventory and Monitoring Program. We would contract with experts at the Heritage Program, USGS–BRD, or universities for surveys for listed species and species which are uniquely difficult to detect. We would implement appropriate tasks identified in existing recovery plans for Federal- and State-listed species. With the development of the draft Forest Management Plan and the proposed Marshland Management Plan, opportunities would exist to evaluate the effects of management practices (e.g., TSI, prescribed fire) on species of concern.

*Monitoring element.*—Species diversity indices; species richness

**Objective 2.2.2.** Control erosion, and create and restore habitat, through the beneficial use of clean dredged material by 2005.

*Basis of the objective.*—The islands of the Chesapeake Bay constitute a unique ecosystem component that is rapidly being lost to erosion. New islands are not being formed due to the armoring of mainland shorelines, and the sediment loads generated are negatively affecting SAV. Shallow waters that formerly were island marsh and forest are characterized by a hard, laminar, mud clay bottom. Such bottom types do not support SAV, and support a comparatively depauperate benthic community. Targeting former fastland areas converted to shallow water minimizes resource tradeoffs associated with filling for wetland, beach, and upland restoration. Restored habitats can be constructed in such a fashion that benefits erosion control, while reducing sediment loads and turbidity.

*Strategies to achieve the objective.*—Using GIS, we would delineate and prioritize the most severely eroding shorelines. Then, we would assess boating channels near the island refuges for the feasibility or desirability of dredging and using the clean dredged material in other erosion control projects. Factors would include baseline conditions, habitat tradeoffs, grain size analysis, contaminants assessment, and distance from priority erosion control sites. In this alternative, we would keep the Susquehanna NWR within the Refuge System, and target it for habitat restoration using clean dredged material.

Throughout project planning, we would coordinate closely with the Baltimore and Norfolk Districts, USACOE, to ensure this approach to the beneficial use of dredged material meets the dual objectives of habitat restoration and navigability. Habitat restoration project types (e.g., wetland, upland, or beach) would be determined by existing site conditions, fetch, habitat tradeoffs, and resource priority. For example, if restoring the northeastern beach tiger beetle were the priority, erosion control would be minimal, in order to maintain or create an unvegetated beach to benefit the beetle. Where erosion control is the highest priority, we would focus on wetland restoration, in conjunction with offshore, segmented stone breakwaters.

In addition to restoring habitat, this alternative includes generating funding to hire a biologist, who would work in close coordination with the Corps, and to hire a biotechnician for monitoring plant, animal, and water quality responses. SAV restoration targeting would be a closely related priority.

*Monitoring element.*—Habitat response, topography (vertical and horizontal), fish and wildlife use, water quality improvements, SAV distributional changes, and acres restored.

**Subgoal 3.** Protect, restore, and enhance SAV habitats.

**Objective 2.3.1.** Restore SAV coverage to 1970s levels by 2020.

*Basis of the objective.*—Waters within and surrounding the island refuges support 16 percent of all SAV within the tidal portion of the Chesapeake. Although 13 principal species are distributed around the Bay, two are prevalent in the “Crabbing Capitol of the World”: eel grass (*Zostera marina*) and widgeon grass (*Ruppia maritima*). Widgeon grass grows in the shallowest water zone (< 3' MLW) and eel grass grows in the deeper shallow zone (3–6" MLW). Both species' water depth tolerances have been reduced by declines in water quality and subsequent reduction in the photic zone.



The Chesapeake Bay Program has targeted SAV as one of its highest priority living resources, because of the many ecological functions it serves: It provides shelter and nursery area for fish, crabs, invertebrates, and epiphytes; it has long been recognized as an essential food for certain waterfowl species; it removes nutrients and heavy metals from the water and sediment, removes suspended sediment and binds substrates; and, in dense beds, it dissipates wave energy and protects shorelines from erosion. SAV is also a barometer on the health of the Chesapeake Bay because its environmental requirements include good water quality that is low in suspended sediments, dissolved nutrients, and phytoplankton. For these reasons, the recent decline in SAV throughout the island refuges is alarming.

*Strategies to achieve the objective.*—We would implement the recommendations of the Chesapeake Bay Program Submerged Aquatic Vegetation Policy for the Chesapeake Bay and Tidal Tributaries (1989). These include:

- Protecting existing SAV beds from further losses due to increased degradation of water quality, physical damage to the plants, or negative disruption to the local sedimentary environment
- Setting and achieving regional water and habitat quality objectives that would result in the restoration of SAV through natural revegetation;
- Setting regional SAV restoration goals in terms of acreage, abundance, and species diversity considering historical distribution records and estimates of potential habitat.

Island refuges strategies can support these recommendations through erosion control and habitat restoration aimed at biodiversity (see goal 2, subgoal 2, objective 2, “Erosion Control and Beneficial Use of Dredged Material”). These strategies would decrease sediment loadings associated with island erosion. Maintaining adequate depths in boating channels decreases the likelihood of resuspension of channel bottom material by boat wakes and propellor wash. We would provide the USACOE with placement locations (presently in short supply) so channels can be dredged on schedule.

In other areas around the island refuges, fetch and wave energy may be the limiting factor for SAV recolonization. Again, working with the COE in looking at historical land mass and SAV records, we would delineate formerly quiescent shallow waters now exposed to higher wave energies. Those sites would not have a wetland, upland, or beach habitat restoration component, and could be prioritized for offshore breakwater construction by the COE. Breakwaters would be constructed to recreate quiescent shallow waters where they historically occurred. We would monitor wave energies, sediment changes, and SAV response before and after construction.

Alternative B also includes a water quality and SAV monitoring initiative to characterize baseline conditions and future SAV response to all management actions. Water quality and SAV monitoring would follow the protocols of the Chesapeake Bay Program SAV Workgroup. This alternative also includes funding to hire a biotechnician for data collection and analysis.

*Monitoring element.*—Water quality, sediment types, wave energy, bathymetry, and SAV distribution.

**Goal 3.** Create the most complete network of protected lands within the Chesapeake Bay watershed.

**Objective 3.1.** Implement strategies for the protection of the island refuges by 2020.

*Basis of the objective.*—Federal management of additional land on the islands would contribute to the resource conservation goals of a variety of international, national, and regional initiatives, including RAMSAR, IBA, NAWMP, and the “National Wetlands Priority Conservation Plan.” Management also supports objectives of the Chesapeake Bay Program Living Resources Subcommittee under specific workgroup recommendations for SAV, wetlands, waterfowl, and blue crab. Protecting land on the islands would also benefit private landowners on the mainland by preserving the barrier function of offshore islands.

*Strategies to achieve the objective.*—We would seek all opportunities to conserve, manage, and protect lands through a combination of easements, forging partnerships with landowners, and developing agreements with other entities having title and other land rights or interests in targeted areas of the watershed by 2020.

- Amend the 2005 appropriations bill for the Department of Defense to include wording that transfers Bloodsworth Island to the Service, should the Navy declare it excess real property.
- Secure management authority of South Marsh Island through a Cooperative Agreement or Memorandum of Understanding with the MD Department of Natural Resources, if amenable.
- Assist partners, including the states and the Chesapeake Bay Foundation, Inc., in developing an island protection plan as part of an ecosystem component.
- Acquire inholdings as they become available from willing sellers.

*Monitoring element.*—The implementation of the Resource Inventory and Monitoring Plan; and, the acquisition and maintenance of remote sensing or GIS layers.

**Goal 4.** Develop and implement quality scientific research, environmental education, and wildlife-dependent recreation programs that raise public awareness and are compatible with refuge purposes.

**Subgoal 1.** Encourage and provide opportunities for research by other agencies, universities, and other institutions, especially as they relate to the mission, management, and objectives of the island refuges.

**Objective 4.1.1.** Foster relationships with governmental entities, conservation groups, universities, and institutions and communicate the most critical research and management needs of the island refuges by 2005.

*Basis of the objective.*—Service policy encourages and supports research and management studies that provide data for making decisions on managing the island refuges. Research and monitoring are crucial to sound resource decisions and adaptive management.

*Strategies to achieve the objective.*—We would actively seek partnership opportunities, and would consider proposals for research in a variety of disciplines, including flora and fauna, public use, and cultural resources. All reports, surveys, and scientific papers generated would be made available to refuge staff and cataloged for future needs. The refuge would communicate and prioritize information gaps we seek to fill. Priority would be given to studies that contribute to the enhancement protection, use, preservation, and management of native fish and wildlife populations and their habitats and natural diversity. In addition to fish- and wildlife-oriented research, we would permit the use of island refuges lands for other investigatory scientific purposes when such use is compatible with the purposes, goals, and objectives of the refuges.

*Monitoring element.*—The number of partnership initiatives; the number of research projects; and the number of participants in each.

**Objective 4.1.2.** Provide adequate facilities and equipment and assess the need for building new facilities for use by researchers and refuge staff.

*Basis of the objective.*—The Middleton House on Martin NWR is the only facility now available to house researchers or as a base of operation for refuge staff. The existing structure is cramped, outdated, poorly insulated, and in need of new plumbing. The house also serves as a small visitor center. Better facilities and equipment would improve research, housing, and headquarters for the island refuges. Given the isolated location of Martin NWR, a self-sufficient research facility and base of operations is required for Service research and management activities.

*Strategies to achieve the objective.*—Renovate and enlarge the Middleton House and purchase new equipment to accommodate researchers, students, and refuge staff.

*Monitoring element.*—Adequacy of facilities and equipment.

**Subgoal 2.** Provide opportunities for environmental education and interpretation to meet the needs of refuge users.

**Objective 4.2.1.** By 2010, develop adequate facilities and equipment for environmental study and interpretation for the island refuges.

*Basis of the objective.*—The Middleton House, the current facility on Martin NWR, is woefully inadequate. No staff are available for environmental interpretation, and the few existing displays fail to capitalize on the human inhabitants' unique island culture, fishing and crabbing industry,

or the islands' crucial role in Chesapeake Bay ecology. An opportunity exists for the refuge to become a major destination for tourists visiting Smith Island. With an adequate facility, the refuge potentially could attract 60,000 refuge visitors per year. Siting a facility in the town of Ewell would ensure compatible use, and provide habitat restoration education possibilities.

*Strategies to achieve the objective.*—We would upgrade the visitor contact station at the Middleton House on Smith Island to provide new displays and material on the island refuges; provide office space with telephone, fax machine, computer, and copy machine; provide suitable furniture for second-floor lodging of interns and researchers; and upgrade plumbing and electrical systems. In addition to the strategies in alternative A, we would increase environmental education and interpretation activities.

In the town of Ewell, we would purchase suitable land near the Middleton House to build and manage an environmental education center that highlights island refuges ecology in partnership with the Chesapeake Bay Foundation, Inc. We would also build a kiosk at the Ewell ferry dock to provide directions and interpretive information, and develop exhibits and habitat restoration projects for the Middleton House and environmental education center.

*Monitoring element.*—The number, type, and location of facilities and programs; the response by refuge visitors (the number and types of visitors or groups).

**Objective 4.2.2.** By 2005, provide interpretation programs to enhance visitors' knowledge of the island refuges and refuge management, while providing an enjoyable refuge experience.

*Basis of the objective.*—Refuges provide opportunities for people to acquaint themselves with the Service and its range of activities at first hand. More importantly, through interpretation programs, facilities, and guided public use strategies, the Refuge System helps people understand their place in the environment. No staffing or programs currently exist for the island refuges to provide interpretation programs. Although staff from the Refuge Complex or Blackwater NWR could implement some of these programs, we need to create specific programs targeting the island refuges if the refuges are to achieve their education and recreation goals.

*Strategies to achieve the objective.*—We would develop a professional video on the island refuges and purchase other videos that apply to the refuges for use in the visitor center; develop a general leaflet and other self-guided leaflets and brochures; install signs where needed; develop additional new outdoor displays; develop at least one special event for the islands, and participate in Crisfield events; create a website and interactive computer information station..

We would hire an Outdoor Recreation Planner to provide the increased public use program activities, supervise interns, and conduct public education, interpretation, and outreach programs for the island refuges. We would develop a volunteer program for monitoring, education and interpretation programs, outreach, and maintenance at the island refuges; develop a friends group to create a small cooperative sales outlet for Federal passes, educational books and other items; seek funding, develop programs; and produce projects.

We would expand our outreach programs to reach an additional 15,000 visitors by incorporating summer programs that coincide with tour boats visiting the island refuges; develop an MOU with the Chesapeake Bay Foundation, Inc., to work together on environmental education and interpretation programs and events; develop an interpretive sea kayak trail among the islands, if compatible with refuge purposes. Upon completing a compatibility determination, we would develop an interpretive canoe or kayak trail on Martin NWR; and, provide guided interpretive estuarine tours for education groups during the spring and fall.

*Monitoring element.*—The number, type, and location of facilities or activities, and response by refuge visitors (the number and type of visitors or groups using each facility, location, or activity).

**Subgoal 3.** Provide opportunities for compatible wildlife-dependent recreation.

*Basis of the subgoal.*—The NWRSA identifies six priority wildlife-dependent recreational uses the Service must facilitate in the Refuge System: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. By providing the public with opportunities for those uses, we would increase public awareness, understanding, and appreciation of ecosystem functions and the benefits of ecosystem conservation to fish, wildlife, and people. Ultimately, these will contribute to the mission of the Refuge System.

**Objective 4.3.1.** By 2007 provide opportunities for wildlife observation and photography by 2005.

*Basis of the objective.*—During our scoping meetings, the public indicated its interest in having opportunities and facilities for wildlife observation and photography. Achieving this objective would provide the public an opportunity to view the relationships among resource management, living resources, and people.

*Strategies to achieve the objective.*—We would construct a wildlife observation trail or boardwalk on Martin NWR associated with the new environmental education center. The resources profiled would include waterfowl, water birds, and saltmarsh ecology. We would also build an observation tower and observation and photography blinds in suitable locations, and install a spotting scope. In cooperation with partners, we would conduct a needs assessment to determine the scope, extent, and compatibility of proposed additional facilities and programs.

*Monitoring element.*—The number, type, location, and response of refuge visitors user hours.

**Objective 4.3.2.** Provide safe and adequate fishing facilities and opportunities.

*Basis of the objective.*—The island refuges do not have jurisdiction over the shallow water interior to the islands, or shallow and deep waters surrounding the islands. The Service is not authorized to regulate fishing or other waterborne activities within the navigable waters of the State, or within areas where water bottoms are State-owned. Public access to fishing is by boat only, and people can fish anywhere, provided they have a boat. Given the vastness and complexity of the wetlands and waterways around Martin NWR, we consider boat rentals a

safety concern for the inexperienced boating public. Therefore, we propose no additional measures.

**Objective 4.3.3.** By 2006, provide opportunities for a high quality hunting program.

*Basis of the objective.*—Recognizing hunting as a traditional family-oriented form of recreation important in developing an appreciation of fish and wildlife, the public requested expanded hunting opportunities during our scoping meetings. Hunting currently is not allowed on any of the refuge islands, nor are we proposing to open any existing Service-owned island lands to hunting. However, should the Maryland DNR enter into an MOU with the Service for its management on South Marsh Island, existing state hunting opportunities and access would be maintained. The MOU would not require a compatibility determination for an existing state use.

*Monitoring element.*—The number and type of hunting experiences, and response of refuge visitors (number and type of visitors or groups participating in each hunt).

**Goal 4.** Ensure that the staffing, facilities, resource protection, and infrastructure necessary for plan implementation are developed.

**Objective 4.5.1.** By 2005, obtain base funding necessary to fund and maintain minimum staffing, facilities, and operational support of the island refuges.

*Basis of the objective.*—Only two full-time equivalencies (FTEs) are now funded for the island refuges. The proposed Refuge Complex staffing chart (see appendix G) identifies the minimum staffing level for these refuges. Staff are needed for basic resource inventorying and monitoring, and to ensure the use of the best science for management decisions. Additional biological and maintenance staff are needed to maintain intact and diverse ecosystems, recover endangered species, and to combat the effects of sea-level rise, land subsidence, and invasive species. Law enforcement officers are necessary to ensure the safety of visitors and resource protection. Critical needs exist in the public use programs to respond to expected high levels of visitation and the demand for opportunities for visitors to experience and appreciate wildlife. Existing equipment inventories are not sufficient to provide effective support to existing or additional staff.

Alternative B would require staff to effectively perform all identified public use, management, inventory, enforcement, and maintenance programs. The existing staff, equipment, and infrastructure for the Refuge Complex cannot manage the additional workload.

*Strategies to achieve the objective.*—We would obtain congressional, national, and regional support for base funding for approved RONS projects; obtain local community support for implementing programs, including expanding use of volunteers, partners, and interns to accomplish programs and projects; and, seek opportunities for collaborative funding projects.

*Monitoring element.*—The number of permanent full-time staff.

# **Alternative C. Maximum Public Use with No Habitat Management**

## **Introduction**

Alternative C differs markedly from alternative B, “Conservation Biology for Trust Species Diversity (Preferred Alternative),” which embodies active management and state-of-the-art conservation science to improve ecosystem, community, and species conditions. Alternative C relies more on merely monitoring the processes, whether natural or anthropogenic, that affect refuge lands and, in some cases, the succession of ecosystem and habitats in response to larger environmental forces acting on the landscape. Alternative C allows natural and anthropogenic forces to act upon the communities, habitats, and species within the Refuge Complex.

Alternative C maximizes our management for compatible public uses on the Refuge Complex, but narrows the emphasis and scope of our wildlife and resource management programs to those mandated by applicable Federal laws and other directives. For example, we would continue programs to conserve and protect waterfowl and other migratory birds, interjurisdictional fish species, and species Federal-listed as “endangered,” “threatened,” or “species of concern,” but would not design or implement other programs specific to a variety of species, habitats, or ecological processes that had not formally been mandated by the laws and other directives that govern the missions of the Service and the Refuge System.

## **Blackwater National Wildlife Refuge—Alternative C**

### **Concepts Used for Developing Alternative C**

**Land Protection.**—Blackwater NWR would continue to acquire or otherwise cooperate in protecting an additional 31,314 acres within the boundaries of the approved LPPs approved by the Director on July 17 and July 25, 1995, respectively. Our land protection program would build upon and enhance our partners’ efforts.

**Fish, Wildlife, and Habitat Management.**—We would not initiate significant new inventorying and monitoring, except as required by mandates on Federal trust species. The Complex-wide Resource Inventory and Monitoring Program would still operate, but at a much narrower focus than in alternative B. More distinctly, refuge staff would conduct no research programs. We would permit compatible research programs requested by other entities on refuge lands, but would not directly support them.

We would not develop or implement programs to address the effects of invasive, injurious, or exotic species. We would not address sea-level rise, land subsidence, water quality impacts, or other known or suspected anthropogenic impacts. We would not emphasize active intervention,

restoration, or intensive manipulation of ecosystems, processes, habitats, or species unless, in our best professional judgment, inaction would result in catastrophic consequences to Federal trust resources.

**Public Use.**—Our management of public use would facilitate a greater level of all aspects of public use than in either alternative A or B. We would expand Blackwater NWR public use by redirecting station management resources to those programs. Public use would become the highest priority. We would provide as many fishing, hunting, environmental education, interpretation, wildlife observation, and wildlife photography opportunities as administratively and logistically possible while remaining compatible with refuge purposes and the mission of the Refuge System. We would allow maximum access on all lands where compatible, and facilitate and schedule training and volunteer programs to the maximum extent practicable. Public uses will not interfere with important nesting or wintering seasons of listed species. No public use activities will be permitted where public safety or trust resources are adversely affected.

The refuge would develop more, improved environmental education, interpretation, and wildlife-dependent recreation facilities, programs, and activities. We would enhance environmental education and interpretation by developing additional programs, an environmental education manual, and teachers' workshops; building an environmental education center; remodeling and enlarging existing structures; building additional information kiosks, observation sites, interpretive trails, photography blinds and observation decks; and, expanding opportunities to hunt.

## Goals, Objectives, Strategies, and Monitoring Elements in Alternative C for Managing Blackwater NWR

**Goal 1.** Protect Service trust resources and other species and habitats of special concern

**Subgoal 1.** Protect habitats to contribute to Maryland's wintering waterfowl populations of Atlantic Population(AP) Canada geese, snow geese, and dabbling ducks.

**Objective 1.1.1.** Implement surveys to monitor wintering waterfowl populations by 2005.

*Basis of the objective.*—Blackwater NWR is managed primarily for wintering waterfowl. Since 1955, 6 percent [SE = 0.6, n = 44] of Maryland's Canada goose, snow goose, and dabbling duck populations counted during the annual Midwinter Waterfowl Inventory have been on Blackwater NWR. To support the objectives of the NAWMP, the Chesapeake Bay Program Waterfowl Management Plan (2000), and Maryland's Canada Goose Management Program, the refuge must maintain a credible waterfowl monitoring program.

*Strategies to achieve the objective.*—Blackwater NWR would continue to conduct three surveys of wintering waterfowl populations at three different spatial scales. The Midwinter Waterfowl



Inventory (MWI) would be flown once annually, supplemented by bimonthly aerial surveys of the refuge and weekly ground counts of the impoundments, croplands, and adjacent river.

*Monitoring element.*—The number of surveys conducted.

**Objective 1.1.2.** Eliminate the management of MSU and cropland by 2009.

*Basis of the objective.*—MSU and adjacent croplands are the most intensively managed areas on Blackwater NWR, representing 4 percent of the total refuge acreage. In alternative C, the refuge would no longer create, maintain, or manage these lands.

*Strategies to achieve the objective.*—Existing MSU and adjacent croplands would be allowed to degrade and, consequently, to naturally revegetate or erode. The only exception would be the Wildlife Drive and its supporting dike, as it provides critical access for photography, wildlife observation, environmental education, and interpretation.

*Monitoring element.*—The cessation of maintenance and management activities.

**Objective 1.1.2.** Protect natural nesting habitats for wood ducks by 2005.

*Basis of the objective.*—The wood duck is a National Species of Special Emphasis. Blackwater has historically contributed to local and regional populations of wood ducks by maintaining 5,000 acres of palustrine wetlands.

*Strategies to achieve the objective.*—The refuge would continue to maintain 5,000 acres of palustrine forested wetlands, and this acreage would increase as new lands are acquired. We would eliminate the existing wood duck nest boxes, except for 15 that we would maintain for environmental education along the Wildlife Drive. Fall brood surveys and roost counts would be conducted as described in alternative A.

*Monitoring element.*—Acreage of palustrine forest maintained.

**Subgoal 2.** Protect habitats that support Neotropical migratory songbirds, emphasizing forest interior dwelling (FID) species.

**Objective 1.2.1.** Provide large, contiguous forest tracts by 2020.

*Basis of the objective.*—Blackwater NWR contains much of the large, contiguous tracts of forested land remaining on the Delmarva Peninsula. Twenty-five species of forest interior dwelling birds (FIDs) potentially breed in the Mid-Atlantic coastal plain (see “A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area,” June 2000). Twenty of the 25 species are Neotropical migrants: species that nest in temperate North America and winter in Central and South America. The cerulean warbler, veery, and black-throated green warbler were eliminated from this list because they are unlikely to breed on Blackwater NWR (H. Armistead, D. Dawson, J. McCann, pers. comm). Consequently, twenty-

two of these FIDs potentially breed on Blackwater NWR, and the breeding forest bird surveys during the past 5 years have documented 20 species (see chapter 3).

Robbins, et al. (1989:28) suggest that, ideally, management should provide the highest probability of providing for the least common species in the forest ecosystem. Partners in Flight has recognized eight of the FID species as “globally significant” (PIF score >21). Eleven of the 22 FIDs are highly area-sensitive; that is, they seldom occur in small, heavily-disturbed or fragmented forests. These species are most vulnerable to forest loss, fragmentation, and overall habitat degradation and, consequently, are the ones that the Refuge Complex has targeted. Most are rare or uncommon on the Maryland coastal plain, and many have highly specialized breeding habitat requirements. In fact, two of these species, broad-winged hawk and brown creeper, were only recently recognized as breeders on the Maryland coastal plain (Robbins and Blom 1996).

According to “A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area” (June 2000), a forest tract is considered to be at least marginal FIDS habitat if either one of two conditions are satisfied: (1) at least four of the 22 species are present with a probable or confirmed breeding status or (2) at least one of the 11 area-sensitive species is present with probable or confirmed breeding status.

Based on Robbins, et al. (1989) and the literature reviewed in Bushman and Therres (1988), a minimum patch size of 400 acres of mature forest provides potential breeding habitat for at least five of the 11 highly area-sensitive FIDs: Kentucky warbler, worm-eating warbler, hooded warbler, American redstart, and barred owl. In addition to these five area-sensitive species, 400 acres would provide potential breeding habitat for 10 other FID species, or 15 species, total. As a minimum habitat objective, it ensures that forested habitat on Blackwater NWR will exceed the definition of marginal FID habitat established in “A Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area” (June 2000). Conversely, an ideal patch size of 865 acres would provide potential breeding habitat for all 11 area-sensitive species, and all but one (northern parula) of the more tolerant FID species.

*Strategies to achieve the objective.*—Blackwater NWR would seek opportunities to protect these species' habitats through a combination of land acquisition and forging partnerships with adjacent landowners. The primary strategy to achieve this objective would be continued acquisition of forested habitats. Habitat mapping, inventorying, and monitoring programs would be employed to establish status and trend information, and habitat health and quality. Because of the patterns of land ownership and use within the focus area (LPPs), we would acquire other lands, as well (e.g., agricultural fields, converted PC wetlands, wetlands, and marsh).

We would allow natural succession to establish additional forested habitats over time, which will help achieve the objective and subgoal outlined above. We would employ remote sensing techniques using digital orthophotography to identify large contiguous forested or previously forested tracts of land within the approved LPPs for Blackwater NWR. Acquiring the most recent and technologically advanced aerial imagery of lands in and around the Refuge Complex and maintaining and managing a state-of-the-art Geographic Information System would prove invaluable in protecting these Federal trust resources and their habitats.

Wildfire prevention will play a vital role in protecting forest viability. All wildfires that occur on or near refuge lands would be promptly contained and extinguished.

*Monitoring element.*—The number of acres in Federal ownership. The number and size of contiguous forest patches in Service ownership.

**Objective 1.2.2.** Monitor migratory and breeding populations of Neotropical migrant songbirds with special emphasis on FIDs by 2006.

*Basis of the objective.*—Monitoring the status and trends of these resources would support the objectives of the Partners in Flight “Mid-Atlantic Bird Conservation Plan.” A refuge-wide breeding bird survey has been conducted for the past 5 years. Surveys reveal that populations of globally and regionally significant birds occur on Blackwater NWR. We expect those populations to increase as we provide more contiguous forest habitat. No habitat-correlated population surveys for FIDs have been conducted on these lands.

*Strategies to achieve the objective.*—As we acquire lands, we would initiate baseline population and habitat monitoring. Their frequency and protocol would likely follow those already established in the Refuge Complex Resource Inventory and Monitoring Program and other programs (e.g., North America Breeding Bird Survey Program). When appropriate, species-specific population and habitat objectives may be needed. We would tier the specific goals and objectives for these species off existing plans and initiatives, and would embody relevant conservation science and management issues (human disturbance, providing high-quality habitats which meet life requirements, disease monitoring, population monitoring or trends, life history or managed-related research). We would incorporate the data collected into GIS technology.

*Monitoring element.*—The number of surveys.

**Subgoal 3.** Protect habitats to support migrating shorebirds and marsh and water birds.

**Objective 1.3.1.** Protect 7,000 acres of estuarine emergent marsh and open water habitat by 2005.

*Basis of the objective.*—Blackwater NWR now supports almost 7,000 acres of estuarine emergent marsh. Since its establishment in 1933, the refuge has lost nearly 7,000 acres of emergent wetlands. Much of this loss occurred in the three-square bulrush marsh at the confluence of the Little Blackwater and Blackwater Rivers, but is now progressing upstream and down. The unusually high rate of loss likely results from several compounding factors, including sea-level rise, land subsidence, saltwater intrusion, severely modified hydrology, and excessive herbivory.

The open water that has displaced the lost wetlands is used now primarily by waterfowl as a disturbance-free rest area during migration and in winter, and by resident AP Canada geese as a safe place to molt during the summer. Emergent marsh provides breeding habitat for several species, primarily, spotted sandpipers, willets, and common snipe. At low tide, these habitats provide shallow pools and mudflats for a number of migrants, most commonly, greater and lesser

yellowlegs, semipalmated sandpipers, least sandpipers, white-rumped sandpipers, dunlins, semipalmated plovers, killdeers, egrets, and herons.

*Strategies to achieve the objective.*—We would minimize the human disturbance of shorebirds, marshbirds, and waterbirds by prohibiting public entry and boating from October 1 through April 1. Large areas of mudflat and shoreline that are exposed at low tide would be identified and a new boat survey would be initiated to evaluate the significance of these sites to spring migrants. Loss of wetlands would be monitored with remote sensing (hyperspectral imagery, aerial photos) and GIS. Continued strategic land acquisition is essential to mitigate (offset) marsh loss.

*Monitoring element.*—Acres of estuarine emergent marsh and tidal mudflats; boat survey of spring migrant populations at selected sites.

**Objective 1.3.2.** By 2007, implement marsh and waterbird habitat and population monitoring programs.

*Basis of the objective.*—This objective contributes to the goals and objectives of the Region 5 priority list for the Partners in Flight Plan and the North American Colonial Waterbird Conservation Plan 2000. The Nanticoke River corridor is one of the last relatively intact riverine systems remaining on the Delmarva Peninsula. Approximately 41 percent of the watershed is forested, with most of that area occurring in the lowlands (e.g., riparian and floodplain forests) along the river and its tributaries. Large expanses of emergent wetland and mudflat habitats also exist within the focus areas.

No information exists on marsh and waterbird use and distribution within the watershed, with the exception of the locations of known rookeries. We expect regionally significant populations to occur, especially great blue heron, green backed heron, black-crowned night-heron, little blue heron, great egret, or snowy egret, as extensive habitats that offer breeding, feeding and sheltering areas are present.

*Strategies to achieve the objective.*—We would initiate baseline population and habitat monitoring as lands are acquired; we would coordinate habitat monitoring with the North American Colonial Waterbird Conservation Plan participants and other partners as needed. There would be no management activities and programs to manipulate, create, or otherwise manage habitats or water levels for these species.

*Monitoring element.*—Acreage in Federal ownership; distribution and use of habitat by marshbirds and waterbirds.

**Objective 1.3.3.** Protect existing marsh and waterbird rookeries and roost sites as lands are acquired.

*Basis of the objective.*—Protection and management of rookeries and significant roost sites (e.g., >10 birds of any species) support the goals and objectives of the Region 5 priority list for the Partners In Flight Plan and the North American Colonial Waterbird Conservation Plan. At

least four documented heron rookeries occur in the Nanticoke watershed; the largest is 200 breeding pairs.

*Strategies to achieve the objective.*—We would conduct surveys during the year to identify and map breeding and roosting sites; provide sanctuaries and appropriate buffer zones around rookeries as they are discovered; ensure that programs for wildlife-dependent recreational opportunities anticipate this resource and are designed to eliminate or minimize the potential for human disturbance. Working in partnership with State and other entities, we would assess the effects of boat traffic from the Nanticoke River.

*Monitoring element.*—Wetland habitat acreage inside and outside sanctuaries by season; distribution and use of habitat by marshbirds and waterbirds.

**Subgoal 4.** Provide habitats to support raptor species diversity.

**Objective 1.4.1.** Protect habitats for raptors by 2005.

*Basis of the objective.*—The forests on Blackwater NWR are the most extensive and contiguous that remain on the Maryland coastal plain. Raptors that frequent forests on the refuge include several that the Partners in Flight draft “Mid-Atlantic Coastal Plain Bird Conservation Plan” considers priority species. Red-shouldered hawks (*Buteo lineatus*), broad-winged hawks (*Buteo platypterus*), and barred owls (*Strix varia*) require large forest tracts (> 250 acres), and are known to breed on the Maryland coastal plain (Robbins and Blom 1996). The draft “Guide to the Conservation of Forest Interior Dwelling Birds in the Chesapeake Bay Critical Area” considers these species highly area-sensitive. The Partners in Flight draft “Mid-Atlantic Coastal Plain Bird Conservation Plan” specifically recommends monitoring these species and Cooper's hawk.

In addition to forested habitats, Blackwater NWR provides almost 7,000 acres of estuarine emergent marsh. Ospreys, northern harriers, and peregrine falcons, all priority species in the Partners in Flight draft “Mid-Atlantic Coastal Plain Bird Conservation Plan, depend on this habitat for at least part of their needs.

*Strategies to achieve the objective.*—Strategies include maintaining large, contiguous stands of mature forest, primarily through continued strategic land acquisition. This is essential to mitigate wetland loss and to reduce the patchiness of existing forest.

*Monitoring element.*—Continue the annual forest breeding bird survey, emphasizing techniques for assessing raptor populations.

**Subgoal 5.** Participate in recovery plan objectives and other management activities for Federal-listed species.

**Objective 1.5.1.** Accomplish recovery tasks for DFS by 2015.

*Basis of the objective.*—The main thrust of the DFS recovery program is to protect occupied habitats and re-establish populations in previously occupied areas. DFS population or habitat surveys on Blackwater NWR have been limited to two benchmark sites. The refuge has significantly more forest habitat known to be occupied by DFS.

*Strategies to achieve the objective.*—First, we must complete a more detailed assessment of potential DFS habitats and, at a minimum, conduct presence or absence surveys to ascertain the percentage of occupied versus potentially occupied habitats. Preferably, we would conduct more extensive mark–recapture studies in all forested habitats, as part of the Complex-wide Resource Inventory and Monitoring Program, to determine current population status and possible trends.

We would implement these additional monitoring or research elements on refuge lands:

- Describe the habitat use and requirements of populations within the DFS current natural range;
- Develop an integrated habitat protection strategy using remote-sensing procedures and geographic information systems;
- Field test and define applications for the habitat suitability model;
- Map available habitat;
- Protect the DFS and its habitats; and
- Monitor current and potential threats to the DFS or its habitat.

*Monitoring element.*—Progress in achieving recovery plan objectives.

**Objective 1.5.2.** Provide large, contiguous forested tracts for DFS by 2020.

*Basis of the objective.*—The primary basis is to significantly improve the likelihood of down-listing or delisting the species. The refuge would significantly contribute to this objective by protecting occupied and potentially occupied habitat within the DFS historical range and providing additional distribution data. This objective supports the DFS Recovery Plan focus on ensuring the long-term availability of habitats needed to maintain natural populations, and ensuring the long-term continuance of a stable or expanding population throughout a significant portion of the DFS historic range.

*Strategies to achieve the objective.*—One of the main thrusts of the DFS recovery program is to protect occupied habitats. Blackwater NWR continues to maintain or enhance habitats that support the largest naturally occurring remnant populations of DFS. Strategies include acquiring land, remote sensing to identify large contiguous patches of mature forest, and monitoring DFS populations.

*Monitoring element.*—The number of acres in Federal ownership; the number and size of contiguous forest patches in Federal ownership; the number of DFS living there.

**Objective 1.5.3.** Protect bald eagle nesting and wintering habitats by 2005.

*Basis of the objective.*—The bald eagle (*Haliaeetus leucocephalus*) population of Chesapeake Bay has been Federal-listed as endangered since 1978. As the most significant nesting area north of Florida on the Atlantic Coast, Blackwater NWR has played a major role in this species' recovery. Nesting pairs on the refuge have increased from 3 in 1978 to as many as 14 in 1997, and almost 300 eaglets have been produced in the past 15 years. Nests on Blackwater NWR have been the source for several translocation efforts in New Jersey and elsewhere. Midwinter Bald Eagle Surveys during the past 5 years indicate that at least 150 bald eagles winter on the refuge.

*Strategies to achieve the objective.*—Following the guidelines in the recovery plan (USFWS 1990) and in “Bald Eagles in the Chesapeake: A Management Guide for Landowners” (National Wildlife Federation 1985), we would continue to monitor winter roost sites and nest sites and protect them from human disturbance. We would maintain an inviolate sanctuary encompassing 11,270 acres of water and marsh, by prohibiting public entry and boating from October 1 through April 1. Refuge biological staff would continue to support two annual surveys sponsored by the Maryland DNR, the Midwinter Bald Eagle Survey in January, and aerial nest surveys from December–March. Staff would continue periodic roost counts, and investigate the status of suspected new roost sites. Blackwater NWR would also continue to be a translocation source for other states, as needed. We would implement the applicable management recommendations in the delisting package.

*Monitoring element.*—The numbers of nesting and wintering bald eagles, as determined by the aerial surveys and the Midwinter Bald Eagle Survey.

**Objective 1.5.4.** Determine the occurrence of the Federal-listed swamp pink, sandplain gerardia, and sensitive joint-vetch on Blackwater NWR by 2006.

*Basis of the objective.*—The swamp pink (*Helonias bullata* L.; G3/S2), Federal-listed as threatened in 1988, is an obligate wetland perennial that occurs along streams and seepage areas in freshwater swamps and other wetland habitats. Swamp pink is known to exist in areas of Dorchester County and, possibly, on Blackwater NWR.

The sensitive joint-vetch (*Aeschynomene virginica*; G2/S1) is an annual legume that occurs in fresh to slightly brackish tidal river systems. In 1992, because of its limited distribution, it was Federally listed as threatened. On the Eastern Shore, populations of *A. virginica* occur on Manokin Creek in Somerset County, and historic populations (before 1910) have occurred on the Nanticoke River in Wicomico County. Where *A. virginica* has been found in Maryland, it has been associated with *Echinochloa* sp., *Spartina cynosuroides*, *Polygonum* sp., *Juncus* sp., and *Hibiscus moscheutos*, although the substrates have been sparsely vegetated; e.g., muskrat “eat-outs” (USFWS 1995). These are certainly habitat conditions that exist on riparian areas of Blackwater NWR. We need to determine whether sensitive joint-vetch occurs on the refuge.

The sandplain gerardia (*Agalinis acuta*) was listed as endangered in 1991. In Maryland, one population on protected state lands occurs on the Western Shore. The Nature Conservancy identifies this species as potentially occurring in the focus areas (“Nanticoke River Bioreserve Strategic Plan,” 1998), but no comprehensive surveys have been conducted for this species.

*Strategies to achieve the objective.*—As part of the Complex-wide Resource Inventory and Monitoring Program, we would aggressively search for Federal- and State-listed flora, particularly swamp pink and sensitive joint-vetch, within the boundaries of Blackwater NWR. We would contract with experts from the State Heritage Program or universities to conduct botanical surveys. Using applicable tasks from the USFWS recovery plans (USFWS 1991, 1995), we would closely coordinate with the State Heritage Program the conservation and management of any listed species identified.

*Monitoring element.*—Completion of the baseline inventory or botanical surveys.

**Subgoal 6.** Protect habitats for anadromous and interjurisdictional fish.

**Objective 1.6.1.** Inventory anadromous and estuarine or inland interjurisdictional fisheries on the Blackwater and Nanticoke rivers and their tributaries by 2008.

*Basis of the objective.*—The Blackwater River watershed historically provided nursery and spawning habitat for striped bass (*Morone saxatilis*), white perch (*Morone americana*), river herring (*Alosa pseudoharengus*, *A. aestivalis*), American eel (*Anguilla rostrata*), hickory shad (*Alosa mediocris*), American shad (*Alosa sapidissima*), and gizzard shad (*Corosoma cepedianum*). Other species of concern that likely occur in the watershed include mud sunfish (*Acantharchus pomotis*; G5/S2) and black-banded sunfish (*Enneacanthus chaetodon*; G4/S1). Turbid waters, due to marsh loss and frequent saltwater intrusion in recent years, have greatly reduced the quality of aquatic habitats. A fishery resource inventory is required to determine the current status and abundance of species.

*Strategies to achieve the objective.*—In cooperation with the USFWS Fisheries Resource Office and other partners, we would conduct an initial survey to determine the occurrence and relative abundance of those species in the Little Blackwater and Blackwater Rivers. We would focus on anadromous species, coastal migratory species identified in the Atlantic Coastal Fisheries Cooperative Management Act of 1993, and species for which the Fisheries Management Workgroup of the Chesapeake Bay Program has developed fishery conservation plans. Based on the outcome of that inventory, monitoring selected populations may be warranted.

*Monitoring element.*—Completion of the survey.

**Objective 1.6.2.** Establish a long-term program to monitor salinity and other water quality parameters at selected sites in the Blackwater, Little Blackwater, and Nanticoke rivers by 2005.

*Basis of the objective.*—Blackwater NWR has routinely monitored salinity and other parameters to document the water quality degradation that may be contributing to marsh loss on the refuge. The current protocol involves discrete sampling of salinity, temperature, pH, dissolved oxygen,



and hydrogen sulfide at 10 sites on the Blackwater, Little Blackwater, and Nanticoke rivers every 2 weeks.

However, because many factors, such as tidal variation and storms, confound the interpretation of these data, this monitoring regime poorly describes long-term trends, and fails to accurately quantify the extent of saltwater intrusion. A more rigorous monitoring program is needed, one that not only would provide more meaningful background levels of water quality parameters, but also would allow continuous sampling to capture extreme saltwater intrusion events.

*Strategies to achieve the objective.*—We would deploy real-time monitoring equipment, capable of sampling diel variation in salinity and other water quality parameters (e.g., Hydrolab Surveyor II™ with data loggers), at four permanent water quality sites: on Blackwater River below Stewart's Canal and Goose Dam; at the confluence of the Little Blackwater and Blackwater Rivers; at the mouth of the Blackwater River near Fishing Bay; and, on the Little Blackwater River adjacent to the boathouse. Monitoring these sites would provide adequate background data for assessing changes in salinity, temperature, pH, dissolved oxygen, hydrogen sulfide, conductivity, light penetration, and turbidity. We would also establish a permanent tide gauge on the Little Blackwater River, adjacent to the Blackwater Field Station, and determine monitoring sites on the Nanticoke River.

*Monitoring element.*—The number of monitoring stations and the applicability of data.

**Goal 2.** Maintain a healthy and diverse ecosystem, with a full range of natural processes, natural community types, and the full spectrum of native plants and animals to pass on to future generations of Americans

**Subgoal 1.** Allow populations of injurious, invasive, and exotic species to increase or decline without human intervention.

**Objective 2.1.1.** Monitor the abundance and distribution of injurious, invasive, and exotic species on Blackwater NWR by 2007.

*Basis of the objective.*—The injurious, invasive, or exotic species listed below impact Blackwater NWR and other lands within the study area (for background information on their effects on resources, see alternative B, Blackwater NWR, goal 2, subgoal 1).

1. Nutria (*Myocastor coypus*);
2. Resident AP Canada goose (*Branta canadensis*);
3. Mute swan (*Cygnus olor*);
4. Gypsy moth (*Lymamtria dispar*);
5. Common reed (*Phragmites australis*);
6. Purple loosestrife (*Lythrum salicaria*);

7. Johnsongrass (*Sorghum halepense*); and
8. Canadian thistle (*Cirsium arvense*).

*Strategies to achieve the objective.*—We would continue to survey injurious, invasive, or exotic species on current and newly acquired lands, and expand current surveys to be more inclusive and scientifically or statistically valid. We would implement additional surveys, as needed. We would incorporate monitoring protocols into the Complex-wide Resource Inventory and Monitoring Program, to ensure that our continued monitoring of population status, trends, and impacts will provide, at a minimum, baseline information to be used by other land managers.

*Monitoring element.*—The number of surveys and the applicability of data.

**Subgoal 2.** Protect the natural diversity of communities and associated ecosystem processes in the Blackwater and Nanticoke watersheds.

**Objective 2.2.1.** By 2009, develop specific inventory and assessment programs for rare, sensitive, and declining species, species of special concern, and rare or unique community types.

*Basis of the objective.*—The Maryland and Delaware Natural Heritage Programs have documented more than 200 plant species and almost 70 animal species categorized as biologically significant, e.g., The Nature Conservancy designations G1 through G5, and S1 through S3 in the Nanticoke River watershed (see appendix E, “Rare Species in the Nanticoke River Watershed”). The Nature Conservancy also has identified high quality examples of several globally and nationally unique types of communities, including Xeric Dunes, Atlantic White Cedar Swamps, Coastal Plain Ponds (e.g., Carolina Bays or Delmarva Bays), Rich Woods, Coastal Plain Bogs, and Wet Meadows.

Blackwater NWR has a clear mandate to protect, manage, and restore habitats that support listed species, as well as migratory birds. Numerous rare, threatened, or endangered plants or animals occur within the Blackwater and Nanticoke rivers watersheds. The Maryland Natural Heritage Program has designated two sites within the refuge as Maryland Natural Heritage Areas: the Upper Blackwater River and Gum Swamp.

*Strategies to achieve the objective.*—Our most important need is to develop and implement the Complex-wide Resource Inventory and Monitoring Program, to help determine the occurrence and distribution of flora and fauna on the Refuge Complex. We would contract with experts at the Heritage Program, USGS–BRD, or universities, for surveys of listed species and species that are uniquely difficult to detect. We would implement the appropriate tasks identified in existing recovery plans for Federal- and State-listed species.

*Monitoring element.*—Species diversity indices; species richness

**Objective 2.2.2.** Implement a Wetland Monitoring Program by 2008.

*Basis of the objective.*—The need to develop a Wetland Monitoring Program is critical, because of the significant loss of marsh, the need to preserve community diversity, the increasing

numbers of invasive and exotic species, the large number of threatened and endangered species, and the contribution of the refuge estuarine wetlands to the Chesapeake Bay ecosystem. Blackwater NWR sustains the northernmost expanse of three-square bulrush. The refuge also continues to maintain tremendous wetland diversity; more than 30 percent of its land lies within two Maryland Natural Heritage Area sites, the Upper Blackwater and Gum Swamp (see objective 2.2.1., above). Federal-listed sensitive joint-vetch (*Aeschynomene virginica*; G2/S1) and State-listed rare skippers (*Problema bulenta*; G2/G3/S1) almost certainly occur within the estuarine marshes of Blackwater NWR. We must develop a comprehensive Wetland Monitoring Program, to locate and conserve these species and this diversity..

*Strategies to achieve the objective.*—The Wetland Monitoring Plan must include a significant monitoring component, due to the dynamic history of the marsh and the planned restoration strategies. LIDAR technology could be used to create fine-resolution Digital Elevation Models (DEMs) to provide an accurate elevation map of the refuge, critical for strategic land acquisition.

Relative Elevation Modeling (REM) would allow the refuge to predict the rate of wetland loss due to sea-level rise and land subsidence. Landscape modeling of habitat change would link the refuge GIS data and wetland ecosystem process models; this would help us predict specific wetland areas that are likely to be lost. We need to monitor the current rates of wetland elevation change and sedimentation to understand current accretionary dynamics and the impact of different management practices.

*Monitoring element.*—Classification of hyperspectral imagery; funding and completion of a DEM and REM; and, approval of the Wetland Monitoring Plan.

### **Goal 3.** Create the most complete network of protected lands within the Chesapeake Bay watershed

**Subgoal 1.** Strategic growth and protection of Blackwater NWR.

**Objective 3.1.1.** By 2020, protect 31,314 acres of additional land described in appendix J, “Land Protection Plan.”

*Basis of the objective.*—Protecting these lands would contribute to the resource conservation goals of a variety of international, national, and regional initiatives, including RAMSAR, IBA, NAWMP, and the National Wetlands Priority Conservation Plan. Acquisition supports objectives of the Management Plan for Canada Geese in MD, the Chesapeake Bay Waterfowl Policy and Management Plan, and workgroup recommendations by the Chesapeake Bay Program Living Resources Subcommittee. Protecting habitat in this area is seen to be critical step in the North American Waterfowl Management Plan, which specifically recommends protecting 53,500 acres in the Blackwater–Nanticoke protection area by the year 2000.

The Nanticoke River is listed in the Emergency Wetlands Resource Act Regional Concept Plan, and is a landscape project supported by The Chesapeake Bay Estuary Program. The Nature

Conservancy has recognized the lands within the Nanticoke protection area as a bioreserve and a Last Great Place; the State has designated the Nanticoke River as a Wild and Scenic River. The Nature Conservancy has developed the “Nanticoke River Bioreserve Strategic Plan” (1998) which outlines the biological significance of the watershed and its threats. More than 23 Natural Heritage sites lie within the project, which also contains the largest contiguous forest remaining on the Delmarva Peninsula.

*Strategies to achieve the objective.*—We would seek opportunities to conserve and protect lands through a combination of acquiring land and easements; forging partnerships with State agencies, land trusts, and other landowners; and, developing agreements with other entities that have title or other land rights or interests in targeted areas of the watershed. We would use hyperspectral imagery to identify significant habitats, and use LIDAR to evaluate the potential effects of sea-level rise, helping to prioritize acquisitions. GIS would help us delineate existing and developing forest cores, which would also help in strategic land acquisition.

*Monitoring element.*—The number of acres protected each year; the acquisition and analyses of remote sensing or GIS layers.

**Objective 3.1.2.** Continue to assist partners in developing a landscape protection plan by 2010.

*Basis of the objective.*—Population growth, fragmentation, and other changes in land use must serve as an important backdrop for this CCP. These forces ultimately result in fundamental changes in fish, wildlife and plant populations and ecosystem processes; they affect land acquisition efforts; they create logistical problems in land management, maintenance, and law enforcement; and, they produce significant recreational demands and pressures on the Refuge Complex. Through the collective efforts of many different agencies, entities, and non-government organizations, the acquisition, planning and conservation of many unique and important habitats, communities, and species is already occurring in the watershed.

The salient issue is what role should the Refuge Complex (and each refuge) play as part of the emerging, larger, interconnected system of protected lands within the watershed. The Service alone cannot acquire or otherwise conserve the resources within the Blackwater River watershed. Our reliance on partners and existing programs would be integral in successfully conserving biological diversity and ensuring the integrity and health of ecosystems and communities.

*Strategies to achieve the objective.*—We would assist in developing the Maryland Green Print program, participate in implementing the Chesapeake 2000 Agreement and work with local, state, and regional governments on strategic partnerships to maximize and coordinate acquisition. We would acquire forested corridors to connect refuge lands with other protected lands. We would participate in the Chesapeake Bay and Susquehanna River Ecosystem Land Protection Plan.

*Monitoring element.*—The number of acres and the quality (composition, structure) of habitat acquired; and, the number of partnerships and initiatives created.

**Goal 4.** Provide opportunities for quality scientific research, environmental education, and wildlife-dependent recreation programs that raise public awareness and are compatible with refuge purposes.

**Subgoal 1.** Encourage and provide opportunities for research by other agencies, universities, and other institutions, especially as they relate to the mission, management, and objectives of Blackwater NWR.

**Objective 4.1.1.** Foster relationships with governmental entities, conservation groups, and institutions and communicate the most critical research and management needs of the refuge by 2005.

*Basis for the objective.*—Service policy encourages and supports research and management studies that provide additional data upon which to base decisions regarding management of units of the Refuge System (4 RM 6).

*Strategies to achieve the objective.*—We would attempt to assist in developing partnerships for Federal trust species and habitats and would provide, to the extent practicable, opportunities for research to occur on Blackwater NWR. However, we would not provide staff or other resources to such endeavors - and would function merely as the host site for the research activity or program.

*Monitoring element.* The number of research projects conducted.

**Objective 4.1.2.** By 2005, provide facilities, equipment, and refuge lands for potential use by researchers and other conservation partners.

*Basis of the objective.*—Providing facilities and equipment would facilitate research, as housing and travel costs can be significant components of research budgets.

*Strategies to achieve the objective.*—Housing, equipment storage, and use of Service equipment would be provided at the discretion of the Project Leader and Refuge Manager; however such allowances would not be a high priority for the station.

*Monitoring element.*—Inventory of facilities available

**Subgoal 2.** Provide opportunities for environmental education and interpretation that meet the needs of users.

*Basis of the subgoal.*—The Refuge System Administration Act and the NWRSIA encourage the Service to provide opportunities for the priority general public uses of the Refuge System. Environmental education and environmental interpretation are two of those six priority public uses. We provide them to advance public awareness, understanding, and appreciation of the functioning of ecosystems and the benefits of their conservation to fish, wildlife, and people. These ultimately contribute to the mission of the Refuge System.

**Objective 4.2.1.** Complete and distribute an environmental education manual by October 2010.

*Basis of the objective.*—Only one environmental education program is available at the refuge, which cannot meet the requests by school groups and scout, church, and 4–H groups. An environmental education manual would provide programs and activities for schools and other groups, while increasing public understanding of wildlife needs, ecosystems, conservation, and habitat management for wildlife, and, ultimately, the public use goal of the refuge.

*Strategies to achieve the objective.*—Refuge staff would edit and print section 1 of an environmental education manual by October 2006, section 2 by October 2008, section 3 by October 2010, and section 4 by October 2016. Additional sections on forest management, refuge ecology, and marsh loss would be developed by 2015. We would distribute the manual to schools and gather feedback 1 year after each section is published.

*Monitoring element.*—The number of schools and teacher groups that bring students to the refuge, and the assessment of how the manual meets their needs and expectations.

**Objective 4.2.2.** Provide four on-refuge teacher training programs each year, beginning in 2005.

*Basis of the objective.*—Many teachers lack the background in environmental education and wildlife to teach the activities in the manual. Their programs might not conform with refuge objectives, and might even adversely affect them. Teacher workshops held on the refuge would enable them to learn how activities should be conducted and what to expect to find at the refuge, and would provide background information for preparing students for the various activities. A well trained teacher would provide the necessary background for the refuge environmental education activities, and focus on the importance of the refuge in wildlife habitat management, enhancing the refuge's ability to meet its environmental education goals.

*Strategies to achieve the objective.*—Conduct four teacher workshops each year.

*Monitoring element.*—The number and types of school groups attending workshops; teacher assessment of education manual; the effectiveness of the training.

**Objective 4.2.3.** By 2012, develop specialized programs and provide 20 types of environmental education programs identified in the environmental education manual for 150 groups of students.

*Basis of the objective.*—Refuges are learning laboratories, and Service programs are designed to show students and teachers the value of fish and wildfire resources. Only one refuge-specific environmental education program is available for teachers, 4–H, scouts, home schoolers, college students, and others. The refuge has not been able to meet the requests for special programs for all these groups. With 20 environmental education programs geared toward the different types of groups and their needs, the refuge could provide the programs requested.

*Strategies to achieve the objective.*—We would develop environmental education programs that can meet the requirements of scout troops, 4–H clubs, home school groups, college programs, adult learning, and special events, to be available when needed by 2008; implement

environmental education manual and refuge activities for elementary-age visiting groups by January 2007, for middle school groups by January 2009, for high school groups by October 2010, and for college groups by October 2015; develop five changeable environmental education activities for the refuge web page by January 2008 and alternate them every 4 months.

*Monitoring element.*—The number of environmental education programs and students per year, and an assessment of how well their needs and expectations were met.

**Objective 4.2.4.** Develop adequate facilities and equipment for environmental education study compatible with the wildlife management purposes of the refuge by 2015.

*Basis of the objective.*—No current facilities are adequate for providing environmental education programs. Building such a facility would greatly enhance our capability of administering the environmental education program, and, ultimately, achieving the public use goal of the refuge.

*Strategies to achieve the objective.*—By 2007, build an environmental education outdoor classroom near Blackwater Wildlife Drive with a lab area, storage, protection from biting insects, and restroom. By 2015, construct an environmental education outdoor classroom near the Nanticoke River.

*Monitoring element.*—Completed construction of the environmental education center; purchased equipment.

**Objective 4.2.5.** Increase interface with the education community, non-government organizations, universities, and other state and Federal agencies by 2012.

*Basis of the objective.*—We recognize the crucial link between public awareness and effective management of the Refuge System. The Volunteer and Community Partnership Act requires us to develop guidance for refuge education programs to further the mission of the Refuge System and the purposes of individual refuges. The act also encourages our cooperation with state and local education authorities and other partners in developing and implementing those programs.

*Strategies to achieve the objective.*—We would develop eight shared education programs and activities with other environmental education centers (Horn Point EE Center, Karen Noonan EE Center, Pickering Creek EE Center, universities) by October 2010; and develop at least six shared environmental education programs with school systems - one each with Dorchester County, Talbot County, Caroline County, and Wicomico County School System, one with Salisbury State University (SSU), and one with the University of Maryland Eastern Shore (UMES). We would foster opportunities for participation by students, co-ops, SCEPs, interns, and SCAs; participate in community and other government-agency-sponsored events; and, develop communication through workshops and meetings with other environmental education interests (the education community, non-government organizations, and other agencies) to share information and ideas and assist in environmental education activities.

*Monitoring element.*—The number and types of partnerships developed, the number of programs established, and the number of participants.

**Objective 4.2.6.** Provide qualified educators to conduct environmental education and interpretation programs by 2010.

*Basis of the objective.*—The Refuge System must have professional public use planners and specialists in recreation, interpretation, and education to provide the American people with more and better opportunities to enjoy compatible wildlife-dependent experiences. Trained professionals would be able to educate visitors so that all ages can enjoy learning about wildlife, the environment, conservation, and refuge management.

*Strategies to achieve the objective.*—In addition to the supervisory ORP and the permanent full-time Recreation Aid or Park Ranger (position vacant since 1989), we would hire a permanent full-time ORP to recruit and train interns and at least 30 volunteers a year, and assist with the environmental education program. We would hire two additional permanent full-time ORPs, a Recreation Aide, and two LE officers for the increased public use. We would also hire a permanent, full-time ORP and two Park Rangers at Nanticoke. We would provide trained professionals and volunteers the opportunity to attend appropriate training.

*Monitoring element.*—The number of trained professionals, volunteers, and students providing environmental education and interpretation programs.

**Objective 4.2.7.** Provide 150,000 hours of interpretation programs to enhance visitors' knowledge of wildlife and refuge management while providing an enjoyable refuge experience by 2012.

*Basis of the objective.*—Refuges are the front yards of the Refuge System, and provide people the opportunity to experience its diverse environmental education and interpretation activities at first hand. Refuges provide visitors with an understanding and appreciation of fish and wildlife ecology and help people understand their role in the environment, through interpretation programs and facilities that, ultimately, achieve the public use goal of the refuge. The refuge now provides 26,000 hours of interpretation programs annually. The refuge Visitor Center, the self-guided Wildlife Drive, and the associated interpretive trails (one self-guided) provide visitors some knowledge of wildlife and refuge management and an enjoyable refuge experience. However, the Visitor Center is in poor condition, short of space, understaffed, its exhibits are outdated, and no staff or facilities exist for the Nanticoke protection area. The refuge cannot meet the increasing number of requests for more activities, programs, demonstrations, and special events. Improving its facilities, staffing, and programs would greatly enhance our capability of administering its interpretation programs and, ultimately, achieving the education and wildlife recreation goal of the refuge.

*Strategies to achieve the objective.*—By 2007, we would remodel and expand the visitor center to include a larger multipurpose room for 150 people, a second-floor observation area with observation telescopes, and an environmental education exhibit area; include office space for five ORPs, three full-time Park Rangers, seasonal or temporary staff, interns, and the volunteer program, as well as sales outlet space for the Friends of Blackwater, fire-safe storage space for historical items; a larger exhibit area; and, catalog and store all slides, photos, and historical items.



By October 2006, we would install an indoor interactive computer console and, by 2012, install an outdoor interactive computer console, and expand the Blackwater Refuge website to include the Nanticoke protection area. By January 2007, we would install a live-action monitor of an eagle nest and an osprey nest in the visitor center, with educational exhibits. By 2010, we would produce a new refuge film, a Nanticoke protection area film, and purchase new videos applicable to the refuge for use in the visitor center as they are produced.

By October 2010, we would revise our Mammals and Wildlife Drive Guide leaflets to FWS standard format, produce a self-guiding Woods Trail leaflet, volunteer leaflet, and exotic species leaflet. By October 2012, we would create a Nanticoke protection area leaflet, an endangered species leaflet, an entrance fee leaflet, and self-guided trail leaflets as trails are developed. We would produce other leaflets as needed.

By 2012, we would update the information at existing kiosks, and place a kiosk at the relocated entrance to the Wildlife Drive and the Nanticoke contact station entrance; place kiosks at all public access areas and trail heads; install interpretive signs in all hiking, biking, and canoeing areas, and in other areas as needed; develop six interpretation programs for hiking trails in different habitats with varying subjects (e.g., forest, wetlands, birds, wildlife in the four seasons, ecology, and marsh loss); and develop self-guided interpretive canoe trail and guided canoe trips for spring, summer, and fall wildlife interpretation. By October 2006, we would build a butterfly garden; establish a habitat demonstration area by October 2007; and provide bat housing in silos at Hog Range.

*Monitoring element.*—The number, type, and location of facilities or activities, and responses by refuge visitors (the number of hours and number and type of visitors or groups using each facility, location, or activity).

**Subgoal 3.** Provide opportunities for wildlife-dependent recreation.

*Basis of the subgoal.*—The NWRSIA identifies six priority wildlife-dependent recreational uses we must facilitate in the Refuge System: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Providing the public with opportunities for those uses increases public awareness, understanding, and appreciation of ecosystem functions and the benefits of ecosystem conservation to fish, wildlife, and people. Ultimately, these will contribute to the mission of the Refuge System.

**Objective 4.3.1.** By 2010, increase the opportunities for wildlife observation and photography.

*Basis of the objective.*—During scoping meetings, the public requested we increase wildlife observation and photography facilities and opportunities. Achieving this objective would provide the public with the opportunity to view the relationships among resource management, wildlife and habitat, and people.

*Strategies to achieve the objective.*—All areas of the refuge would be open to wildlife observation and photography year-round. Visitors would be allowed to hike all roadways that allow access into the refuge. Mountain bikes and three-wheelers would be allowed in designated

areas. Parking areas would be constructed at all access areas for the public. Other wildlife observation and photography facilities would be constructed with new acquisitions (see figures below, “Alternative C: Public use facilities”).

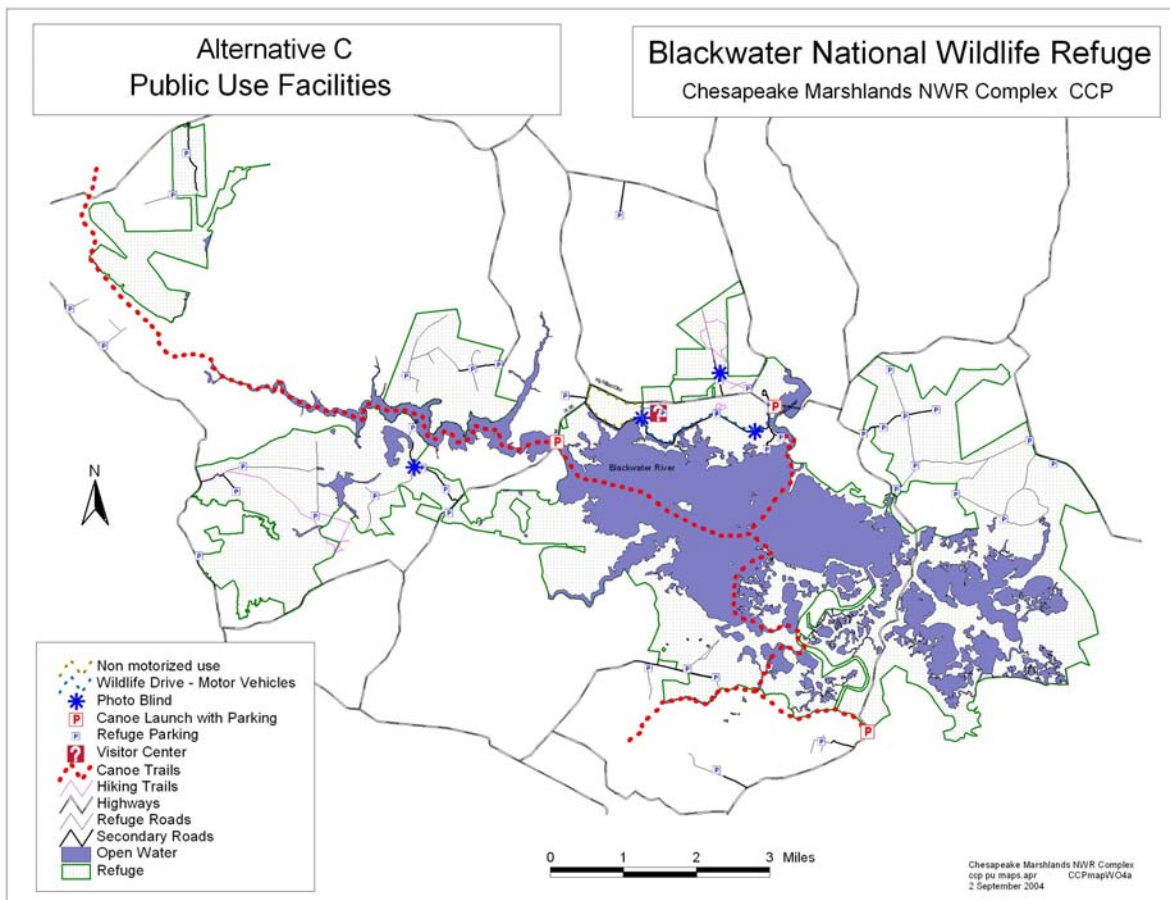


Figure 8. Alternative C: Public use facilities (color plate)

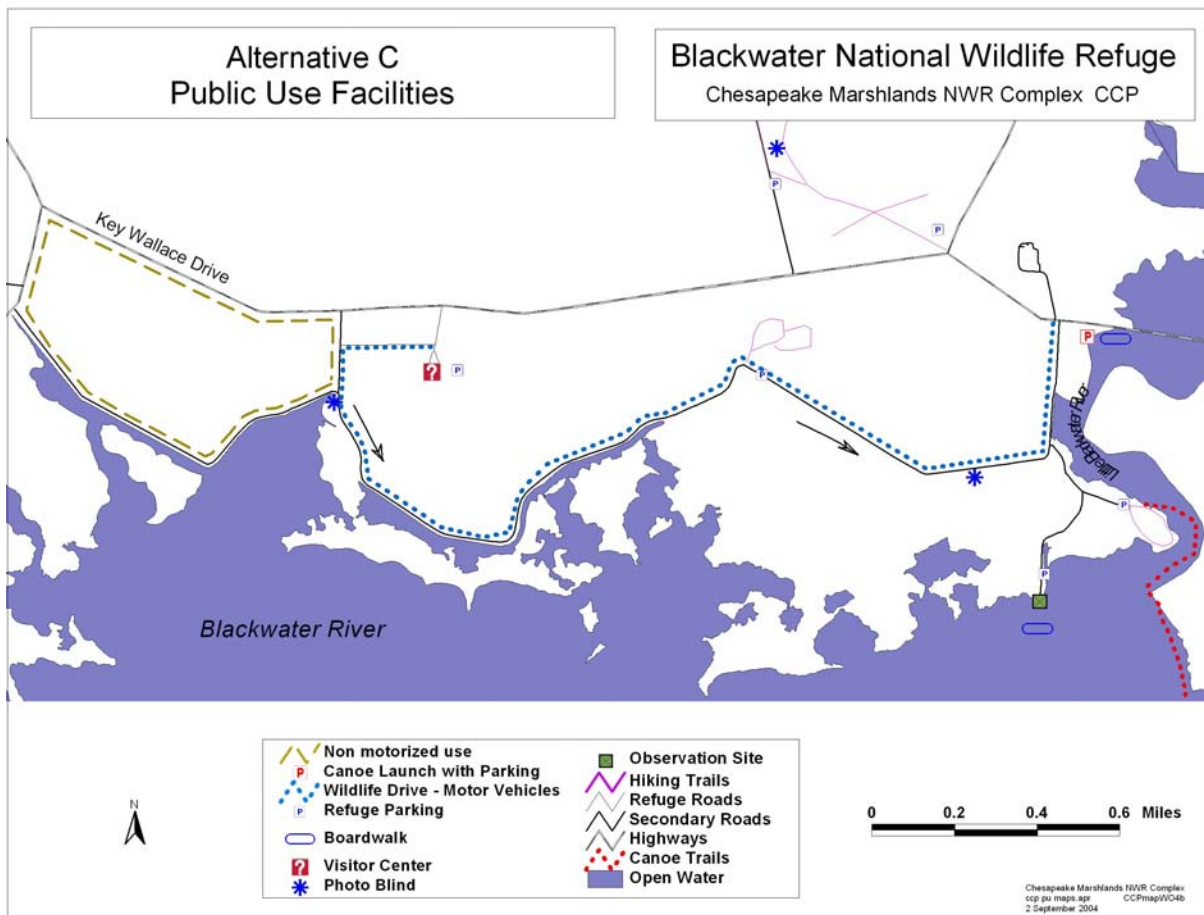


Figure 9. Alternative C: Public use facilities (color plate)

By January 2012, we would install nine blinds for wildlife observation and photography. Four would be constructed along the Wildlife Drive including one off the road to the observation site area with a deck and enclosed photo blind, near the entrance to the second half of the Wildlife Drive, near pool one, and in an area to observe an eagle’s nest. The other five blinds would be constructed along the proposed 3-mile hiking trail, on Shorters Wharf Road, at Kuehnle, and on the Nanticoke River. We would provide a wildlife photography program in each of the four seasons.

By January 2008, we would redesign the Wildlife Drive to start from the Visitor Center and finish at its present entrance, to give visitors a better wildlife observation experience, and enable them to get information and assistance from staff and volunteers at the Center before entering the drive; convert the pool 5 section of the drive to non-motorized use, to allow a separate area for pedestrians and bicyclists that would not conflict with motorists, thereby improving visitor safety; also, build a new parking area for visitors who wish to bike or hike.

By October 2007, we would construct a wildlife observation trail on the Newcomb tract with an associated parking area; and, install benches along the existing and new hiking and biking trails to allow hikers and bikers to rest and enjoy the wildlife.

By January 2008, we would replace the observation tower, which was removed in 1990, with an accessible deck over wetlands and an elevated observation platform at waters edge at the junction of the Little Blackwater and Blackwater Rivers, to be used for environmental education programs, as well as by visitors viewing the wetlands.

By 2006, we would install a second-floor observation deck and spotting telescopes at the visitor center.

*Monitoring element.*—The number, type, and location of facilities constructed, and the response of refuge visitors, by season (the number of visitors using each of the facilities).

**Objective 4.3.2.** Provide increased opportunities for fishing and crabbing by 2012.

*Basis of the objective*—During scoping meetings, the public requested we increase fishing opportunities. The need is increasing to provide safe and adequate fishing and boating opportunities compatible with the resource that would provide the public recreation and the opportunity to view and learn about the relationships among resource management, wildlife and habitat, and people.

*Strategies to achieve the objective.*—We would open the entire refuge to year-round fishing and crabbing, and bank fishing from any refuge shoreline. Fishing and crabbing would conform to State seasons, size and creel limits, methods, and any other restrictions or regulations. We would stock refuge ponds with fish, and build island camping platforms to provide increased fishing areas.

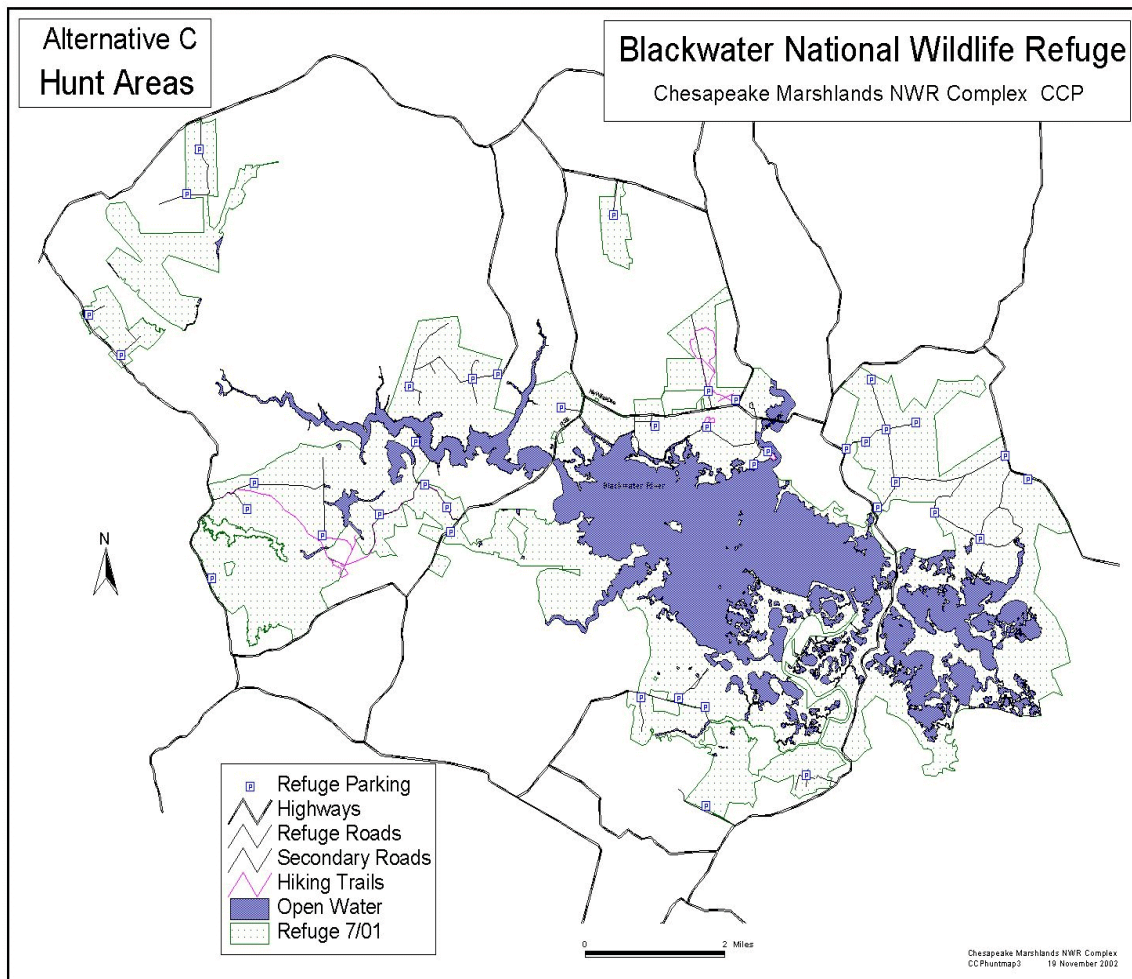
We would provide public boating access to the Little Blackwater River from the refuge boat ramp near Pool 1 on Blackwater NWR; build a kiosk with fishing and crabbing information and parking areas at fishing and crabbing access areas, particularly on Route 335, Key Wallace Drive, on the Wildlife Drive and on the Nanticoke River; provide trails to fishing and crabbing areas; build accessible boardwalk or pier, kiosk, designated fishing and crabbing area, and parking area on the Little Blackwater near Key Wallace Bridge by January 2012; provide law enforcement of fishing, boating, and crabbing regulations within the refuge; and, develop and provide interpretive fishing, crabbing, and boat safety programs, and National Fishing and Boating Week activities.

In partnership with the State of Maryland, we would build a canoe access ramp and controlled parking area at the Route 335 bridge. We would develop canoe trails with associated maps, kiosk information, and signs, and post navigation and boundary signs; develop interpretive canoe tours for spring, summer, and fall visitors; and, encourage canoe and kayak rental by the Friends of Blackwater or a concessionaire.

*Monitoring element.*—The number, type, and location of facilities constructed; the number of hours of fishing; survey of fishermen to determine quality; number of interpretive fishing, crabbing, and boating activities; and public attendance.

**Objective 4.3.3.** Provide additional opportunities for high-quality hunting experiences by 2005.

*Basis of the objective.*—The public recognizes hunting as a traditional family-oriented form of recreation, important in developing an appreciation of fish and wildlife, and has requested that we provide increased hunting opportunities compatible with the resource (see figure below, “Alternative C: Hunt areas.”)



**Figure 10.** Alternative C: Hunt areas (color plate)

*Strategies to achieve the objective.*—We would open the entire refuge year-round to hunting in conformance with State species seasons and bag limits, with no quota system, in all zones: forest game, 150 days; small game, except squirrels, 150 days; big game, 105 days; and waterfowl, 96 days. We would authorize hunters to use refuge roads during all hunting seasons; eliminate seasonal restrictions and waterway closures on Blackwater NWR; restrict vehicles to existing

roadways; authorize waterfowl hunting on a maximum of 40 percent of all refuge areas; permit recreational turtle trapping according to State seasons and regulations; build kiosks and parking areas in each hunt area that provide hunt maps and hunting information; install hunt information signs; hire three additional full-time Law Enforcement Officers to enforce hunting regulations; and, continue to restrict hunting near eagle nests to a maximum radius of 250 yards, in accordance with the “Management Guidelines for Bald Eagles in the Chesapeake.”

*Monitoring element.*—The number and type of hunting experiences, and the response of refuge visitors (the number and type of visitors or groups participating in each hunt).

**Subgoal 4.** Enhance and increase outreach activities.

*Basis of the subgoal.*—Recognizing the crucial link between public awareness and effective management of the Refuge System, and in order to build a stronger base of public understanding, support, and activism, beyond that portion of the American public who visit refuges, we have supported nationwide strategies, including the 100-On-100 Outreach Campaign, the National Outreach Strategy, A Master Plan for Communicating in the U.S. Fish and Wildlife Service, the NWRSA, the Cooperative Alliance for Refuge Enhancement (CARE), the Volunteer and Community Partnership Act, and the Challenge Grant Cost-Share Program, to enhance outreach activities supporting this goal.

**Objective 4.4.1.** Increase public knowledge of the Refuge Complex and each refuge’s existence, location, and activities by 2015.

*Basis of the objective.*—Many people, including numerous local residents, are unaware of the refuge, its mission, and what it does. Increasing public knowledge of the refuge’s existence, location, and activities, would encourage more people to visit the refuge and become aware of the importance of the refuge habitat management, wildlife, and conservation in supporting the mission of the Service.

*Strategies to achieve the objective.*—We would install two travelers’ information radio stations on Route 50: one near Cambridge by January 2005, and one near the Nanticoke River in Vienna by 2010. We would participate in local events, such as the Bay Country Festival, 4-H Fairs, Waterfowl Festival, Shad Festival, and other events as they develop; would work with Dorchester County Tourism, South Dorchester Folk Museum, Harriet Tubman Organization, and other community organizations in events and activities as they are developed.

By October 2010, we would develop ecotourism programs at the Hyatt Regency Conference Center; develop better personal relationships with the media; develop a monthly or weekly refuge activity report for local newspapers and radio stations; continue to work with the Friends of Blackwater to seek funding, develop programs, produce projects, expand the cooperative sales outlet, plan and conduct public events, promote national projects, and other activities as they develop; involve more people from the community in the Volunteer Program; participate in developing watershed-wide cooperative outreach groups of Dorchester, Caroline, Somerset, and Wicomico Counties; continue to participate in the Nanticoke Watershed Alliance and Lower

Shore Tributary Strategies Team; and, develop an envirothon for middle and elementary schools by 2015.

*Monitoring element.*—The number of types of community-involved activities, and the number of participants in each.

**Goal 5.** Ensure that the staffing, facilities, resource protection, and infrastructure necessary for plan implementation are developed.

**Objective 5.1.1.** By 2006, obtain base funding necessary to fund and maintain minimum staffing and operational support of the refuge.

*Basis for the objective.*—The Refuge Complex conceptual staffing chart identifies the minimum staffing level for Blackwater NWR. Staff are needed for basic resource inventorying and monitoring, and to ensure the use of the best science for management decisions. Additional biological and maintenance staff are needed to maintain intact and diverse ecosystems, recover endangered species, and monitor populations status and trends. Law enforcement officers are necessary to ensure the safety of visitors and for resource protection.

Critical needs exist in the public use programs to respond to expected high levels of visitation and demands for opportunities for visitors to experience and appreciate wildlife. Existing equipment inventories are not sufficient to provide effective support to existing or additional staff. Clearly, implementing this alternative would require staff to effectively perform all identified public use, management, inventory, and maintenance programs identified in this alternative.

*Strategies to achieve the objective.*—We would obtain congressional, national, and regional support for base funding for approved RONS projects; obtain local community support for implementing programs during transition period, including expanding use of volunteers and interns to accomplish programs and projects; and, seek opportunities for collaborative funding projects with partners.

*Monitoring element.*—Achieved base funding level necessary to maintain minimum staffing and operations.

## Chesapeake Island Refuges—Alternative C

### Concepts Used for Developing Alternative C

**Land Protection.**—This proposal would expand the island refuges management responsibilities through cooperative management agreements and memorandums of understanding. We propose management agreements for Bloodsworth, Adam, and Northeast Islands (U.S. Naval Reservation lands, advocated by Representative Gilchrest), and South Marsh Island (MD DNR Wildlife Management Area).

**Fish, Wildlife, and Habitat Management.**—These concepts differ somewhat from the ecological concepts in alternative B: active management that embodies state-of-the-art conservation science to improve ecosystem, community, and species conditions. Alternative C narrows our management emphasis to the legal mandates embodied in applicable Federal wildlife laws and Service policy. We would not design or implement any programs for species, habitats, or processes that are not formally mandated as a responsibility of the Refuge System. We would limit our management to waterfowl and other migratory birds, Federal-listed endangered or threatened species, species of concern, and interjurisdictional fish species. In alternative C, we would declare as excess real property and transfer the Susquehanna NWR to Harford County, Maryland, or to an appropriate NGO.

In alternative C, the Refuge Complex would not initiate or perform significant inventory and monitoring, except as required by mandates relevant to Federal trust species. The Complex-wide Resource Inventory and Monitoring Program would still operate, but at a much more focused level than in alternative B. More distinctly, refuge staff would conduct no research programs. We would permit, but would not directly support, compatible research programs requested by other entities on refuge lands.

Alternative C relies more on merely monitoring the processes that affect the refuge lands and, in some cases, the succession of ecosystem habitats in response to larger environmental or anthropogenic forces acting on the landscape. We would allow natural and anthropogenic forces to act upon the communities, habitats, and species within the Refuge Complex. We would not facilitate or promote island protection programs. We would not develop or implement programs to address the effects of invasive, injurious, or exotic species on refuge lands; instead, we would restrict our program to monitoring the spread of these species. We would not address sea-level rise, water quality impacts, and other known or suspected anthropogenic-induced impacts. We would not emphasize the management (active intervention, restoration, or intensive manipulations) of ecosystems, processes, habitats, or species unless, in our best professional judgment, our inaction would result in catastrophic consequences to Federal trust resources.

**Public Use.**—Compared to alternative B, our management of public use would facilitate more wildlife-dependent recreation. We would expand public use by redirecting station resources to these programs, which would become our highest priority. We would provide maximum opportunities for fishing, hunting, environmental education and interpretation, and wildlife observation and photography; allow public access to all lands, where compatible; and, facilitate



and schedule training and volunteer programs to the maximum practicable extent to support public use. Public uses will not interfere with important nesting or wintering seasons of listed species. No public use activities will be permitted where public safety or trust resources are adversely affected.

## Goals, Objectives, Strategies, and Monitoring Elements in Alternative C for Managing the Chesapeake Island Refuges

**Goal 1.** Protect Service trust resources and other species and habitats of special concern.

**Subgoal 1.** Protect wintering waterfowl habitats.

**Objective 1.1.1** On a broad scale, protect a mix of wetland habitat types throughout the island marshes for wintering waterfowl by 2005.

*Basis of the objective.*—This objective supports the goals of the Atlantic Coast Joint Venture (ACJV), the North American Waterfowl Management Plan, 1989 Chesapeake Bay Program Waterfowl Populations Objective (as updated in 2000). The ACJV project has specifically identified Martin NWR. In conformance with NAWMP, four priority waterfowl species associated with the island refuges would benefit from the important estuarine emergent and submergent habitats: black duck, mallard, northern pintail, and blue-winged teal. Other than the midwinter waterfowl survey, the island refuges lack standard protocols and surveys. Waterfowl law enforcement activities have been restricted to Martin NWR, and little is known about possible illegal hunting on the remaining satellites. Emergent wetland and SAV habitats are being impacted by erosion and poor water quality.

*Strategies to achieve the objective.*—Management strategies in this alternative include cooperative agreements and law enforcement. We would assess the significance of boat traffic and the need for a sea duck sanctuary; initiate standard protocols and annual winter surveys throughout the island refuges by the year 2005; record habitat types for waterfowl concentration areas; incorporate them into a GIS data base; note signs of hunting; assess illegal hunting; and, determine and implement specific actions through an operational plan.

*Monitoring element.*—The amount (acres) and the quality (composition and structure) of available habitat, present wintering waterfowl populations, boat traffic, and law enforcement requirements.

**Subgoal 2.** Protect habitats for designated species of Neotropical migrants identified for protection in the Partners In Flight Plan.

**Objective 1.2.1.** Determine suitable breeding habitat and population status for Henslow's sparrow, seaside sparrow, and sharptail sparrow by 2007.

*Basis of the objective.*—This objective generally contributes to the goals and objectives of the Region 5 priority list for the Partners In Flight Plan. Island and headland wetland habitats, particularly those occurring on Martin NWR and the Bishops Head Division, which includes Spring Island, are potentially crucial breeding habitats for Henslow's sparrow, seaside sparrow, and sharptail sparrow. Although suitable habitats are present, their current use for breeding is unknown.

*Strategies to achieve the objective.*—Our initial strategy would be to determine the distribution of breeding birds and their habitat use on the three targeted refuge units. We would establish a baseline breeding bird survey and subsequent annual surveys by the year 2007; collect vegetation and hydrology data to determine preferred nesting habitat types; and, incorporate that data into a GIS breeding habitat map.

Other strategies in this alternative would involve monitoring, management agreements on strategic lands, and managing to prevent human disturbance. We would assess the significance of human disturbance.

*Monitoring element.*—The amount (acres) and the quality (composition, structure) of available habitat and present breeding bird populations.

**Objective 1.2.2.** Protect stopover and resting habitat for Neotropical migrants and raptors by 2005.

*Basis of the objective.*—This objective also contributes to the goals and objectives of the Region 5 priority list for the Partners In Flight Plan. Martin NWR and the Watts Island and Barren Island Divisions have been identified as potentially crucial migration and stopover areas for migratory passerines, and raptors. Large numbers of monarch butterflies also are purported to use these offshore forested and shrub habitats, although we do not know to what extent.

*Strategies to achieve the objective.*—The initial strategy would be to determine the distribution of Neotropical migrants and their use of habitat on the three refuge units we have targeted. We would establish a baseline spring and fall Neotropical migrant survey and subsequent annual surveys by the year 2005; collect vegetation data to determine preferred habitat types and use by various species; and, incorporate that data into a GIS Neotropical migrant habitat map.

*Monitoring element.*—The amount (acres) and the quality (composition, structure) of available habitat.

**Subgoal 3.** Protect island habitat for colonial waterbirds.

**Objective 1.3.1.** Protect colonial waterbird nesting habitat by 2005.

*Basis of the objective.*—With the exception of great blue heron and least tern, all heron and larid colonies occur on island sites. Most of the islands composing the island refuges have limited amounts of upland topography, which can support vegetation suitable for shrub and tree nesting wading birds. Next to erosion, human disturbance is the factor that most impacts colonial nesting waterbirds.

*Strategies to achieve the objective.*—We would survey existing rookeries and potential waterbird nesting habitats; incorporate the information into a GIS data base; and, prioritize law enforcement activities in delineated areas.

*Monitoring element.*—The acreage and quality of shrub and hammock habitat suitable for colonial waterbird nesting.

**Subgoal 4.** Protect habitats to support a diversity of migrating and nesting shorebirds, gulls, terns, and allied species.

**Objective 1.4.1.** Protect foraging and nesting habitat for a diversity of migrating shorebirds, gulls, terns, and allied species by 2005.

*Basis of the objective.*—The island refuges habitats primarily comprise emergent estuarine wetlands, SAV beds, and upland shrubs and forest. Shorebird use, either for nesting or foraging, is concentrated in the less prevalent intertidal flats, beach, and bay dune habitats on the fringes of the islands. Erosion is impacting many of these shorebird areas; as much as 50 feet of beach habitat per year is being lost. The limited shorebird areas that remain are susceptible to human disturbance.

Maryland DNR has an existing shorebird banding and brown pelican color marking program, which includes colonies on the island refuges. The Service needs to take a more active role in expanding this program.

*Strategies to achieve the objective.*—Our primary strategy would be to survey existing shorebird nesting and foraging habitats; collect information to be incorporated into a GIS data base; and, use it to target law enforcement activities; generate funding to hire a biologist to work with the Maryland DNR banding and color marking program and monitor these and other programs on the refuge.

*Monitoring element.*—Shorebird population dynamics and distribution, and fish and wildlife use of the habitat.

**Subgoal 5.** Protect natural habitats to support raptors.

**Objective 1.5.1.** Evaluate the efficacy of the artificial nesting program for raptors by 2005.

*Basis of the objective.*—Martin NWR, Spring Island, and Watts Island have played a pivotal role in the recovery and delisting of the peregrine falcon. Four artificial nesting structures have fledged 56 peregrine falcons since 1986. In addition, the installation and maintenance of osprey nesting platforms at Martin NWR has created the region's largest concentration of nesting osprey. Since 1980, the osprey program has produced 850 fledglings. Barn owls are another species of concern in Maryland and take readily to artificial nesting structures.

Scientists involved in peregrine recovery have questioned continuing the construction of peregrine nesting structures anywhere on the Delmarva peninsula. Translocations now are restricted to the Maryland and Virginia Piedmont, which, unlike Delmarva, is considered that species' former range.

Osprey populations plummeted in the 1950s due to eggshell thinning associated with the uptake of the pesticide DDT. Following the ban on DDT, osprey populations throughout Chesapeake Bay dramatically rebounded. Although natural nesting sites are limited on some of the island refuges (e.g., Spring Island), this is not the case for most of the Refuge Complex or the watershed. Also, ospreys readily use other structures (e.g., channel marks and towers).

*Strategies to achieve the objective.*—We would no longer maintain existing artificial nesting structures or build new ones; we would evaluate the consequences for these raptor species.

*Monitoring element.*—The population trends of ospreys, peregrine falcons, and owls in the island refuges.

**Subgoal 6.** Accomplish applicable recovery objectives for Federal-listed species as outlined in recovery plans.

**Objective 1.6.1.** Conduct surveys for northeastern beach tiger beetles by 2008.

*Basis of the objective.*—The northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) occurred historically “in great swarms” on beaches along the Atlantic Coast, from Cape Cod to central New Jersey, and along Chesapeake Bay beaches in Maryland and Virginia. Only two small populations remain on the Atlantic Coast. The subspecies occurs at more than 50 sites within the Chesapeake Bay region.

The tiger beetle is most vulnerable to disturbance in the larval stage, which lasts 2 years. Larvae live in vertical burrows generally in the beach intertidal zone, where they are sensitive to destruction by high levels of pedestrian traffic, ORVs, and erosion control projects which allow the beach to become vegetated. Population recruitment seems to be hampered by a lack of both undisturbed beaches and of nearby populations as a colonizing source. Although suitable habitat

appears to be available on Martin NWR and Watts Island, the occurrence of the tiger beetle is unknown.

*Strategies to achieve the objective.*—Our initial strategy would be to contract university experts to survey the islands with habitat suitable for the tiger beetle. If tiger beetles are found, we would follow the guidelines of the Northeastern Beach Tiger Beetle Recovery Plan (USFWS 1994) in implementing management actions. Such actions would not include creating or manipulating habitat. They would include closing beaches with beetle populations to human intrusion.

*Monitoring element.*—Monitor known populations and any additional populations that are discovered; evaluate human impacts.

**Objective 1.6.2.** Protect the bald eagle population by 2005.

*Basis of the objective.*—The bald eagle population in Chesapeake Bay has been Federal-listed as endangered since 1978. Eagle nesting occurs on Smith, Watts, and Barren Islands, and has been continuous on the islands in recent years. This success has been the result of protecting nests from human disturbance during the nesting season. Regardless of the proposed delisting of the bald eagle, we would continue to focus on maintaining existing eagle nesting sites and protecting them from disturbance.

*Strategies to achieve the objective.*—We would continue to implement the guidelines in the “Bald Eagle Recovery Plan” (USFWS 1990).

*Monitoring element.*—The number of nesting bald eagles as determined by aerial surveys.

**Subgoal 7.** Protect habitats for anadromous and interjurisdictional fish species

**Objective 1.7.1.** Inventory anadromous and estuarine or inland interjurisdictional fisheries on the island refuges by 2010.

*Basis of the objective.*—Tidal creeks, which provide spawning or feeding habitat for an abundance of finfish, permeated the marshes of the island refuges. Their adjacent shallow and deeper waters support an extensive fishery stock and commercial fishing industry. This productivity in large part is related to the extensive SAV beds associated with the island refuges. However, many colonial waterbirds that nest on the islands travel daily to the mainland for feeding. Why those birds elect to travel to the mainland, and whether forage fish stocks are less plentiful around the islands, are unknown.

*Strategies to achieve the objective.*—Our initial strategy would be to design an inventory jointly with our Fisheries Resources Office in Maryland, in conformance with the Complex-wide Resource Inventory and Monitoring Program, to compare the waterbird forage base on mainland sites with island sites.

*Monitoring element.*—Approval of the inventory plan.

**Goal 2.** Maintain a healthy and diverse ecosystem with a full range of natural processes, natural community types, and the full spectrum of native plants and animals to pass on to future generations of Americans

**Subgoal 1.** Allow populations of exotic, injurious, and invasive species to expand or decrease without human intervention

**Objective 2.1.1.** Monitor the abundance of injurious, invasive, and exotic species on the island refuges by 2007.

*Basis of the objective.*—The island refuges support common reed (*Phragmites australis*) and mute swans (*Cygnus olor*). No comprehensive assessments or inventories have been conducted.

*Strategies for achieving the objective.*—We would design and implement comprehensive assessments or inventories to monitor the abundance of those injurious, invasive, and exotic species on the island refuges by 2007.

*Monitoring element.*—The status and distribution of common reed and mute swans.

**Subgoal 2.** Protect the natural diversity of communities and associated ecosystem processes in the island refuges.

**Objective 2.2.1.** By 2009, develop specific inventory, assessment, and research programs for identified rare, sensitive, declining, or of special concern species and community types.

*Basis of the objective.*—We have a clear mandate to protect, manage, and restore habitats that support Federal- and state-listed rare or threatened species and species of special concern. At present, we know very little about the occurrence of those species on the island refuges.

*Strategies to achieve the objective.*—The most important need is to develop and implement the Complex-wide Resource Inventory and Monitoring Program. We would contract experts at the Heritage Program, USGS–BRD, or universities for surveys of listed species and species that are uniquely difficult to detect. We would implement the appropriate tasks identified in the existing recovery plans for Federal- and state-listed species. Following our development of the draft Forest Management Plan and the proposed Marshland Management Plan, opportunities to evaluate the effects of management practices (e.g., TSI, prescribed fire) on species of concern would exist.

*Monitoring element.*—Species diversity indices and species richness.

**Objective 2.2.2.** Protect remaining SAV beds on refuge lands by 2005.

*Basis of the objective.*—The waters within and surrounding the island refuges support 16 percent of all SAV in the tidal portion of the Chesapeake Bay. Although 13 principal species are distributed around the Bay, two are prevalent in the “Crabbing Capitol of the World:” eel grass

(*Zostera marine*) and widgeon grass (*Ruppia maritima*). Widgeon grass grows in the shallowest water zone (< 3' MLW) and eel grass grows in the deeper shallow zone (3–6" MLW). Both species' water depth tolerances have been reduced by declines in water quality and subsequent reduction in the photic zone.

The Chesapeake Bay Program has targeted SAV as one of its highest priority living resources because of the many ecological functions it serves. It provides shelter and nursery area for fish, crabs, invertebrates, and epiphytes. SAV has long been recognized as an essential food for certain species of waterfowl. In addition to those roles, it also removes nutrients and heavy metals from the water and sediment, removes suspended sediment and binds substrates, and in dense beds, dissipates wave energy and protects shorelines from erosion. SAV is also a barometer of the health of the Chesapeake Bay, because its environmental requirements include good water quality that is low in suspended sediments, dissolved nutrients, and phytoplankton. For these reasons, the recent declines in SAV throughout the island refuges are alarming.

### **Goal 3.** Create the most complete network of protected lands within the Chesapeake Bay watershed.

**Objective 3.1.** Strategic growth and protection of the island refuges by 2015.

*Basis of the objective.*—Federal management of additional land on the islands would contribute to the resource conservation goals of a variety of international, national, and regional initiatives, including RAMSAR, IBA, NAWMP, and the National Wetlands Priority Conservation Plan. Federal management also supports specific workgroup recommendations of the Chesapeake Bay Program Living Resources Subcommittee for SAV, wetlands, waterfowl, and blue crab. Effective landowner outreach enlarges the pool of willing sellers. Islands protection would also benefit private landowners on the mainland, by maintaining the offshore barrier function of the islands.

*Strategies to achieve the objective.*—We would seek opportunities to conserve, manage, and protect lands through a combination of easements, partnerships with landowners, and agreements with other entities that have title or other land rights or interests in targeted areas of the watershed by 2015. In the near term, specifically, we would:

- Amend the 2005 appropriations bill for the Department of Defense to include wording that transfers Bloodsworth Island, if and when the Navy declares it excess, to the Service.
- Secure management authority of South Marsh Island through a Cooperative Agreement or Memorandum of Understanding with the Maryland Department of Natural Resources.
- Assist partners, including the states and the Chesapeake Bay Foundation, Inc., in developing an island protection plan as part of an ecosystem component.
- Acquire inholdings when they become available from willing sellers.

*Monitoring element.*—The number of additional acres managed by the Island Refuges.

**Goal 4.** Develop and implement quality scientific research, environmental education, and wildlife-dependent recreation programs that raise public awareness and are compatible with refuge purposes.

**Subgoal 1.** Encourage and provide opportunities for research by other agencies, universities, and other institutions, especially as they relate to the mission, management, and objectives of the island refuges.

**Objective 4.1.1.** Foster relationships with government entities, conservation groups, and institutions; and, communicate the most critical research and management needs of the refuge by 2006.

*Basis for the objective.*—Service policy encourages and supports research and management studies that provide additional data upon which to base decisions regarding management of units of the Refuge System (4 RM 6).

*Strategies to achieve the objective.*—We would assist in developing partnerships for Federal trust species and habitats, and would provide, to the extent practicable, opportunities for research to occur. However, we would not provide staff or other resources; the island refuges would function merely as the host site for the research activity or program.

*Monitoring element.* The number of research projects conducted.

**Objective 4.1.2.** Facilities, equipment, and refuge lands would be available periodically for potential use by researchers and other conservation partners by 2005.

*Basis of the objective.*—Providing facilities and equipment would facilitate research, as housing and travel costs can be significant components of research budgets.

*Strategies to achieve the objective.*—Housing, equipment storage, and use of Service equipment would be provided at the discretion of the Project Leader and Refuge Manager; however, such allowances would not be a high priority for the station.

*Monitoring element.*—Inventory of facilities available.

**Subgoal 2.** Provide opportunities for environmental education and interpretation to meet the needs of refuge users.

**Objective 4.2.1.** By 2010, provide adequate facilities and equipment for environmental study and interpretation for the island refuges.



*Basis of the objective.*—An opportunity exists for the refuge to become a major destination for tourists visiting Smith Island, but the current facility on Martin NWR, Middleton House, is woefully inadequate. No staff are available for environmental interpretation, and the few existing displays and mounts fail to capitalize on the unique island culture, fishing and crabbing industry, and the islands' crucial role in the Chesapeake Bay ecology. If an adequate facility existed, we could potentially welcome 60,000 visitors each year. Siting an adequate facility in the town of Ewell would assure compatible use and provide opportunities for habitat restoration education.

*Strategies to achieve the objective.*—We would upgrade the visitor contact station at the Middleton House on Smith Island to provide new displays and updated material on the island refuges; provide office space with telephone, fax machine, computer, and copy machine; provide suitable furniture for second-floor lodging of interns and researchers; upgrade plumbing and electrical systems; and expand Middleton House to include a small auditorium and a wet lab for researchers and interns.

We would purchase suitable land near the Middleton House in the town of Ewell and, in cooperation with the Chesapeake Bay Foundation, build and manage a new environmental education center that highlights island refuges ecology; construct a kiosk at the Ewell ferry dock to provide interpretive information and directions to the Middleton House and new environmental education center; and, acquire additional housing to provide lodging for overnight education groups.

*Monitoring element.*—The number, type, and location of facilities and programs, and the response by refuge visitors (the number and type of visitors or groups).

**Objective 4.2.2.** By 2006, provide environmental education and interpretation programs to enhance visitors' knowledge of the island refuges and refuge management, while providing an enjoyable refuge experience.

*Basis of the objective.*—Refuges provide people with opportunities to acquaint themselves at first hand with the Service and its activities. More importantly, through public use, the Refuge System helps people understand their place in the environment. The island refuges have no staffing or programs to provide interpretation programs. Although at first, staff from the Refuge Complex or Blackwater NWR could implement some of these programs, we need to create programs that target the island refuges, if they are to achieve their education and recreation goals.

*Strategies to achieve the objective.*—We would develop exhibits and habitat restoration projects for the environmental education center; develop a professional video on the island refuges, and purchase other videos applicable to the refuge for use in the visitor center; develop general leaflets and other self-guided leaflets and brochures; develop additional new outdoor displays; install signs where needed; develop an environmental education handbook for local schools and educators outlining available outreach programs, dates, times, and who to contact to schedule a program; expand outreach programs to reach an additional 15,000 visitors by incorporating summer programs which coincide with tour boats visiting the island refuges

After completing a compatibility determination, we would develop an interpretive canoe or kayak trail on Martin NWR; provide guided estuarine interpretation tours for environmental education groups during the spring and fall; develop an MOU with the Chesapeake Bay Foundation, Inc. to work together on environmental education and interpretation programs and events; and, if compatible, develop an interpretive sea kayak trail among the islands that compose the island refuges.

We would establish partnerships with the Chesapeake Bay Foundation, Inc., the U.S. Army Corps of Engineers, the National Fish and Wildlife Foundation, the National Aquarium in Baltimore, the National Oceanic and Atmospheric Association, and the local Waterman Museum to provide additional environmental education programs and opportunities for visitors; develop a Friends group to create a small cooperative sales outlet to provide Federal passes, educational books and other items; seek funding; develop programs; and produce projects.

*Monitoring element.*—The number, type, and location of facilities or activity, and response by refuge visitors (number and type of visitors or groups using each facility, location, or activity).

**Subgoal 3.** Provide opportunities for compatible wildlife-dependent recreation by 2006.

*Basis of the subgoal.*—The NWR SIA identifies six priority wildlife-dependent recreational uses the Service must facilitate in the Refuge System: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Providing the public with opportunities for those uses increases public awareness, understanding, and appreciation of ecosystem functions and the benefits of ecosystem conservation to fish, wildlife, and people. Ultimately, these will contribute to the mission of the Refuge System.

**Objective 4.3.1.** By 2007, provide opportunities for wildlife observation and photography.

*Basis of the objective.*—During the scoping meetings, the public requested opportunities for wildlife observation and photography, and associated facilities. Achieving this objective would provide the public an opportunity to view the relationships among resource management, living resources, and people.

*Strategies to achieve the objective.*—We would build a wildlife observation trail or boardwalk on Martin NWR, in association with the new environmental education center, to profile resources such as waterfowl, water birds, and saltmarsh ecology; build an observation tower and observation or photography blinds in suitable locations; install an outdoor spotting scope; build an outdoor pavilion with outdoor displays and covered brochure holders to provide visitors with a place to rest, acquire information, and view the marsh. In cooperation with our partners, we would conduct a needs assessment to determine the scope, extent, and compatibility of proposed and additional facilities and programs.

*Monitoring element.*—The number, type, location, user hours, and response of refuge visitors.

**Objective 4.3.2.** Provide safe, adequate fishing facilities and opportunities by 2008.

*Basis of the objective.*—The island refuges are not authorized to regulate fishing or other activities on the navigable waters of the State of Maryland, or in areas where the water bottoms are State-owned. Public access to the fishing is by boat only, and, with the exception of time-of-year closures for waterfowl at Martin NWR, people can fish anywhere, provided they have a boat. In spite of that, at our scoping meetings the public requested more fishing opportunities.

*Strategies to achieve the objective.*—We would open the island refuges to bank fishing from any refuge shoreline; build trails with kiosks at access points to all fishing and crabbing areas; build piers on the islands for easy docking and fishing for visitors who arrive by tour boat or mail boat; develop fishing, crabbing, and boat safety interpretation programs and National Fishing and Boating Week activities; develop a canoe trail with maps, kiosks, and signs; post navigation and boundary signs; and, provide law enforcement of fishing, boating, and crabbing regulations.

**Objective 4.3.3.** By 2008, provide opportunities for a high quality hunting experience.

*Basis of the objective.*—During the scoping meetings, the public recognized hunting as a traditional, family-oriented form of recreation, one that is important in developing an appreciation of fish and wildlife, and requested expanded hunting opportunities. At present, hunting is not allowed on any of the refuge islands.

*Strategies to achieve the objective.*—We would determine the compatibility of waterfowl and rail hunting on the islands not affected by the Secretarial Order closing Martin NWR to the taking of waterfowl. If we determine it is compatible, we would open 5,000 acres to both waterfowl and rail hunting, in conformance with State seasons and bag limits, on Spring Island, Watts Island, and—should Maryland DNR either enter into an MOU with the Service for its management, or decide to sell the island to the Service—on South Marsh Island. For reasons of human safety, no hunting would be permitted on Bloodsworth Island; and, hire one full-time and one seasonal Law Enforcement Officer to conduct the waterfowl and rail hunts, enforce refuge regulations, and assist with outreach programs.

*Monitoring element.*—The number and type of hunting experiences, and the response of refuge visitors (number and type of visitors or groups participating in each hunt).

**Goal 5.** Ensure that the staffing, facilities, resource protection, and infrastructure necessary for plan implementation are developed.

**Objective 5.1.** By 2020, obtain base funding necessary to fund and maintain minimum staffing, facilities, and operational support of the island refuges.

*Basis of the objective.*—Only two full-time equivalencies (FTEs) are now funded for the island refuges. The conceptual Refuge Complex staffing chart identifies the minimum staffing level for the refuges. Staff are needed for basic resource inventory and monitoring, and to ensure the use

of the best science in management decisions. Additional biological and maintenance staff are needed to maintain intact diverse ecosystems, recover endangered species, and monitor populations status and trends. Law enforcement officers are necessary to ensure the safety of visitors and resource protection.

Critical needs exist in the public use programs to respond to expected high levels of visitation and demands for opportunities for visitors to experience and appreciate wildlife. Existing equipment inventories are not sufficient to provide effective support to existing or additional staff.

Clearly, implementing this alternative would require staff to effectively perform all identified public use, management, inventory, enforcement, and maintenance programs identified. Existing staff, equipment, and infrastructure for the Refuge Complex cannot manage the additional workload.

*Strategies to achieve the objective.*—We would seek congressional, national, and regional support for base funding for approved RONS projects; seek local community support for implementation of programs, including expanding use of volunteers, partners, and interns to accomplish programs and projects; and, seek opportunities for collaborative funding projects.

*Monitoring element.*—The number of permanent full-time staff.

# Tabular Comparison of Alternatives

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
<b>Exotic, Invasive, or Injurious Species Management</b>			
Resident Canada Goose	No population control	Reduce population to 350	No population control
Mute Swan	Active population control in accordance with Atlantic Flyway Council (AFC) recommendations	Eradicate by 2010	No population control
Gypsy Moth	Aggressive control (annual egg mass and defoliation surveys and aerial spraying)	Aggressive control as in alternative A, but also implement IPM techniques and silvicultural prescriptions of our Forest Management Plan	No control
Purple Loosestrife	No control	Aggressive mechanical, chemical, biological controls	No control
Nutria	Remove 4,000 nutria annually, using primarily trapping incentives	Eradicate by 2015	No population control
Johnson Grass and Canadian Thistle	Mechanical and chemical control as necessary	Aggressive mechanical, chemical, and biological control	No control

Tabular Comparison of Alternatives

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
Phragmites	Mechanical and chemical control in MSUs only	Eradicate in MSUs and reduce below calendar year 2000 acreage in natural marshes through mechanical, chemical, and biological control	No control
<b>Inventory, Monitoring, and Research</b>			
Surveys	Conduct 34 types (not numbers) of biological surveys: <ul style="list-style-type: none"> <li>■ 4 habitat</li> <li>■ 8 waterfowl</li> <li>■ 2 colonial bird</li> <li>■ 4 big game</li> <li>■ 1 shorebird</li> <li>■ 1 mammal</li> <li>■ 5 raptor</li> <li>■ 3 breeding bird</li> <li>■ 1 contaminant</li> <li>■ 1 forest pest</li> </ul>	In addition to the surveys in alternative A: <ul style="list-style-type: none"> <li>■ Develop and implement an inventory and monitoring program and baseline inventory</li> <li>■ Complete GIS</li> <li>■ Implement long-term monitoring</li> <li>■ Implement adaptive management</li> </ul> Additional surveys include <ul style="list-style-type: none"> <li>■ NAAMP route</li> <li>■ Expanded Region 5 surveys</li> <li>■ MD colonial waterbirds</li> <li>■ MAPS</li> </ul>	Eliminate most surveys in alternatives A and B, but continue to <ul style="list-style-type: none"> <li>■ Develop and implement a Complex-wide inventory and monitoring program, but only for trust species</li> <li>■ Monitor selected exotics</li> <li>■ Inventory forests on newly acquired lands</li> <li>■ Complete GIS</li> </ul> Management-based surveys would be eliminated.

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
Research	Limited management-based research	<ul style="list-style-type: none"> <li>■ Monitor water quality</li> <li>■ Expand forest inventory</li> <li>■ Distribution and inventory of invasive species, rare flora, lepidopterans, threatened or endangered species, and anadromous fish</li> </ul> <p>Greatly expanded research, particularly in an adaptive management context, including</p> <ul style="list-style-type: none"> <li>■ Nutria Damage Reduction Pilot Program</li> <li>■ Effects of prescribed fire on DFS, FIDs, marsh habitats</li> <li>■ Effects of TSI on DFS, FIDs</li> <li>■ Sea-level rise and land subsidence research</li> <li>■ American Black Duck Initiative</li> <li>■ Effects of AFOs on water quality</li> <li>■ Genetics of blue-winged</li> </ul>	Management-based research would be eliminated.

Tabular Comparison of Alternatives

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
teal and lesser snow geese			
<b>Fish and Wildlife Population Management</b>			
Waterfowl	Actively manage habitat to support 6% of Maryland’s AP Canada geese, lesser snow geese, and dabbling duck populations	Actively manage habitat to sustain 10% of Maryland’s AP Canada geese, lesser snow geese, and dabbling duck populations	No active management; protect habitat only; only monitor waterfowl populations
Neotropical Migrants (FIDs)	No management	Actively manage forest habitats for 22 breeding Neotropical or FID and 9 area-sensitive species	No management
Shore/Marsh/Water Birds	No specific management	Actively manage water levels in 200 acres of MSU specifically for these species	No management
		Maintain, enhance 15,000 acres of estuarine emergent marsh	
		Manage Pool 3C as marsh or water bird rookery	
Raptors	Except for actions identified for	Continue supplemental nest	No active management or



Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
Supplemental Nest Structures	raptor species in the “Supplemental Nest Box” programs, no management other than protection  Maintain existing structures: <ul style="list-style-type: none"> <li>■ 30 Osprey platforms</li> <li>■ 200 Wood Duck boxes</li> <li>■ 30 Bluebird boxes</li> <li>■ 10 Barn Owl boxes</li> <li>■ &lt;10 Prothonotary Warbler boxes</li> </ul>	box programs if warranted  Manage forest habitats specifically for red-shouldered hawks, broad-winged hawks, Coopers hawks, and barred owls  Evaluate program efficacy in achieving local, regional, and national population goals	monitoring of these species          Eliminate supplemental nest structures except those used for environmental education.
Fish	No management	Inventory anadromous and interjurisdictional species  Restore the natural hydrology of the upper Blackwater River  Monitor water quality  Implement contaminants study on AFOs	Species inventory and water quality monitoring only

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
Furbearers	Use public trapping as a tool for managing muskrat, red and gray fox, racoon, river otter, mink, and nutria populations	Continue to use trapping as a management tool for muskrat and nutria only, but modify program to include recommendations from the Nutria Damage Reduction Pilot Program	No management
<b>Threatened and Endangered Species Management</b>			
Delmarva Fox Squirrel	Active management in accordance with Recovery Plan including <ul style="list-style-type: none"> <li>■ Benchmark surveys</li> <li>■ 25 acres of food plots</li> <li>■ Capture for translocation</li> <li>■ Public education and outreach</li> <li>■ Law enforcement</li> <li>■ Forest type inventory</li> <li>■ DFS research</li> </ul>	In addition to alternative A: <ul style="list-style-type: none"> <li>■ Conduct presence-or-absence surveys*</li> <li>■ Extend mark and recapture studies*</li> <li>■ Describe habitat use and requirements*</li> <li>■ Develop integrated habitat protection strategy*</li> <li>■ Field test HSI model*</li> <li>■ Monitor threats to habitats*</li> <li>■ Implement forest habitat management scheme (15" DBH)</li> <li>■ Monitor effects of timber</li> </ul>	☞ Only the activities identified by asterisks in alternative B

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		harvest <ul style="list-style-type: none"> <li>■ Develop, refine, and monitor prescriptive habitat management</li> <li>■ Establish connective forested corridors</li> <li>■ Increase law enforcement*</li> <li>■ Increase public education and outreach</li> </ul> * See alternative C	
Bald Eagle	Active management to provide wintering and nesting habitat for 10 nests, with Recovery Plan activities, including <ul style="list-style-type: none"> <li>■ Maintain an 11,270-acre inviolate sanctuary</li> <li>■ Protect nesting areas</li> <li>■ Participate in Midwinter Survey</li> </ul>	Same as alternative A	Same as alternative A
Swamp Pink, Sandplain Gerardia, and Sensitive Joint-Vetch	No management	Determine occurrence, distribution, and abundance, and implement recovery plan	No management
Red-cockaded Woodpecker	Maintain 1,000 acres of mature	In addition to alternative A,	No active management

*Tabular Comparison of Alternatives*

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
	loblolly pine forest habitat	implement surveys and determine the appropriateness of reintroduction	
<b>Habitat Management</b>			
Cropland Management	Crop 640 acres, force account (100% available for wildlife)	Crop 420 acres (300 acres of grasses, forbs, force account and 120 acres corn and sorghum by contract) 100% available for wildlife	No cropland management; allow 560 acres of current cropland to succeed naturally; abandon infrastructures
Moist Soil Management	Maintain 370 acres as MSUs for wintering or migrating waterfowl	Increase MSUs to 460 acres and manage 200 acres specifically for spring migrating shorebirds	Fire management
Riparian Zone Management	Survey water quality	Promote State and Federal cost share programs  Develop partnerships  Replace bulkhead at Pool 1  Rip-rap the Wildlife Drive	No active management; continue water quality surveys; promote cost share programs.

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		Continue water quality surveys	
Fire Management	Annual prescribed fire regime in marshlands, and aggressive wildfire suppression.	<p>Multiple-objective prescribed fire regime of four fire frequencies: annual; 3-yr.; 10-yr.; and no year.</p> <p>Extensive monitoring program.</p> <p>Prescribed fire in marshlands and woodlands.</p> <p>Aggressive wildfire suppression.</p>	<p>Limited suppression fire regime: wildfire suppression where necessary to protect human safety, infrastructures, and important resources.</p> <p>No prescribed fire.</p>
Forest Management	No active management; continue to acquire forested land	<p>Actively manage current 8,400 acres of forest and acquire additional forest.</p> <p>Forest management includes</p> <ul style="list-style-type: none"> <li>■ Creating seven contiguous mature forest cores &gt;400 acres each</li> <li>■ Increasing size of four cores to 865 acres</li> </ul>	Same as alternative A, and include a monitoring component

*Tabular Comparison of Alternatives*

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
<b>Public Use Management</b>	<p data-bbox="632 919 1035 989">Conduct one environmental education (EE) program</p> <p data-bbox="632 1036 1035 1105">Conduct one teacher workshop per year</p> <p data-bbox="632 1149 1035 1219">Loan EE equipment to teachers Conduct two group programs</p> <p data-bbox="632 1263 1035 1333">Active role in Dorchester County Envirothon</p>	<ul style="list-style-type: none"> <li data-bbox="1062 412 1472 444">■ Developing forest corridors</li> <li data-bbox="1062 451 1472 521">■ Implementing IPM program to control pests</li> <li data-bbox="1062 527 1472 743">■ Using silvicultural treatments, timber harvest, prescribed fire, TSI, reforestation, and salvage cuts to maintain, enhance forest health</li> <li data-bbox="1062 750 1472 820">■ Implementing monitoring components</li> </ul> <p data-bbox="1062 919 1388 951">Conduct 15 EE programs</p> <p data-bbox="1062 995 1331 1065">Conduct two teacher workshops per year</p> <p data-bbox="1062 1109 1430 1179">Publish EE Manual for three age groups</p> <p data-bbox="1062 1222 1446 1255">Conduct nine group programs</p> <p data-bbox="1062 1299 1425 1331">Develop Envirothon for two</p>	<p data-bbox="1493 919 1818 951">Conduct 19 EE programs</p> <p data-bbox="1493 995 1761 1065">Conduct four teacher workshops per year</p> <p data-bbox="1493 1109 1902 1179">Publish EE manual for four age groups</p> <p data-bbox="1493 1222 1854 1255">Conduct 20 group programs</p> <p data-bbox="1493 1299 1871 1331">Develop Envirothon for three</p>

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
	Maintain environmental education pavilion  Conduct one shared EE program  Train 100 volunteers per year  No website programs	age groups  Purchase land and build EE outdoor classroom  Conduct five shared EE programs  Train 250 volunteers  Develop three changeable EE website programs	age groups  Purchase land and build EE Center  Conduct 10 shared EE programs  Train 350 volunteers  Develop five changeable EE website programs
Environmental Interpretation	Maintain 3,000-sq-ft Visitor Center w/ outdated exhibits  Conduct 26,000 hours interpretation annually  Conduct 3 special events and 12 programs annually  Maintain 11 interpretive brochures	Remodel Visitor Center w/ new exhibits  Conduct 100,000 hours interpretation annually  Conduct 8 special events and 24 programs annually  Develop 17 interpretive brochures	Remodel Visitor Center w/ new exhibits  Conduct 150,000 hours interpretation annually  Conduct 8 special events and 52 programs annually  Develop 30 interpretive brochures

Tabular Comparison of Alternatives

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
Maintain Refuge interpretive video and film library	Update refuge video and film library	Update refuge video and film library	
Maintain four kiosks with interpretive panels	Build 2 kiosks with interpretive panels	Build 30 kiosks with interpretive panels	
	Build butterfly garden	Build butterfly garden	
	Serve as Chesapeake Gateway site	Serve as Chesapeake Gateway site	
	Develop habitat demonstration area	Develop habitat demonstration area	
	Develop MOU with South Dorchester Folk Museum	Develop MOU with South Dorchester Folk Museum	
Wildlife Observation and Photography	Maintain 6.5-mile Wildlife Drive	Reconstruct 6.5-mile Wildlife Drive	Reconstruct 6.5-mile Wildlife Drive
	3 to 4 miles of hiking trails	5 miles of hiking trails	40 miles of hiking trails
	No canoe, kayak trails; boating permitted from April 1 to September 30	10 miles canoe, kayak trails (open same as alternative A)	20 miles of canoe, kayak trails (open year-round)



Blackwater NWR		Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		Do not rebuild observation tower	Build ADA observation tower	Build ADA observation tower
		Photography permitted	Build three photo blinds	Build six photo blinds
		No photography programs	Develop four photo programs	Develop eight photo programs
Fishing and Crabbing		April 1–September 30 boat only; 5,350 acres	April 1–September 30; boat only; 5,785 acres	Year-round bank and boat fishing; entire refuge
		No public boat or canoe ramps	Build canoe ramp and parking	Permit public use of Little Blackwater ramp
		No refuge shoreline access to fishing	Build accessible fishing boardwalk, pier, and parking	Build trails, parking and kiosks to all fishing areas
			Implement concessionaire canoe rentals	Implement concessionaire canoe rentals
				Build island camping platforms and stocked fish ponds
Hunting	Big Game: Sika and White-tailed Deer	4 days quota hunt; 7,000 acres (firearms only)	51 days quota hunt; 10,000 acres (archery, muzzle-loader, firearms, disabled)	150 days; entire refuge; no quota (archery, muzzle-loader, firearms, disabled)

*Tabular Comparison of Alternatives*

<b>Blackwater NWR</b>	<b>Alternative A Species-specific Management</b>	<b>Alternative B Conservation Biology for Trust Species Diversity</b>	<b>Alternative C Maximum Public Use with No Habitat Management</b>
Resident Geese	None	8,300 acres spring season; quota	Entire refuge, State season; no quota
Waterfowl	None	40% of new acquisition areas, State season; no quota	40% all refuge areas; State season; no quota
Turkey	None	15 days spring season; quota	State season; no quota
Small Game	None	None	State season; no quota
Outreach	<p>Display refuge exhibit at special events on Eastern Shore</p> <p>Participate in other organizational events and programs</p> <p>Produce news releases as needed</p> <p>Continue interactions and relations with congress and other organizations</p> <p>Provide programs offsite when requested</p>	<p>Display refuge exhibit in all local events on Eastern Shore</p> <p>Develop partnerships with other organizational events and activities</p> <p>Provide monthly reports to local radio stations and newspapers</p> <p>Build stronger relationships with congress and other organizations</p> <p>Provide programs offsite</p>	<p>Display exhibit in all local events and all events within reasonable traveling distance</p> <p>Develop partnerships with other organizational events and activities</p> <p>Provide weekly reports to radio and news media</p> <p>Build even stronger relationships with congress and NGOs</p>

Blackwater NWR	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		monthly	Provide programs offsite weekly
<b>Land Protection</b>	Acquire inholdings only; 3,865 acres remaining	Protect 31,300 additional acres; acquire inholdings; establish Nanticoke River Refuge Unit	Same as alternative B
<b>Cultural, Social, and Economic Resources Management</b>			
Archeology and History	No archeological or historical review	Complete cultural reconnais- sance in 2000	Same as alternative B
<b>Refuge Administration</b>			
Staffing	18 FTEs: 16 current plus 2 tier 1 FTEs  8 FTEs fire management	26.5 FTEs: alternative A plus Nanticoke area staff and 2 Outdoor Rec. Planners  10 FTEs fire management	32.5 FTEs: alternative B plus 2 Park Rangers, 2 LE, 1 BioTech, and 1 RecAid  9 FTEs fire management w/ no prescribed burning and more wildfires
Wilderness Review	Completed; none recommended	Completed; none recommended	Same as alternative B

*Tabular Comparison of Alternatives*

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
<b>Exotic, Invasive, or Injurious Species Management</b>			
Mute Swans	Follow the guidelines of the Swan Management Plan	Eradicate mute swans	No management
Phragmites	Limited control	Aggressive control to reduce below calendar year 2000 acreage	No management
<b>Inventory, Monitoring, and Research</b>			
Research	Limited management-based research	Long-term monitoring and adaptive research, including <ul style="list-style-type: none"> <li>■ Evaluate need for marshland burning study to include wildlife values</li> <li>■ Evaluate what is limiting SAV</li> <li>■ Identify sources of water pollution</li> <li>■ Monitor water quality</li> <li>■ Assess the efficacy of artificial nesting structures</li> </ul>	Same as alternative A, except no research for adaptive management

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		<ul style="list-style-type: none"> <li>■ Before-and-after monitoring of wetland restoration and erosion control</li> <li>■ Conduct research assigned in recovery plans</li> <li>■ Develop GIS</li> <li>■ Evaluate fish use of island and mainland wetlands</li> <li>■ Band brown pelicans</li> <li>■ Measure water turbidity monthly</li> <li>■ Assess terrapin populations with recommendations for management</li> <li>■ Monitor State of Virginia black duck nests</li> <li>■ Evaluate the effects of predators on ground nesters</li> </ul>	

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
Surveys	Conduct 19 types of surveys: <ul style="list-style-type: none"> <li>■ 2 habitat</li> <li>■ 6 waterfowl</li> <li>■ 2 colonial bird</li> <li>■ 1 furbearer</li> <li>■ 1 shorebird</li> <li>■ 4 raptor</li> <li>■ 2 breeding bird, and</li> <li>■ 1 contaminant survey.</li> </ul>	In addition to alternative A: <ul style="list-style-type: none"> <li>■ Develop and implement a baseline inventory plan for refuge complex</li> <li>■ Develop GIS</li> </ul> Also implement other surveys: <ul style="list-style-type: none"> <li>■ Marshbird callback</li> <li>■ Black duck production</li> <li>■ Butterfly stopover use of Island Refuges</li> </ul>	Eliminate most surveys in alternatives A and B, but continue to <ul style="list-style-type: none"> <li>■ Develop and implement Complex-wide I&amp;M Program, but only for Federal trust species</li> <li>■ Monitor selected exotics</li> <li>■ Inventory forests on newly acquired lands</li> <li>■ Complete development of GIS</li> </ul> Management-based surveys would be eliminated.
<b>Fish and Wildlife Population Management</b>			
Raptors	Maintain nesting structures for ospreys and hacking towers for peregrine falcons	Maintain but assess the contributions of existing nesting structures, and implement recommendations	Remove structures
Waterfowl	Provide sufficient habitat to support 300,000 AP Canada goose use days, 2,000,000 dabbling duck use days,	Provide sufficient habitat to support 5% of AP Canada geese, dabbling	No active management; protect habitat only; monitor pops.

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
	and 150,000 tundra swan use days annually	ducks, and tundra swans in MD  Restore, protect, enhance habitat for black duck production	
Shorebirds, Gulls, Terns, et al.	No management	Create islands with dredged material  Protect and create upland forest sites (reforestation)  Assess predator populations and need for control  Restore dredged material disposal areas for nesting	No active management; protect habitat only; monitor populations
Colonial Birds	Banding and surveys	In addition to alternative A, create 25 acres of colonial bird nesting habitat	No management

*Tabular Comparison of Alternatives*

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
Neotropical Migrants	No management	Establish breeding bird survey  Restore, protect, and enhance habitats for these sparrows: seaside, Henslows, and sharptail	No active management; protect habitats only
Marsh and Water Birds	Maryland DNR co-op program of banding and inventory	Implement marsh callback survey	Same as alternative A
<b>Threatened and Endangered Species Management</b>			
Bald Eagle (T)	Protect nests	Prioritize protecting shoreline and pine islands to prevent loss of nest sites  Implement bald eagle recovery plan objectives	Same as alternative A
Northeastern Beach Tiger Beetle (E)	No management	Survey occurrence on island beaches  Implement recovery plan  Consider reintroduction	No management



Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		Create 10 acres of beach and dune habitats	
<b>Habitat Management</b>			
Wetland Restoration and Erosion Control	No management	Restore 100 acres of wetland habitat  Protect 2 miles of shoreline at Barren Island  Create 200 acres of emer- gent wetland at Martin NWR  Restore 5,000 acres of SAV at Martin NWR  Protect 15 miles of shoreline at Martin NWR  Develop a habitat management plan	No management

*Tabular Comparison of Alternatives*

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
<p>Develop plans with USACOE for addressing shoreline erosion throughout the island chain</p> <p>Restore SAV beds on the Island Refuges to 1970 levels</p> <p>Create habitat using dredged material</p> <p>Restore 200 acres of wetland and beach habitats throughout the Island Refuges, using dredged material</p>			
<b>Public Use Management</b>			
Environmental Education	700 students per year	Purchase land and build EE Center in partnership with CBF; 15,000 students per year	Same as alternative B

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		Develop EE programs and restoration projects	
		Develop EE handbook	
Environmental Interpretation	Maintain Middleton House with outdated exhibits at Ewell, Monday–Friday	Upgrade Middleton House and exhibits	Same as alternative B; but, increase the intensity and hours of guided tours to at least 20,000 hours.
	Maintain kiosk at Middleton House	Upgrade Martin NWR brochure, and expand informational materials to include all Island Refuges	
	Conduct 1,000 hours guided tours	Build kiosk at Ewell ferry dock and at Crisfield	
		Develop Island Refuges leaflet and other self-guided leaflets	
		Conduct 10,000 hours guided tours	
		Develop professional Island Refuges video	

*Tabular Comparison of Alternatives*

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
		Build outdoor displays  Develop Friends group and sales outlet  Develop self-guided canoe trail  Develop special events  Create web site  Develop 100-person volunteer program	
Fishing and Crabbing	Not allowed from refuge properties	Same as alternative A	Open islands to bank fishing  Build trails with kiosks at all fishing areas  Build piers on islands
Hunting	No hunting	Quota waterfowl and rail hunting; State seasons on Spring, Watts, and South Marsh Islands	Same as alternative B

Island Refuges	Alternative A Species-specific Management	Alternative B Conservation Biology for Trust Species Diversity	Alternative C Maximum Public Use with No Habitat Management
<b>Land Protection</b>	Continue to acquire inholdings within approved boundary	Same as A plus Cooperative Management Agreements with partners	Same as alternative B
<b>Cultural, Social, and Economic Resources Management</b>			
Cultural, Social, and Economic Resources	No management	Establish a sustainable lifestyle foundation  Cooperate with Somerset County heritage and tourism groups  Assess cultural resources on the Island Refuges	Same as alternative B
<b>Refuge Administration</b>			
Facilities and Infrastructure	Intentionally left blank	Build a visitor and research center to highlight island ecology and the local waterman culture	Same as alternative B
Minimum Staffing	2.5 FTEs	2.5 FTEs	6.5 FTEs

*Tabular Comparison of Alternatives*

<b>Island Refuges</b>	<b>Alternative A Species-specific Management</b>	<b>Alternative B Conservation Biology for Trust Species Diversity</b>	<b>Alternative C Maximum Public Use with No Habitat Management</b>
Wilderness Review	Reviewed Martin NWR in 1971; no designation	Completed; none recommended	Same as alternative B

Back to Volume 1 titles