

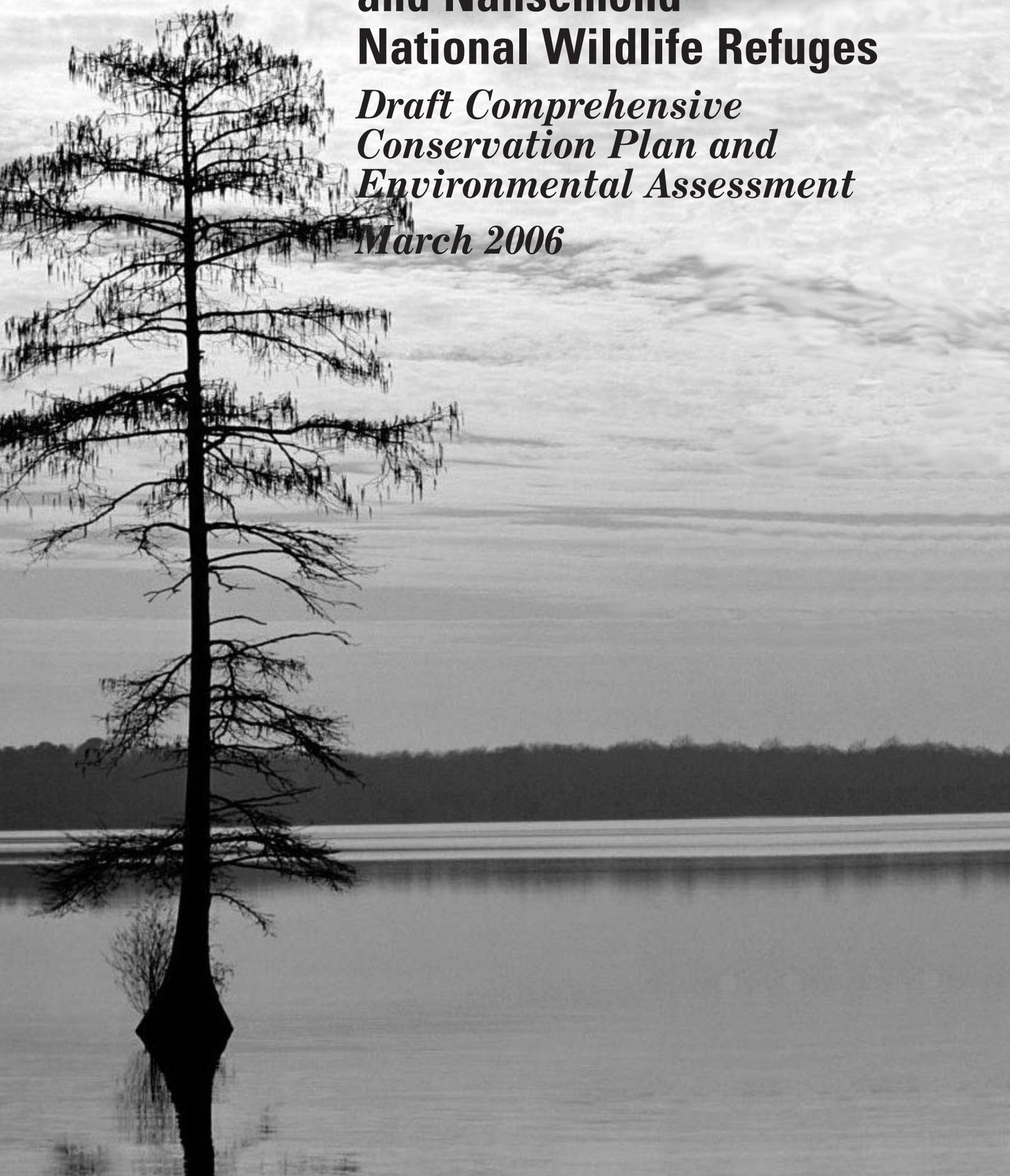
U.S. Fish & Wildlife Service



Great Dismal Swamp and Nansemond National Wildlife Refuges

*Draft Comprehensive
Conservation Plan and
Environmental Assessment*

March 2006





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

The *U.S. Fish and Wildlife Service* is the principal federal agency responsible for conserving, protecting, and enhancing fish and wildlife, plants and their habitats for the continuing benefit of the American people. The Service manages the 96-million acre National Wildlife Refuge System comprised of 544 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological services field stations. The agency enforces federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

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



Guiding Principles of the National Wildlife Refuge System

We are land stewards, guided by Aldo Leopold's teachings that land is a community of life and that love and respect for the land is an extension of ethics. We seek to reflect that land ethic in our stewardship and to instill it in others.

Wildlands and the perpetuation of diverse and abundant wildlife are essential to the quality of the American life.

We are public servants. We owe our employers, the American people, hard work, integrity, fairness, and a voice in the protection of their trust resources.

Management strategies from preservation to active manipulation of habitats and populations is necessary to achieve the missions of the National Wildlife Refuge System and the U.S. Fish and Wildlife Service.

Wildlife-dependent uses involving hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation, when compatible, are legitimate and appropriate uses of the National Wildlife Refuge System.

Partnerships with those who want to help us meet our mission are welcome and indeed essential.

Employees are our most valuable resource. They are to be respected. They deserve empowering and mentoring, and support through a caring work environment.

We respect the rights, beliefs, and opinions of our neighbors.



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Readers Guide

The U. S. Fish and Wildlife Service (Service) planning process for all national wildlife refuges involves generally two levels of planning: 1) the development of a broad Comprehensive Conservation Plan (CCP); and, 2) the formulation of more detailed step-down management plans required to fully implement the CCP. Public involvement and compliance with the National Environmental Protection Act (NEPA) is to be incorporated into the process at all appropriate stages.

This Environmental Assessment (EA) provides NEPA compliance for the future management of the Great Dismal Swamp National Wildlife Refuge (GDSNWR) and the Nansemond National Wildlife Refuge (NNWR). Following the release of our final NEPA decision document (a Finding of No Significant Impact [FONSI] in the case of an environmental assessment) we will release the final CCP for the refuges. The CCP consists of the information found in the following sections of this document:

Chapter 1 Purpose of and Need for Action

This chapter discusses the purpose of and need for action; it provides background information on the refuges, the U. S. Fish and Wildlife Service and the National Wildlife Refuge System, and the associated ecosystems. It briefly describes the planning process followed. Goals were guided by establishing legislation mandates. Alternatives are shown addressing each goal. This chapter also describes issues, concerns, and opportunities identified during public scoping and issues not addressed in this EA.

Chapter 2 Affected Environment

This chapter describes the existing environment of each refuge. It describes the physical, biological, socio-economic and cultural resources that would be affected by the management actions of each alternative discussed in Chapter 3. The affected environment is the baseline for comparing the consequences of implementing each alternative.

Chapter 3 Alternatives

This chapter describes the alternatives for each refuge based on the goals discussed in Chapter 1. The Service's Proposed Action for each refuge is identified. Alternatives describe what management will occur over the next 15 years. A table at the end of the chapter summarizes the alternatives and compares the differences between them.

Chapter 4 Environmental Consequences

This chapter describes the environmental consequences of implementing each of the alternatives. It provides scientific and analytical bases for comparing the alternatives. It describes the probable consequences (impacts or effects) of each of the alternatives on the physical, biological, cultural, and socio-economic resources of the refuges.

Chapter 5 Consultation and Coordination with Others

This chapter describes the effort made by the Service to identify the issues, concerns, and opportunities to be described in this CCP/EA.

Appendices

The Appendices contain materials relevant to the decision being made, the affected environments of each of the refuges, and the analysis involved in determining environmental consequences.

In general, each section's text refers to Great Dismal Swamp National Wildlife Refuge unless specific reference to Nansemond National Wildlife Refuge is made.

The final approved CCP will provide the vision and strategic direction for the Great Dismal Swamp and the Nansemond National Wildlife Refuges. When fully implemented, the CCP will help achieve the refuge's purpose, fulfill the National Wildlife Refuge System Mission, maintain and/or restore the

biological integrity, diversity, and environmental health of the refuges, and meet other mandates. The CCP will also guide management decisions and set forth goals, objectives, and strategies to accomplish these ends. It will be supported by step-down management plans to provide additional details and to describe schedules for implementation. The CCP will be based on the principles of sound fish and wildlife management, available science, legal mandates, and other policies, guidelines, and planning documents. It will, above all else, ensure that **wildlife comes first on the refuges.**

We greatly appreciate the time and effort of the many citizens who contributed to the creation of the refuge and the development of the CCP. While this plan does not satisfy all the concerns expressed during the planning process, public involvement and participation substantially shaped the plan. Public involvement also greatly assisted the Service in determining how best to balance the important conservation of the natural resources found on the refuge while ensuring that environmental education and visitor use needs are met, as mandated by legislation.

For further information on our planning process, please refer to part 602 of the Fish and Wildlife Service Manual, National Wildlife Refuge System Planning, or go to the web at:

<http://policy.fws.gov/manual.html>

Purpose of and Need for Action

- Introduction
- The Planning Area
- Purpose of and Need for Action

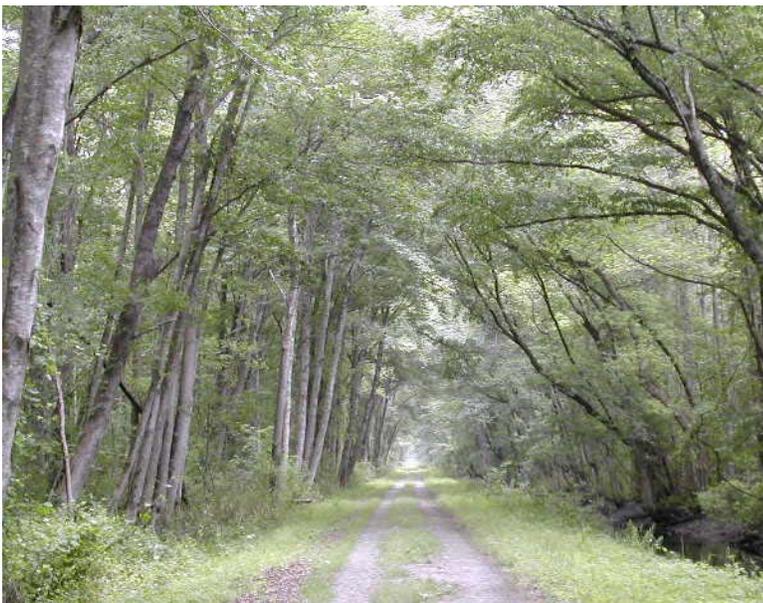
- Department of Interior
- U.S. Fish & Wildlife Service
- National Wildlife Refuge System
- The Roanoke-Tar-Neuse-Cape Fear Ecosystem
- Relationships with Federal, State, and Local Agencies
- Legal Policy Content

- CCP Planning Process
- Step-Down Management Plans
- Refuge Vision Statement
- Refuge Goals
- Key Issues and Concerns

1. Purpose of and Need for Action

Introduction

The National Wildlife System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, requires the Service to develop a CCP for each refuge. The purpose of developing a CCP is to provide refuge managers with a 15-year



Washington Ditch Trail.

Four mile hiking trail to Lake Drummond paralleling historic Washington Ditch. USFWS.

strategy for achieving refuge purposes and contributing toward the mission of the National Wildlife Refuge System, consistent with sound principles of fish and wildlife science, conservation, legal mandates, and Service policies. In addition to outlining broad management direction on conserving wildlife and habitats, a CCP identifies wildlife-dependent recreational opportunities available to the public, including opportunities for hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The CCP will be reviewed and updated at least every 15 years in accordance with the National Wildlife Refuge System Administration Act of 1969, as amended

by the National Wildlife Refuge System Improvement Act of 1997, and the National Environmental Policy Act of 1969.

When fully implemented, this plan will strive to achieve the management vision. Overriding considerations reflected in the plan are 1) fish and wildlife conservation requires first priority in refuge management, and 2) wildlife-dependent recreation is allowed and encouraged as long as it is compatible with, or does not detract from the refuge's mission or purpose.

The information provided in this Chapter sets the stage for Chapters 2 through 5. Chapter 2 describes the existing physical, biological, and human environment. Chapter 3 describes alternative strategies for meeting goals and objectives and compares them to current management ("no action") strategies. Chapter 4 evaluates the environmental consequences of implementing each of the proposed management alternatives. Chapter 5 discusses the consultation and coordination process that took place during the project, and provides a list of preparers.

In general, each section's text refers to Great Dismal Swamp National Wildlife Refuge unless specific reference to Nansemond National Wildlife Refuge is made.

The Planning Area

The Great Dismal Swamp National Wildlife Refuge

The Great Dismal Swamp National Wildlife Refuge (NWR) is the largest intact remnant of a vast habitat that once covered more than one million acres of southeastern Virginia and northeastern North Carolina. Formal protection of this resource began in 1973, when the Union Camp Corporation (a local forest products company) donated 49,097 acres to The Nature Conservancy. The Nature Conservancy conveyed the donated land to the federal government, which, combined with additionally purchased land, was used to establish the Great Dismal Swamp NWR in 1974. Today, the refuge encompasses 111,201 acres of this environmentally and biologically important area (Figure 1-1).

Located at the southern boundary of the northeastern administrative region (Region 5) of the U.S. Fish and Wildlife Service, the refuge is its largest and protects nearly 25% of all service owned land found in the region.

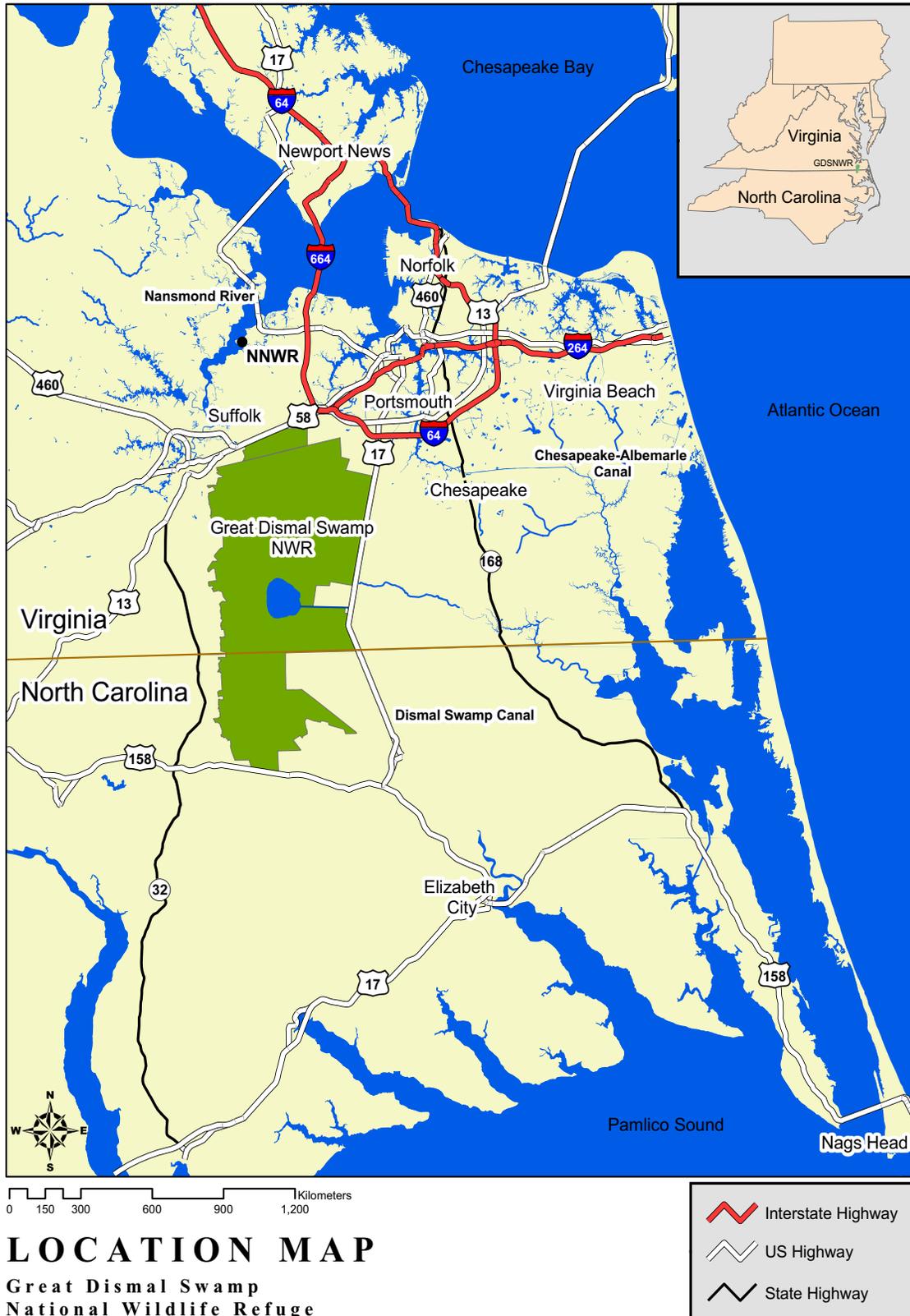
Nansemond National Wildlife Refuge

The Nansemond National Wildlife Refuge is a non-staffed, satellite refuge of the Great Dismal Swamp NWR. It is not open to the public. Located on the Nansemond River in Suffolk, Virginia, the refuge lies approximately five miles to the northwest of the GDSNWR. The 423 acre refuge was established on December 12, 1973, when three tracts of tidal marsh were transferred from the Department of Defense to the U.S. Fish and Wildlife Service. An additional tract of upland was added to the refuge in 1996 after the closing of the Driver Naval Facility, also as excess lands from the Department of Defense.

Purpose of and Need for Action

The purpose of the plan is to identify the role the refuge will play in support of the mission of the National Wildlife Refuge System and to provide guidance in refuge management activities.

Figure 1-1.



The plan is needed to:

- Provide a clear statement of direction for the future management of the refuge.
- Provide refuge neighbors, visitors, and government officials with an understanding of Service management actions on and around the refuge.
- Ensure that Service management actions, including land protection and recreation and education programs, are consistent with the mandates of the National Wildlife Refuge System.
- Provide long term continuity and direction in management.
- Provide a basis for the development of budget request for operations, maintenance, and capital improvement needs.

Overview of the Department of the Interior

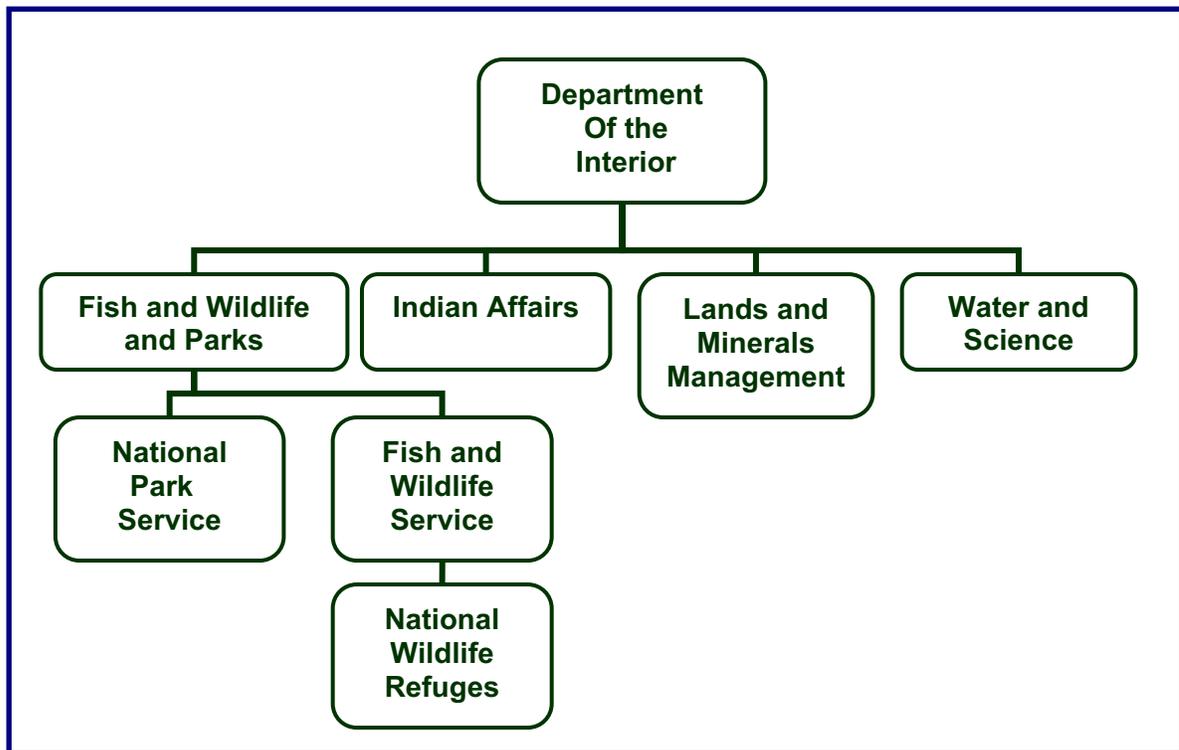
The Department of the Interior is the principal landowner of most of our nationally owned public lands and cultural resources. Management responsibilities include fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, managing the National Wildlife Refuge System, and providing for the enjoyment of life through outdoor recreation (Figure 1-2).

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service is the principal organization through which the Department of the Interior carries out its responsibilities of working with others to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of people.

The Service manages the National Wildlife Refuge System, the world's largest collection of lands set aside specifically for the protection of fish and wildlife populations and habitats. More than 540 national wildlife refuges covering more than 93 million acres provide important habitat for native plants and many species of insects, amphibians, reptiles, fish, birds, and mammals. These refuges also play a vital role in preserving threatened and endangered species, as well as offering a wide variety of recreational opportunities. Many refuges have visitor centers, wildlife trails, and environmental education programs. The Service also manages all national fish hatcheries.

Figure 1-2. *Organizational Chart of the Fish and Wildlife Service within the U.S. Department of the Interior.*



National Wildlife Refuge System

Mission

The mission of the National Wildlife Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997 is:

“...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources, and their habitats within the United States for the benefit of present and future generations of Americans.”

The wildlife and habitat vision for national wildlife refuges stresses that wildlife comes first; that ecosystems, biodiversity, and wilderness are vital concepts in refuge management; that refuges must be healthy; that growth of refuges must be strategic; and that the refuge system serves as a model for habitat management with broad participation from others.

Roanoke-Tar-Neuse-Cape Fear Ecosystem

The Ecosystem Approach to Fish and Wildlife Conservation

Throughout the past decade, the Service has placed more emphasis on focusing habitat and wildlife protection on entire ecosystems. To this end, the Service has pursued new partnerships with private landowners, state and federal agencies, corporations, conservation groups and volunteers. In implementing an ecosystem approach to management, 52 ecosystem teams were formed across the country, typically using large river watersheds to define ecosystems. Individual ecosystem teams are comprised of Service professionals and partners who work together to develop goals and priorities for research and management.

The Great Dismal Swamp National Wildlife Refuge is contained within two ecosystems: the Roanoke-Tar-Neuse-Cape Fear (RTNCF) watershed and the Chesapeake Bay-Susquehanna River watershed. The Nansemond National Wildlife Refuge is contained entirely within the Chesapeake Bay-Susquehanna River watershed (Figure 1-3).

Most ecosystem activities for the Great Dismal Swamp NWR have been associated with the RTNCF eco-team, for less than 20% of the refuge is contained within the Chesapeake Bay watershed. Moreover, the habitat within the Great Dismal Swamp NWR is more similar to that within the RTNCF watershed; thus increasing the probability of synergistic approaches to habitat protection and restoration with other Service field stations and partners (Figure 1-4).

One of the prominent characteristics of the RTNCF ecosystem is that it contains nearly a half million acres of refuge land. Three refuges (Great Dismal Swamp, Alligator River, and Pocosin Lakes) exceed 100,000 acres in size --- making these refuges relative behemoths compared to most other refuges within the eastern United States. Thus, the RTNCF ecosystem likely contains more refuge land than any other watershed east of the Mississippi River.

The large refuge component of the RTNCF watershed creates considerable potential to launch habitat protection and restoration partnerships using these refuges to anchor meaningful habitat protection and restoration programs. To begin tapping this potential, the RTNCF eco-team developed a *Resource Conservation Initiative* (RCI) -- a template for applying an ecosystem approach



Figure 1-3. FWS Region 5 Ecosystems map. Region 5 USFWS.

to Fish and Wildlife conservation needs of trust resources within the ecosystem at the landscape level. The RCI shares the talents and fiscal resources of the Service installations within the watershed, and it is dependent upon active partnerships.

The RCI is a land protection strategy that emphasizes migration pathways and corridor linkages between established refuges. The basic tenets of the RCI are that a strategically oriented land base is critical to the well being of trust resources, maintenance of biodiversity, and overall ecosystem health; it is neither feasible nor desirable that ownership and management of the land base be limited to the Service; and that the socioeconomic effects of land protection be given full consideration.

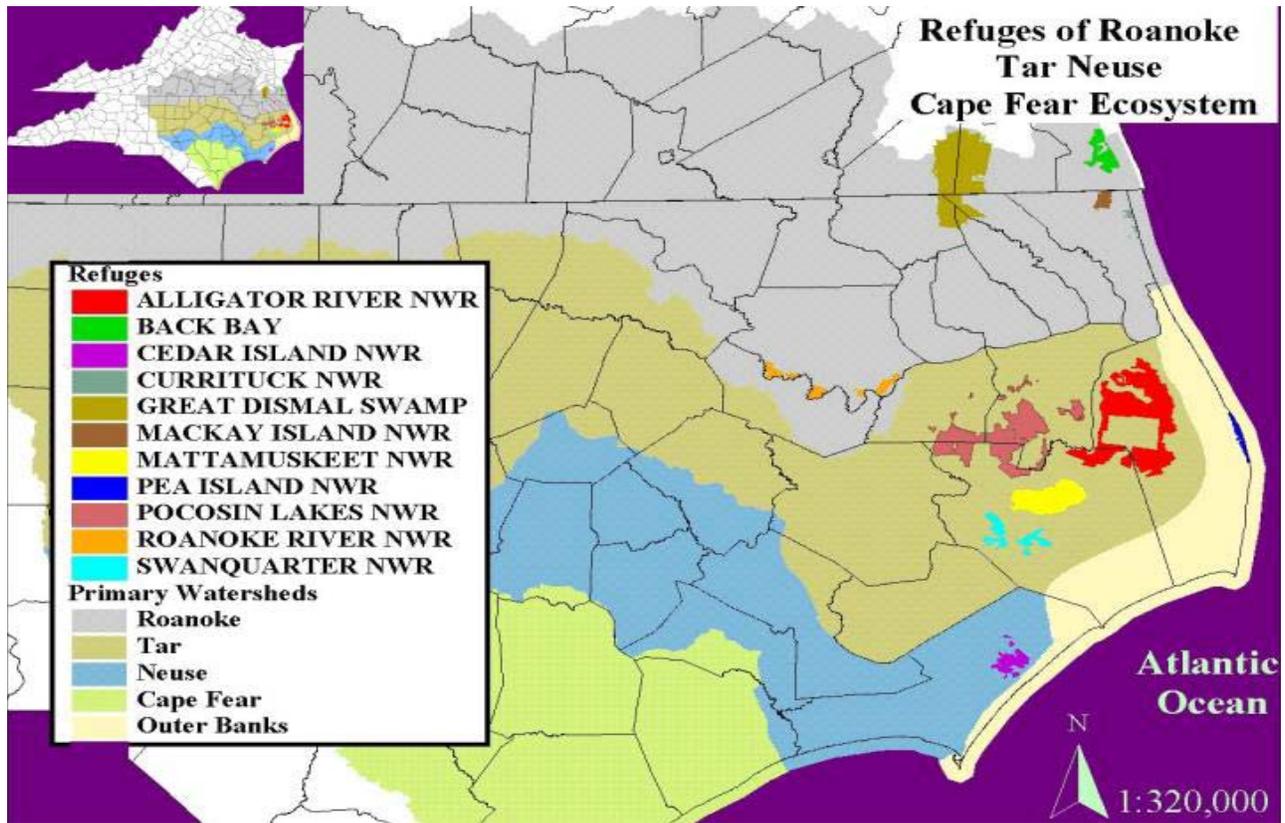


Figure 1-4. Roanoke/Tar/Neuse/Cape Fear Ecosystem map. USFWS Region 4.

Relationship to Federal, State, and Local Agencies

Another provision of the National Wildlife Refuge System Improvement Act of 1997, and subsequent agency policy, is that the Service shall ensure timely and effective cooperation and collaboration with other government agencies and state fish and wildlife agencies during the course of acquiring and managing refuges. The Great Dismal Swamp NWR must collaborate with several federal, state, and local agencies, since the refuge incorporates large tracts of land in two states, affects the operation of the Atlantic Intracoastal Waterway, and is a prominent feature within the jurisdictions of five cities and counties.

Virginia Agencies

The refuge is, by far, the largest National Wildlife Refuge within the Commonwealth of Virginia by including nearly 85,000 acres within the Cities of Suffolk and Chesapeake. The refuge watershed supports

approximately 25-30% of the state's wintering population of tundra swans, and the refuge and surrounding area provides habitat for most of the black bears in eastern Virginia. The refuge collaborated with the Virginia Department of Game and Inland Fisheries (VDGIF) in identifying the refuge and surrounding watershed as key links within the Virginia Birding and Wildlife Trail in Suffolk and Chesapeake. The refuge participated on the Stakeholder Advisory Committee during the preparation of the statewide Black Bear Management Plan. VDGIF and the refuge have worked together to respond to the care of nuisance bears within the Hampton Roads area, and they are in support of establishment of a controlled bear hunting on the refuge.

The refuge has collaborated with the Cities of Suffolk and Chesapeake in the development of nature-based tourism strategies in the interest of developing activities that would complement Service interpretive and educational programs. The refuge also provides feedback to the cities on development issues for land that abuts the refuge or is located within the refuge watershed to help with the assessment of the impacts on the refuge.

North Carolina Agencies

The refuge includes over 26,000 acres within Camden, Pasquotank, and Gates Counties in North Carolina. The Service manages several large refuges within the coastal plain of the state, so the land within the Great Dismal Swamp NWR represents a relatively small amount of refuge acreage. Nevertheless, the refuge has collaborated with the North Carolina Wildlife Resources Commission on several issues including the establishment of special deer hunting seasons for the refuge, the management of black bear populations (especially those issues regarding crop depredation), and law enforcement.

The refuge's North Carolina neighbors view the refuge as a significant influence on nature-based tourism in the area. The Dismal Swamp Canal Welcome Center, operated by the North Carolina Department of Transportation in Camden County, has literally become the refuge's de facto visitor center, as the center's staff has estimated that at least 30% of their 600,000 visitors annually request information or directions to the refuge.

Elizabeth City (Pasquotank County) has waterfront businesses that cater to the yacht traffic along the Dismal Swamp Canal, so the refuge's influence on canal operations can impact their downtown economy. The refuge also works with the county to address flooding issues created by the hydrologic disruptions along US Highway 158.

Chapter 1 Purpose of and Need for Action

Most of the refuge's North Carolina acreage is within Gates County, and many of their residents view the refuge as a critical component of maintaining their natural resources in the face of mounting development pressures from the greater Hampton Roads vicinity. The county's local newspaper, "The Gates County Index", has labeled the county as "Heaven's Gateway to the Great Dismal Swamp" since the early 1990's. More recently, the county has proposed that the refuge move part of its operations to Sunbury to strengthen the bonds between the county and refuge.

The 14,000 acre Dismal Swamp State Natural Area, located along the refuge's southeastern boundary in Camden County, is managed by the North Carolina Department of Environment and Natural Resources, Division of Parks and Recreation. For the most part, the Natural Area has been managed as a non-staffed, undeveloped satellite of Merchants Millpond State Park in Gates County since the Natural Area was established in 1974. The refuge has provided some habitat restoration and road maintenance on the Natural Area under the terms of a cooperative agreement since 1992. The state appointed the first park superintendent for the Natural Area in 2003, and plans to significantly improve visitor facilities along the west bank of the Dismal Swamp Canal in the near future. The refuge is represented on the advisory committee for the Dismal Swamp State Natural Area.



Lake Drummond Reservation. *Primitive camping is available adjacent to the spillway and boat tram on the Feeder Ditch. USFWS.*

Army Corps of Engineers

The Army Corps of Engineers (COE) maintains and operates the Dismal Swamp Canal along the eastern boundary of the refuge. The canal is a link within the Atlantic Intracoastal Waterway system, and Lake Drummond serves as the primary source of water for providing navigable depths within the canal. The refuge's establishing legislation directed that the operation of the canal could not adversely affect the refuge. Therefore, the COE ceases releasing water from Lake Drummond during severe droughts under the terms of an informal arrangement that was developed in 1977. During these periods, the canal is closed to yacht traffic, since the canal's locks at Deep Creek (Virginia) and South Mills (North Carolina) cannot operate without the replenishing water from Lake Drummond.

The Corps of Engineers also manages and maintains the Feeder Ditch/Lake Drummond Reservation access to the refuge. The Feeder Ditch connects Lake Drummond to the Dismal Swamp Canal and US Highway 17. The Lake Drummond Reservation is a modest campground surrounding the Lake Drummond water control structure operated by the COE. Since 1996, the refuge has operated under a COE permit to manage public access and interpretive programs at the Reservation.

The Nature Conservancy

The relationship between The Nature Conservancy (TNC) and the refuge began when Union Camp Corporation donated the first 49,097 acres of land through TNC to establish the refuge. TNC retained some oversight rights when the land was conveyed to the Service. Therefore, the refuge collaborates with TNC on major facility development and resource management issues within the area they donated. More recently, the refuge has provided technical assistance, equipment, and personnel for fire management operations on TNC lands near the refuge. TNC fire specialists have worked with refuge personnel on prescribed burning operations on refuges in Virginia and Maryland.

Legal Policy Context

Administration of national wildlife refuges is guided by the mission and goals of the National Wildlife Refuge System, Congressional legislation, Presidential Executive Orders, and international treaties. Policies for management options of the refuge are further refined by administrative guidelines established by the Secretary of the Interior and by policy guidelines established by the Director of the Fish and Wildlife Service. Management guidance is provided by the refuge's establishing legislation, the Dismal Swamp Study Act of 1972 (Public Law 92-478) and the Dismal Swamp Act of 1974 (Public Law 93-402); the National Wildlife Refuge System Improvement Act of 1997; and the laws and policies for the operation of the National Wildlife Refuge System that are listed in Appendix B.

Lands within the National Wildlife Refuge System are closed to public uses unless specifically and legally opened. All programs and uses must be evaluated based on mandates set forth in the National Wildlife Refuge System Improvement Act (Appendix B).

CCP Planning Process

Writing the Plan

The CCP is written to give overall guidance for the protection, use and development of the Great Dismal Swamp and Nansmond National Wildlife Refuges over the next 10-15 years. NEPA, meanwhile, ensures

Chapter 1

Purpose of and Need for Action

the Service will also assess the environmental impacts of any actions taken as a result of implementing the CCP. Figure 1-5 describes how the CCP process and the NEPA process have been integrated in this document.

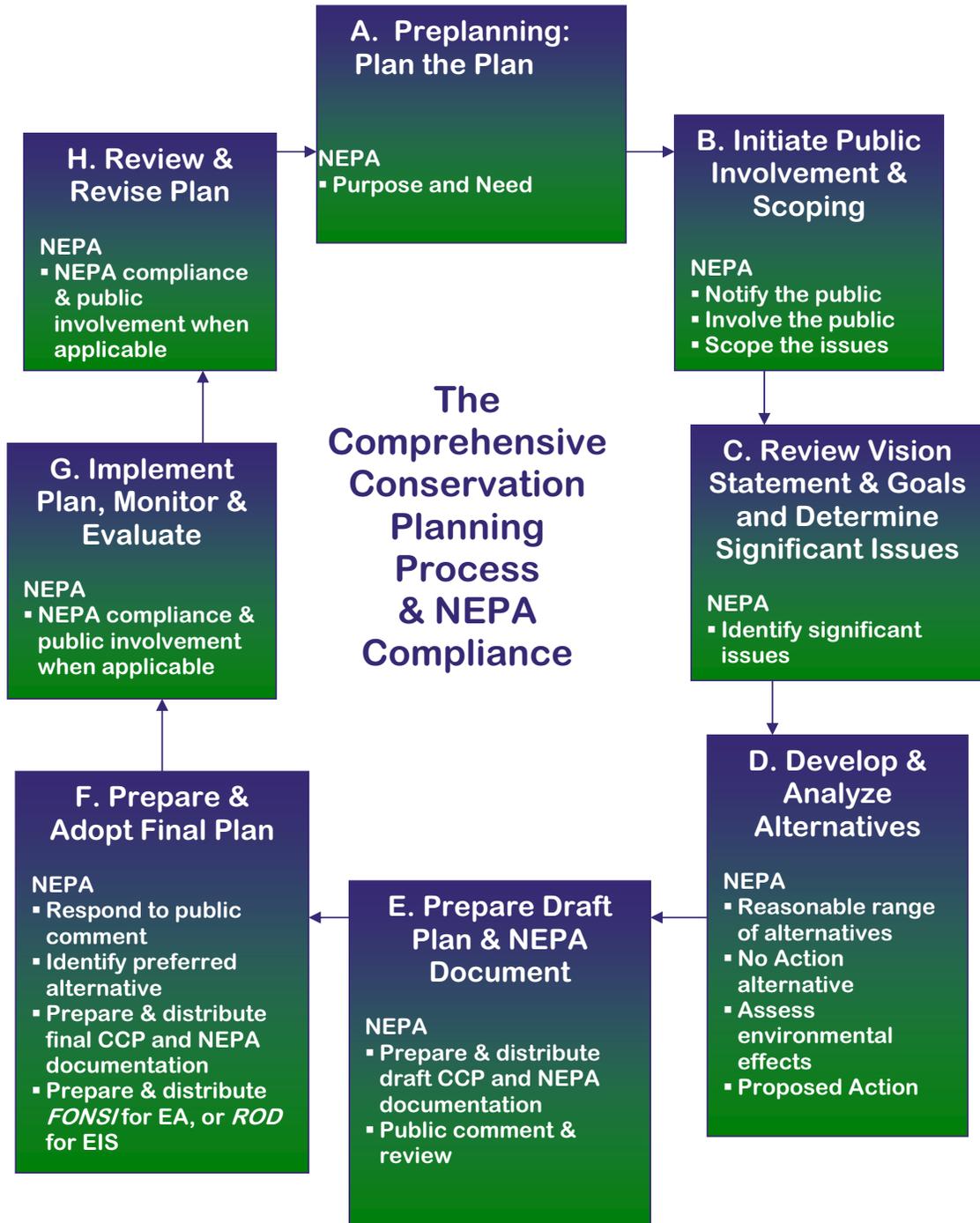
The planning process for the Great Dismal Swamp and the Nansemond National Wildlife Refuges began in August, 2001. It was then that the core planning team was assembled to begin the process of identifying needs and direction for the development of the comprehensive plan. A mailing list was compiled of nearly 600 contacts and in December, 2001, a newsletter was sent to everyone on the mailing list. Additional copies were distributed at the refuge headquarters and at all outreach events. Four scoping and public information meetings were held on January 8, 10, 22, and 24, 2002, in Elizabeth City and Gatesville, North Carolina, and Suffolk and Chesapeake, Virginia, respectively. Approximately 290 people attended the scoping meetings.

The complete planning team met in February, 2002, to review public comments and explore management options. This was followed by the mailing of an *Update* newsletter in March, 2002, summarizing public comments from the workbook and other written comments, and from the scoping meetings. Another meeting of the planning team was held in June, 2002, to review considerations for management objectives and strategies, and to discuss a Wilderness Study Area proposal. The core planning team then began working to formulate specific alternatives, objectives, and strategies that addressed each of the envisioned goals.

Additional meetings and workshops were held with refuge partners and other interested parties to discuss issues of habitat management and public use, among other things. This process lasted into the spring of 2003 when a range of management alternatives was finalized. By June, 2003, the team was ready to consider environmental consequences for each alternative.

Upon release of this draft CCP/Environmental Assessment there will be a 45 day period of comment. At the conclusion of the comment period, substantive comments will be addressed, an expected *Finding of No Significant Impact* (FONSI) will be release, and the final plan will be developed. Implementation of the preferred alternative can then begin immediately upon availability of funding.

Figure 1-5.



Step-down Management Plans

The Comprehensive Conservation Plan is one of several plans necessary for refuge management. The CCP provides guidance in the form of goals, objectives, and strategies for several refuge program areas but may lack some of the specifics needed for implementation. Step-Down Plans describe specific management actions the refuge will follow to achieve those objectives or implement management strategies. Some plans require additional NEPA analysis, public involvement, and compatibility determinations before they can be implemented. A status list of Step-Down Management Plans follows (Figure 1-6):

Step-Down Management Plans	
	<i>Date of Current Plan</i>
<p>Current: Fire Management Pollution Prevention (Spill Prevention, Control and Countermeasures)</p>	<p>1998 2001</p>
<p>Requires Updates by 2009: Water Management* Forestland Habitat Management* Fisheries Resource Management Hunting Fishing Law Enforcement Public Use Management Wildlife Population Management (Inventory and Monitoring) Safety Operations</p>	<p>1990 1987 1986 1986 1973 1986 1990 1984 1997</p>
<p>New Plans (Complete by 2009) Cultural Resources Management Habitat Management Plan</p> <p>*To be included in Habitat Management Plan</p>	

Figure 1-6. Status list of Step-Down Management Plans for the GDSNWR.

Great Dismal Swamp National Wildlife Refuge Vision Statement

The following vision statement was developed to define the desired future status of the Great Dismal Swamp National Wildlife Refuge:

Great Dismal Swamp National Wildlife Refuge was established in 1974 for the primary purpose of protecting a unique ecosystem. Thus, the refuge pioneered the concept of natural resources stewardship on a landscape scale. Incorporating over 111,200 acres in Virginia and North Carolina, the refuge has become one of the largest National Wildlife Refuges on the east coast of the United States. Yet, this large remnant of seasonally flooded wetlands is located near the heart of metropolitan Hampton Roads, Virginia.

The refuge will endeavor to restore the biological diversity of the Great Dismal Swamp ecosystem through hydrologic restoration and fire management. The refuge will support the diverse flora and fauna that have historically existed within a healthy swamp ecosystem, including one of the largest populations of black bears on the east coast. Seasonally flooded forests will be maintained as habitat for neotropical migratory birds and waterfowl. The rare Atlantic white cedar forests will be restored through forest management practices that promote natural regeneration. Remnant bogs, marshes, and pocosin habitats will be restored and maintained to enhance habitat diversity as well as provide potential habitat for the endangered red-cockaded woodpecker. Wildlife and wildlands-related research, environmental education, natural and cultural interpretation, and wildlife-dependent recreation will be developed and managed in a manner that does not conflict with the primary objectives of the refuge and promotes awareness and understanding of the entire Great Dismal Swamp ecosystem. Refuge land acquisition will focus on those areas where public ownership is required for hydrologic protection and restoration, for restoring and maintaining fire-dependent habitats, and for habitat development for wintering waterfowl. Through partnerships, wildlife corridors that link the refuge to natural areas within the Albemarle-Pamlico watershed will be protected.

Great Dismal Swamp National Wildlife Refuge Goals

The following goals were developed for the Great Dismal Swamp National Wildlife Refuge to highlight specific elements of our vision statement which will be emphasized in future management. The goals are not in order of priority.

1. Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein.
2. Protect and enhance Service trust resources and other significant species.
3. Support the restoration and protection of those areas within the Great Dismal Swamp watershed that either are remnants of Dismal Swamp habitat or can be restored to Dismal Swamp habitat.
4. Establish a public use program that will encourage awareness, understanding, appreciation and stewardship of the Great Dismal Swamp ecosystem while complementing the refuge resource management objectives.



Lake Drummond. *Sunrise at the Lake.* Waverley Traylor.

Key Issues and Concerns

Key issues were first identified by the core planning team in the beginning phase of the CCP planning process. Public comments from responses to the *Issues Workbook* and from the scoping meetings were then taken into consideration. The original key issues were modified based on the public input. Together with the previously mentioned four goal statements, the following list of issues formed the basis for the development and comparison of the alternatives proposed in Chapter 3. They are not in order of priority.

Great Dismal Swamp National Wildlife Refuge

Biodiversity Conservation

Due to its geographic location and climate, the Great Dismal Swamp is known for its unique blending of northern and southern species. Even though it is a highly disturbed ecosystem, it has retained at least remnants of most of the historic vegetative components and habitats. Its mosaic of vegetative communities supports an astounding variety of vertebrates and invertebrates and its very size permits the maintenance of a viable bear population. Our stewardship includes not only the game species such as deer and bear, but the tiny hairstreak butterfly and orb weaving spider as well.

The Great Dismal Swamp is the largest, most complex ecosystem in public ownership in the Northeast Region of the U.S. Fish and Wildlife Service. Inventories of the mammals, birds and reptiles have been completed and the amphibians, fish and plants have been surveyed. Little is known about the majority of the invertebrates. Untold decades will be needed to unravel the relationships of the vegetative communities to their inhabitants in this swamp environment.

With its proximity to urban populations, the Great Dismal Swamp has the potential to be a preeminent environmental laboratory for research and education. Working with the academic community and governmental partners we must develop research priorities that will aid in understanding and managing this complex ecosystem.

The refuge management must maintain the gene pools of the remnant communities and their associated fauna while research is prioritized, conducted and answers found. Ongoing management efforts must focus on maintaining the habitat diversity. The following management priorities have been identified.

- **Wilderness management-** Several areas on the refuge meet the “roadless” requirement for wilderness study areas. Concerns about restrictions to future habitat and public use management must be considered.
- **Forest (Habitat) management-** Many communities within the GDS are pioneer or early successional species, which will be replaced by longer-lived climax species if not disturbed. These communities include the Atlantic white cedar, shrub pocosin, marsh and sphagnum bog. Each of these vegetative communities was historically a result of wildfire and/or maintained by fire. Wildfires have been aggressively suppressed since the 1940’s resulting in reduced size and vitality of dominant species. With the changes in water regime throughout the swamp and the surrounding urbanization, permitting drought-driven wildfires to burn today is not an option.

Management of these communities must create the disturbance required for regeneration or maintenance. Strategies include the use of herbicides, and /or timber sales to reduce competition, surface preparation completed by scarifying with heavy equipment, and/or highly controlled prescribed burning. Pre-treatment and post-treatment field studies must be conducted to establish success of each management effort and quantify ancillary impacts to soil, water, faunal components, and adjacent vegetative communities.

- **Hydrologic management-**The historic water regime within the GDS has been altered; some elements beyond restoration. The upland watershed has been timbered and the fields tilled to quickly remove excess water from the crops. Water enters the swamp in a matter of hours instead of days after a rain event and must be discharged or wasted when it exceeds the swamp’s storage capacity.

The majority of the ditches were dug to provide material for logging roads. The roads are now dams to the historic sheet flow of surface water. In addition, the ditches were dug deep enough to remove the confining clay layer over the sustaining aquifer sands and now the ditches shunt vital ground water through the swamp.

The refuge cannot manage the adjacent cropland to slow incoming surface water, nor can it abandon or remove the roads within the swamp because compaction has already altered the substrate and road access must be maintained to fight wildfires. The refuge cannot abandon the ditches because the clay-confining layer cannot be replaced over the aquifer.

The refuge can operate and maintain a number of water control structures that slow discharge of both surface and ground water from the swamp and serve to mitigate many of the impacts of these

developments. Currently, 30 structures are maintained for this purpose with considerable success.

Concerns include excess storage resulting in spring flooding through nesting season for warblers and other neotropical migratory birds, including the Swainson's warbler. The flooding reduces food supplies for the adult birds and subjects the fledglings to death from exposure when they fall in the water upon first leaving the nest. Excess spring storage can also reduce needed discharge from adjacent upstream agricultural fields reducing the productivity of these privately owned lands.

Water conservation within the swamp is only one part of habitat maintenance and restoration. The ground water-surface water relationship must be understood; water table requirements for the various vegetative communities in both development and other phases must be established; methods to move water throughout the ditch network in order to sustain existing communities should be considered.

An additional concern has arisen regarding the beaver's return to the swamp after a hiatus of nearly 60 years. They have their own management objectives that include excess flooding. They attain their ends by damming culverts and water control structures within the swamp and the upstream watershed. Their success once more alters the productivity of adjacent cropland and interferes with refuge management objectives.



Lake Drummond Spillway.

Water control spillway releasing into the Feeder Ditch. USFWS.

- **Fire management-** Prescribed fire is considered an essential tool for habitat restoration and maintenance as well as for fuel reduction. In addition, lightning-caused wildfires are a high probability during dry years. The use of prescribed fire, as well as fire suppression, for resource management in the GDSNWR is highly complex due to the burning on organic soils and the refuge's location within a heavily populated area. The use of refuge facilities and staff support for the Region 5 fire operations program should also be taken into consideration for facility needs.

- **Endangered Species and Wildlife Management/Research-** Limited information on habitat requirements is available for the majority of the swamp's faunal components. It is important to review the needs of the high-profile species and state and federal listed species.

Several colonies of red-cockaded woodpeckers exist within the RTNCF watershed. The refuge has large acreages of maturing loblolly and pond pine which could serve as primary habitat for this highly selective bird. The Great Dismal Swamp NWR has been identified as a potential site for relocation under the Safe Harbor agreement. Management of mature pine stands is within the mandate of refuge programs, unlike the

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need to cut mature stands before loss of timber value when in private or corporate ownership.

Through ongoing Swainson's warbler research on Jericho Ditch, nearly 50 years of data regarding this species as well as all neotropical species using this habitat have been collected. Staff from the Smithsonian Institution are continuing the mist-netting and banding of birds started by the well known naturalist and ornithologist Brook Meanley in the 1950's. This type of research needs to be expanded to other habitats within the refuge.



Bear Population Study.
Virginia Tech. research project. USFWS.

The black bear is a species of great interest to the general public. First, it fascinates the urban dwellers that they really live in reasonable proximity to hundreds of bears living wild. On the other hand, the farmers are distressed when the bears make nightly forays into the crop fields or appear in their back yards. Bears crossing highways are struck and killed by motorists. Management of the bear population must incorporate elements of the swamp's carrying capacity, the seasonal variability in mast and the number of undesirable contacts with the public. A recreational bear hunt is being proposed and is supported by the Virginia Department of Game and Inland Fisheries.

Other birds of interest include the bald eagles that have returned to nest after nearly 50 years, and the tundra swans and snow geese that use Lake Drummond as a resting area and adjacent farmlands as feeding areas.

- **Zero management-** Some see the refuge as a *de facto* wilderness and propose a "hands off" approach to management. Some propose to go as far as removing the existing developments including the roads and ditch plugs.
- **Academic Partnerships-**The stewardship of a refuge established to restore and protect a unique ecosystem requires a multi-disciplinary approach to resource management. Resource management and direction must be evaluated and guided by studies and surveys conducted by biologist, ecologist, foresters, hydrologists, ornithologists, ichthyologists, entomologists, soil scientists, mammalogists, herpetologists, mycologists, geologists, archeologists, botanists, taxonomists, botanists, plant physiologists, and morphologists, geneticists, historians, limnologists, remote sensing specialists, wildlife epidemiologists, and GIS specialist ---to name a few of the disciplines. The need exists for refuge management to collaborate with academic institutions to develop and support research on the wide range of natural and cultural issues that affect refuge resource management.
- **Hurricane Isabel:** Hurricane Isabel inflicted considerable changes

to the refuge landscape on September 18, 2003. Several thousand acres of Atlantic white cedar forests were destroyed, and countless trees were blown down throughout the refuge, creating a potentially volatile fire situation. Without restoration, significant Atlantic white cedar acreage will be lost. The potential for catastrophic fires due to the added fuels created by the hurricane will increase in 2004 and beyond.

Land Protection

- **Urban interface-** Urban sprawl places commercial and residential development near the refuge boundary and threatens wildlife corridors. It increases habitat management complexity related to water and fire management, and increases nuisance wildlife concerns. Wildlife corridors connect the refuge to other natural areas within the Great Dismal Swamp (GDS) watershed. They are important for maintaining a healthy gene pool for bears and other wildlife. There is a need for highway designs that incorporate bear crossings and therein improve highway safety by reducing the probability of vehicle collisions with bears. Refuge water conservation strategies and beavers often are blamed for downstream flooding of private lands. The refuge staff believes most flooding problems are related to disruption of surface water flow by highways, railroads, and general development within the historic GDS floodplains.

- **Land acquisition-** All refuge land has been acquired from willing sellers. About 3,000 acres were added to the refuge since 1998 through Migratory Bird funds after years of failing to pick up sufficient Land and Water Conservation Funds. Some propose extending the refuge acquisition boundary to pick up existing or restorable swamp habitat south of US Highway 158 and east of US Highway 17. Some call for the protection of inflows from the west of the refuge and to establish a buffer from development along the western boundary to White Marsh and Desert Road. Even so, pockets of opposition to public land ownership remain. Easements are a potential tool to protect habitat short of fee title acquisition.



Urban interface. *North refuge development/flooding issues. USFWS.*

- **Boundary issues-** Considerable portions of the refuge boundary have not been posted due to inadequate staffing and some ambiguous boundary descriptions. Several known disputes are the result of neighboring owners failing to heed easements and boundaries. Some disputes are a result of contradictory and vague legal filings.

Public Use

- **The public-** There is growing interest world-wide in nature based tourism. The refuge's establishing legislation and refuge size would deem the "big six" wildlife dependent uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) on the refuge to be compatible. Lack of staffing and facilities is the primary limiting factor.
- **Hunting-** Only deer (archery and shotgun, without dogs) hunting is allowed at the present. The refuge will be considering a bear hunt in the Railroad Ditch area. Some contend the use of dogs for both should be allowed. Other groups vigorously oppose hunting with dogs, particularly for bear hunts. Permits for motorized access are issued during the hunting season for retrieval of hunt dogs that stray onto refuge land from adjacent private lands. There was some interest in waterfowl hunting for snow geese on Lake Drummond expressed during scoping.
- **Fishing/boating-** The refuge fishing season is from April 1- June 15, allowing by permit motorized vehicle/boat access to Lake Drummond via the Railroad Ditch entrance. Fishing is primarily for black crappie, although the lake is not considered to be a sport fishery since most of the more popular game fish do not reproduce well in the naturally acidic waters. Improved access for fishing and boating was requested at the public scoping. Although the refuge has never had a concessionaire agreement, one could be considered to provide rental equipment for boating and fishing. Some outfitters have provided various types of guided tours. Some have operated under a refuge permit, but most have not since they do not contact the refuge office for special services. Commercial operations are supposed to be covered by a refuge permit.
- **Environmental education-** This is one of the priority uses associated with the establishing legislation. Currently, facilities and staffing are limited. Sites have been identified as potential outdoor classroom areas, but have not been developed.
- **Interpretation-** Refuge interpretive programs need to be expanded to include not only natural history, but cultural history themes.
- **Wildlife observation/photography-** Public access is limited due to lack of facilities and inadequate roads for general vehicle access.
- **Horseback riding-** The North Carolina Horse Council is coordinating efforts to open more public lands to horseback riding. The GDSNWR is one of their focus areas.

- **Visitor/Administrative facilities-** Visitor services support facilities are woefully inadequate. Refuge administration operations have outgrown the current headquarters. The refuge is currently modestly developed, primarily for self-guided visitation, even though the refuge is located within an area populated by 1.6 million people. Public expectations for further development range from little or no development to heavy development. The 1979 Public Use Plan called for visitor facilities in Suffolk and Chesapeake, Virginia. Gates County, North Carolina, desires to establish an operations office and visitor facility in a reconditioned school building. Some Virginia interests are opposed to this location.

Partnerships

- **Army Corps of Engineers-** Operation and maintenance of both the Dismal Swamp Canal and the Lake Drummond Reservation is by the COE. Lake Drummond is the primary source of water for the canal. Establishing legislation directed the canal operation not to adversely affect the refuge. An informal agreement between the FWS and the COE may prompt the closing of the canal to Intracoastal waterway traffic during dry periods. The COE has agreed to cease to release water from Lake Drummond when the lake level falls to a specified point so as to comply with the mandate found within the refuge's establishing legislation. The COE allows no-fee, no permit camping at the Lake Drummond Reservation. The refuge operates under a COE permit to manage public use activities at the site. Supported guided tour services have occurred intermittently, but none are in place now. The lack of sufficient refuge staff prohibits the appropriate management to occur.
- **Dismal Swamp State Natural Area-** Adjacent to the refuge, this area has been an unstaffed satellite of the Merchants Millpond State Park since establishment in the early 1970's. Staffing and site plan development began in early 2004.
- **Nansemond Indians-** Historically, the Great Dismal Swamp lands were a primary hunting ground for this state recognized tribe.

Other Key Issues/Concerns

- **Law enforcement/public safety-** Considerable staff time is needed for investigation of criminal activities. Illegal vehicle access, car clouting, marijuana cultivation, bear and deer poaching, lewd and lascivious activities, trash dumping, vandalism, violation of refuge-specific hunt regulations, and homicide investigations, along with search and rescue, are among the chief law enforcement issues occurring on the 111,200 acre refuge. There is a lack of sufficient LE and public use

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personnel to assure a reasonably safe visit to the refuge at all times and locations.

- **Mosquitoes-** Eastern Equine Encephalitis and West Nile Virus have been found in the area. Aerial mosquito control occurred in October, 1999, during flood emergencies.
- **Support-** Generally, there is positive public support throughout the refuge area, although some communities seem to have competing interests.
- **Mercury contamination:** The Virginia Department of Environmental Quality issued a fish consumption advisory for mercury contamination for fish taken from the Feeder Ditch and Dismal Swamp Canal in October 2003. These waterways are not within the refuge, but they do drain from the refuge --- suggesting the possibility of contaminants issue extending into Lake Drummond and other ditches that drain into the lake.

Nansemond National Wildlife Refuge

Nansemond National Wildlife Refuge has been managed as a closed, non-staffed satellite refuge of the Great Dismal Swamp National Wildlife Refuge since the 1973 establishment. Even so, management issues and concerns were presented by both refuge staff and public comment during the planning process. These include:

Habitat

- **Management considered-** Salt marsh dominates the Nansemond NWR acreage. Grasslands management had been once considered as a management strategy during the base closure process. Recent information suggests that acreage available for grasslands or for forest management would be too small to have significant impact on the area. No-active-management was also suggested. There has been no prescribed burning on the refuge.

- **Species inventory** – Bald eagles have reportedly nested in nearby marshes along the Nansemond River. The refuge has tidal bottoms that may be suitable for establishing oyster beds to improve water quality. Phragmites has invaded the river's marshes.



Nansemond National Wildlife Refuge. Tidal marsh on Nansemond River.

USFWS.

Land Protection

- **Acquisition-** The entire refuge was established from lands declared excess by the Department of Defense. No further acquisition has been considered to date. There has been no condemnation in the past and none is anticipated. Today, the surrounding area is under tremendous development pressure.
- **Boundary disputes-** The refuge boundary has not been marked adequately. Encroachment by agricultural operations has occurred in the past.

Public Use

- **The Public-** The Nansemond NWR is virtually unknown since it has not been opened to the public.
- **Hunting-** No refuge hunting is allowed. Waterfowl hunting does occur on the Nansemond River.
- **Fishing/boating-** Boating occurs on the Nansemond River. The City of Suffolk, Virginia, has obtained a route on adjacent land to provide boat access to the Nansemond River.
- **Environmental education/wildlife observation/general access-** Nansemond NWR is not opened for public use.
- **Facilities-** There are no public use or administrative facilities on the site.

Partnerships

- **City of Suffolk, Virginia-** The City of Suffolk is looking at the Nansemond River basin as part of an ecotourism opportunity. In addition to the improvements for the adjacent public boat ramp, the City has also considered plans to build a recreation area (ball park) on their portion of the site nearest to Sleepy Hole Road.
- **Old Dominion University-** ODU had been considered to be a potential habitat management/research partner on an adjacent 150 acres. However, they have recently indicated that they were not going to obtain the site.

Other Key Issues/Concerns

- **Law enforcement/public safety-** LE staff and/or other staff is non-existent.
- **Contaminants-** Much of the refuge was contaminated by PCB's in the past. However, considerable remediation did occur before the base was closed. Nonetheless, the former presence of contaminants on the refuge will constrain future management options.

Affected Environment

- Introduction
- Physical Environment
 - Location and size
 - Physiography and Topography
 - Geology
 - Soils
 - Climate
 - Water Resources
 - Air Quality
 - Contaminants/Hazardous Materials
 - Aesthetics
- Biological Resources
 - Refuge Habitats and Regional Context
 - Fauna
 - Flora
 - Rare Species
 - Noxious/Invasive Species
 - The Role of Fire
- Cultural Resources
 - Cultural history
 - Archaeological resources
 - Underground Railroad
- Socio-Economics
 - Population
 - Employment
 - Public Use
 - Political Setting

2. Affected Environment

Introduction

The Great Dismal Swamp National Wildlife Refuge (NWR) is the largest intact remnant of a vast ecosystem that once covered more than one million acres of southeastern Virginia and northeastern North Carolina.

Formal protection of this resource began in 1973, when Union Camp Corporation (a local forest products company) donated 49,097 acres to The Nature Conservancy. The Nature Conservancy conveyed the donated land to the federal government, which, combined with additional purchased land, was used to establish the Great Dismal Swamp NWR in 1974.



Great Dismal Swamp Watershed. *The Great Dismal Swamp National Wildlife Refuge (NWR) is the largest intact remnant of a vast ecosystem that once covered more than one million acres of southeastern Virginia and northeastern North Carolina. Satalite image. USFWS.*

The Dismal Swamp Act of 1974 directs the U.S. Fish and Wildlife Service to:

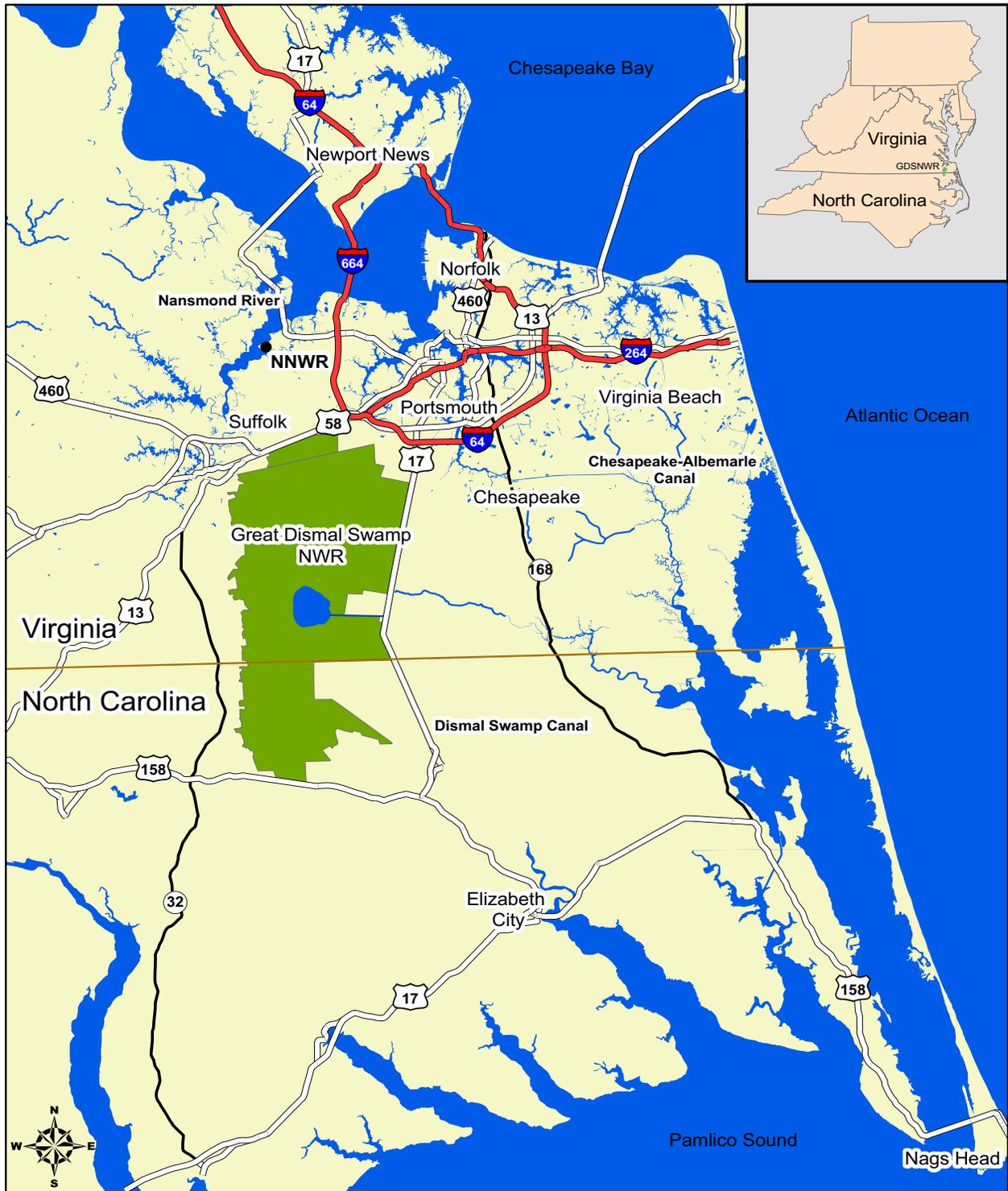
“Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein. Management of the refuge will be directed to stabilize conditions in as wild a character as possible, consistent with achieving the refuge’s stated objectives.”

With a secondary purpose to:

“Promote a public use program when not in conflict with the primary objectives of the refuge.”

This document also addresses management of the Nansemond NWR, a 423-acre parcel located on the southeastern side of the Nansemond River approximately 5 miles north of the Great Dismal Swamp NWR. The Nansemond NWR was created in 1973 when 207 acres were transferred from the U.S. Navy to the U.S. Fish and Wildlife Service, pursuant to the Federal Property and Administrative Services Act of 1949, as amended, 63 Stat. 377 (40 U.S.C. 471). In 1999, an additional 216 acre parcel of upland grassland and forested stream corridor was added as a result of the Base Realignment and Closure (BRAC)

Figure 2-1



0 150 300 600 900 1,200 Kilometers

LOCATION MAP

**Great Dismal Swamp
National Wildlife Refuge**



process. The Nansemond NWR is an unstaffed, satellite refuge administered through the Great Dismal Swamp NWR. It is not open to the public.

Physical Environment

Location and Size

The name “Dismal Swamp” originated in colonial days, referring to the poorly drained area that lies between the James River in southeastern Virginia and the Albemarle Sound in North Carolina (Oaks and Whitehead, 1979). The Great Dismal Swamp originally extended over more than one million acres in southeastern Virginia and northeastern North Carolina (USDOJ, 1974). Clearing and draining for agricultural uses and residential development have greatly reduced the size of the original ecosystem and significantly altered the water cycle and fire regime of the remaining area.

The Great Dismal Swamp NWR is but one component of an extensive conservation network providing protection to the remaining resources. Within the GDS watershed other lands are protected by the City of Chesapeake, Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Department of Conservation and Recreation (VDCR), North Carolina State Parks, North Carolina Wildlife Resources Commission, The Nature Conservancy, the U.S. Navy, the U.S. Army Corps of Engineers, and conservation easements on private lands. The total area protected by this network of organizations is approximately 185,000 acres (The Nature Conservancy, 2001).

The Great Dismal Swamp NWR currently occupies 111,200 acres. Additional planned acquisitions are anticipated to increase the refuge size to approximately 115,000 acres. The refuge is located approximately 30 miles from the Atlantic Ocean. It is delineated on the north by U.S. Highway 58, on the east by the Dismal Swamp Canal, on the south by U.S. Highway 158, and on the west by the Suffolk Scarp (Figure 2-1). The Refuge occupies portions of two cities in Virginia, Suffolk and Chesapeake, and three counties in North Carolina, Gates, Camden, and Pasquotank.

The Great Dismal Swamp NWR is one of seventy wildlife refuges in the northeastern administrative region of the U.S. Fish and Wildlife Service. The refuge is the largest in Region 5, representing nearly 25 percent of all service owned land found in the northeast region. The refuge straddles the region's southern boundary with approximately 33 percent of the refuge overlapping into the Service's southeastern region, Region 4.

Physiography and Topography

Great Dismal Swamp NWR lies in the Embayed Section of the Atlantic Coastal Plain, which consists of three wide, gently sloping terraces separated by longitudinal, eastward-facing escarpments. The middle terrace, known as Dismal Swamp Terrace, is bisected by the Deep Creek swale, also running north-south. The refuge is located on the western portion of this terrace, between the Suffolk Escarpment (Scarp) and the Deep Creek Swale. Churchland Flat bounds the refuge on the north.

The refuge can be divided into three physiographic zones: Lake Drummond, the forested wetland, and a transition zone. Lake Drummond, a 3,108 acre shallow lake, is located near the center of the refuge. The forested wetland portion, the predominant feature of the refuge, is sharply disrupted on three sides by the Dismal Swamp Canal and U.S. Highways 58 and 158. Along its western edge, the transition zone from swamp to uplands is more gradual, creating an area of mixed characteristics.

Along the Suffolk Scarp, on the western side of the Great Dismal Swamp NWR, elevations rise and relief is variable. Traveling eastward across the refuge from the Suffolk Scarp, elevation drops at a rate of one foot per mile to the Deep Creek Swale (east of the Dismal Swamp Canal). In the Virginia portion of the refuge, elevations range from 15 to 25 feet; in Pasquotank County, North Carolina, elevations range from 10 to 20 feet; Camden County varies from 21 feet or lower. The topography exhibits a gentle west to east slope imposed on an even gentler north to south slope. The normal surface elevation of Lake Drummond is 18.65 feet.

Nansemond NWR also lies within the outer part of the Atlantic Coastal Plain physiographic province. The generalized physiography of the area is known for a "stair-step" appearance, consisting of wide, gently eastward sloping planes separated by linear, steeper, eastward-facing scarps. The planes slope eastward at less than two feet per mile, whereas the scarps have slopes of as much as 50-450 feet per mile through short distances.

The Nansemond NWR is situated on the east bank of the Nansemond River, east of the Suffolk Scarp. Elevation varies from sea level to 21 feet above sea level. Much of the Nansemond NWR is a well-drained knoll, with drainages emptying into the river and marshes.

Geology

Great Dismal Swamp NWR and Nansemond NWR are underlain by several geologic formations: the four most significant are the Yorktown, the Norfolk, the London Bridge, and the Sandbridge formations (USDOI, 1979).

The Yorktown Formation is the oldest and deepest unit of the four, consisting chiefly of impermeable clay. The top of the Yorktown Formation is within 15 feet of the surface throughout much of the western part of the refuge and within 25 feet of the surface in the eastern part.

The Norfolk Formation overlays the Yorktown Formation beneath most of the refuge and is closely associated with the Great Dismal Swamp NWR's water budget. The Norfolk Formation is composed of two layers. Its lower level consists primarily of coarse sand and is very permeable. The upper layer consists of eight strata, three of which play an important role in the hydrology of the refuge. The coarse-sand stratum under the Suffolk Scarp and the extreme western part of refuge serves as a shallow aquifer. The Norfolk Formation is exposed at elevations between 25 to 70 feet in a belt less than a mile wide that runs north-south along the Suffolk Scarp. This is the groundwater recharge area for the aquifer. The formation then grades eastward under the refuge into the medium-sand stratum. This stratum underlies most of the Great Dismal Swamp NWR and in turn grades into fine sand beneath the area east of refuge. Groundwater input from the Norfolk Formation accounts for the majority of water that upwells in the swamp.

The London Bridge Formation, clay silt that overlays the Norfolk Formation, occurs throughout the eastern and most of the western portions of the refuge. The Sandbridge Formation generally overlies the London Bridge Formation, where the London Bridge is present, or directly overlies the Norfolk Formation. It is composed of two sheet-like deposits: a lower layer of sand and an upper layer of silty clay. The London Bridge and Sandbridge Formations confine the Norfolk aquifer. More recent deposits over these formations consist of a layer of inorganic soils and an overlying organic layer of peat.

Soils

Organic Soils

The soils of Great Dismal Swamp NWR play a critical role in supporting its wetland communities. Organic soils predominate, with mineral soils confined to the toe of the Suffolk Scarp and to historic outflows of tributaries to the Elizabeth, Northwest, and Pasquotank Rivers. The organic soils are divided into two taxonomic classes: Typic Medisaprists and Terric Medisaprists. The mineral soils are divided into several classes with widely varying characteristics.

Typic Medisaprists are organic soils more than 51 inches thick, underlain by mineral subsoil. There are two types of Typic Medisaprists within the Great Dismal Swamp NWR: those composed of finely divided and those composed of coarsely divided soil material. Terric Medisaprists are organic soils more than 16 inches and less than 51 inches thick, underlain by loamy or sandy mineral subsoil.

In general, the organic soils of the refuge are black, fine-grained, highly decomposed mucky peat. Partially decomposed logs and stumps are buried in the decomposed organic material at depths ranging from a few inches to five feet. These soils are characterized by poor or very poor drainage, high acidity, and mean annual soil temperatures between 59° and 72° Fahrenheit. Permeability varies with the composition of the subsoil.

During much of this century, the suitability of the swamp's organic soils for cultivation resulted in conversion of extensive tracts of swamp woodlands to agricultural lands. Although the organic soils are often saturated and extremely acid, they are quite fertile, and high yields of corn, soybeans, and grain are reported from drained organic soils on the periphery of the refuge. However, remaining areas of organic soils within the refuge have low potential for agriculture due to their thickness, buried debris, and inaccessibility.

Remaining organic soils on the refuge are subject to a number of other forces. The organic soils are highly susceptible to fire. When burned, the average combustible component of the soil is 93%, leaving a 7% ash content (Otte, 1985). Historically, uncontrolled fires directly removed organic soils from the swamp. In more recent times fire suppression has countered this trend, allowing organic soils to accumulate.

Uncontrolled drainage has also contributed to organic soil loss on the ditch side of the road-ditch corridors within the refuge. In their

natural saturated state, the swamp's organic soils are 85- 95% water. In areas that have undergone excessive drying due to drainage, these soils aggregate into a granular form that will not re-wet even under inundated conditions. The dehydrated soils oxidize at a rapid rate and their granular nature reduces saturation in the vegetation root zone, possibly facilitating the intrusion of vegetation typical of drier sites.

Where water is impounded in the refuge by elevated roads and functioning water control structures, saturated organic soils accumulate. The interplay between organic soil loss and accumulation caused by the opposing forces of burning, fire suppression, drainage, and impounding, as well as inherent soil instability, have resulted in very complex soil dynamics in the swamp. As peat accumulates, the distance between surface soils and the water table increases, renewing the oxidation/ subsidence process in the unsaturated layer with subsequent soil loss, until the cycle begins again. The key to maintaining saturated soils for wetland vegetation is, therefore, to keep the optimum distance between surface elevations and the water table.

In any case, due to their saturation and high organic matter content the organic soils are generally unsuitable for sanitary facilities, building site development, recreational development, and trails. They are highly corrosive to both steel and concrete construction.

Mineral Soils

Mineral soils are defined as those having an organic layer of less than 16 inches. Those present within the refuge include several taxonomic classes: Histic Humaquepts, Typic Ochraquults, Typic Hydroquents, Typic Umbraquults, and Typic Humaquepts.

Histic Humaquepts are soils with organic layers 8 to 16 inches thick over mineral subsoil of varying composition (sand, loam, and clay). Permeability depends upon the texture of the subsoil. They are usually poorly drained and moderately subject to fire and compaction.

Typic Ochraquults include loam and fine sandy loam soils and are mildly to strongly acidic. Drainage and permeability vary with the texture of the subsoils. Seasonal ponds form in some areas.

The Typic Hydroquent class is heavy gray clay that occurs frequently. It is a deep, very poorly drained soil. Ponds commonly form during wet seasons.

Other mineral soils occur to a limited extent along the Suffolk Scarp.

They are generally better drained and less subject to flooding than the soils described above. Although some mineral soils have high water tables and are subject to brief flooding, they are more suited for sanitary facilities, construction, and recreational development than the organic soils because their load-bearing strength is generally much higher.

Nansemond NWR Soils

Several soil series exist on the Nansemond NWR, including the Nansemond, Kenansville, and Bohicket series. The Nansemond series consists of a loamy fine sand surface layer with a sandy loam or sandy clay loam subsoil about 47 inches thick (USDA, SCS, 1984). The permeability of the Nansemond series is moderately rapid, and the soil has a seasonally high water table at depths of 2 to 3 feet.

The Kenansville series has a dark, grayish-brown loamy sand surface layer about three inches thick. The subsurface layer is an olive-yellow loamy sand about 20 inches thick. The subsoil is usually 20 inches deep and composed of brown fine sandy clay loam. The permeability of the Kenansville series is moderately rapid and it has a seasonally high water table of 4 to 6 feet.

The Bohicket series is a dark, grayish brown, silty clay loam, typically 13 inches thick. It is underlain by approximately 60 inches of clay. The permeability of the Bokicket series is very low. This series is typical of salt water marshes.

Climate

The Great Dismal Swamp NWR and Nansemond NWR are located in the humid-subtropical zone, characterized by long, humid summers and mild winters. The climate is moderated by the proximity of water bodies, including the Atlantic Ocean, Albemarle Sound, and Chesapeake Bay. The average annual temperature is approximately 60° F (15.6°C), ranging from monthly averages of 45°F(7.2 °C) in January to 79°F(26.1°C) in July. Extremes have been recorded as high as 105°F (40.6°C) and as low as 2°F (-16.7°C).

Rainfall is well distributed throughout the year and long periods of drought seldom occur. Average annual precipitation at Norfolk, Virginia, is 45.74 inches (116.2 cm), with the normal annual snowfall at 8.8 inches (22.4cm) (National Weather Service, Wakefield, Virginia). The annual potential evapotranspiration is 32 inches (81.3 cm).

Southwesterly winds dominate during the warmer months, while northwesterly winds dominate the cooler months. Northeast winds are less common and are usually associated with storm events and the passage of cold fronts. The mean wind speed is 10.5 miles per hour.

Water Resources

The Great Dismal Swamp is less than 9,000 years old; it was formed on a hillside instead of a basin and without the benefit of rivers flowing into or beside it. These facts set it apart from all other southern swamps. Regionally unique geologic formations and the presence of a shallow artesian aquifer changed the prehistoric, climax oak hickory forest into the cypress gum wetland complex of recent history. It is these same hydrologic factors that are maintaining the swamp today.

Hydrology

Many people perceive swamps as having standing water year round. This is not the case in the Great Dismal Swamp; in fact, most of the swamp's vegetation could not survive permanent inundation. The Great Dismal Swamp has an annual hydrologic cycle that results in changing water levels throughout the year. Historically, the swamp's natural hydrologic cycle has followed the seasons. Otte (1985) provides a description of this cycle:

“In autumn the swamp was at its driest, with little or no standing water (except for Lake Drummond and some of the larger channels) and a low water table. There was little downstream movement of water; most water moved upward and out of the soil by evapotranspiration.

In the winter -- as rains increased, temperatures declined, and evapotranspiration rates slowed, stream flow swelled and the water table rose until it reached the surface. At this point streams overflowed into the swamp and surface sheetflow toward the east and south predominated.

By spring the swamp was flooded to its maximum extent with little lateral water movement. As temperatures rose and plants began to grow in the late spring, evapotranspiration removed large quantities of water from the swamp and the water table began to drop below the ground surface. This allowed soils to aerate and vegetation to obtain oxygen needed

for growth. While there were fluctuations in the annual cycle of surface water within the swamp, subsurface water losses were moderated by the large water holding capacity of the peat soils.”

Water Dynamics:

Great Dismal Swamp NWR’s water budget is influenced by several natural input-output events. Direct precipitation is a major source of water, contributing about 28.5 billion gallons to the refuge annually and accounting in part for the fact that more water flows out of the refuge than enters it as surface inflow. Precipitation is highest during the summer months.



Washington Ditch . *By late winter, streams have swelled and overflowed into the swamp. Sheetflow. USFWS.*

Surface water inflow occurs in the form of stream and sheet flow from the west along the Suffolk Scarp. About 82 square miles of upland area drain into the refuge, primarily via Cypress and Taylor Swamps, supplying approximately 22 billion gallons of surface water each year. Eighty-nine percent of this inflow occurs from November through April. Evapotranspiration in areas upstream from the swamp severely limits inflow during summer despite higher rainfall rates.

Evapotranspiration accounts for the biggest portion of water removal from the swamp ecosystem. It exceeds rainfall during the growing season and causes a lowering of water levels in the refuge throughout the summer. Estimated annual evaporation loss from the refuge is about 39 inches (data from Dismal Swamp Canal hydrology substation). The rate of transpiration is not known.

Surface water runoff through the swamp is also a major means of outflow. Historically, the principal drainages have been the Northwest, Pasquotank, and Elizabeth Rivers, and Shingle Creek. Much of the winter discharge within the swamp was in the form of sheet flow. During low flow periods, the water would follow the random channels cut during high flow. Over the last two centuries natural outflow patterns have been altered; most surface water now drains through the refuge in the network of canals and ditches with minimal sheet flow.

Ground water discharge is a secondary output event. Wherever the upper layer confining the shallow aquifer is absent, ground water wells up into the overlying peat and is discharged from the peat by evapotranspiration. Ground water is also discharged by seeping directly into Lake Drummond. Where the aquifer is breached, ground water is discharged from the refuge as surface flow through outlet channels that are left uncontrolled.

Current hydrologic setting:

The hydrology of the Great Dismal Swamp has been modified through years of human activities. The ramifications of these changes are not fully understood but a few generalizations can be made. The amount and rate of annual surface inflows into the refuge have increased due to upland land use practices such as field tiling, road building, and housing along the Suffolk Scarp. Water that used to recharge the shallow aquifers and enter the swamp as much delayed ground water, is now intercepted and diverted into the refuge as surface water. This increase in the volume of surface water contributes to higher surface water levels during winter and storm events and may be in part responsible for reduced volumes of water to recharge the swamp during dry summer periods.

Ditches

Within the refuge, the construction of 158 miles of canals and ditches with their attendant spoil bank roads have combined to form the single most significant alteration to the swamp's water regime. The elevated spoil bank roads serve as dams blocking overland water flow. Conversely, those ditches without controls can quickly shunt water through to the swamp. In those areas where the confining layer was removed from the underlying artesian aquifer, ground water can also be shunted through during periods of low water. The loss of the artesian waters may reduce an important buffer needed for spring and summer evapotranspiration drawdown.

Many of the refuge's ditches form a network that channels much of the current surface flow into Lake Drummond, which in turn drains into the Feeder Ditch through a gated spillway and then into the Dismal Swamp Canal. Other ditches, including Corapeake, Big Entry, and several smaller ditches, drain directly into the Dismal Swamp Canal. Several ditches in the southern portion of the swamp drain into Cross Canal and ultimately into the Pasquotank River basin. Jericho Ditch drains northwest to Shingle Creek and also south to Lake Drummond. Due to flat terrain, the flow in several ditches is reversible, depending on rainfall, obstructions, and other factors.

The Dismal Swamp Canal has had a powerful effect on the hydrology of the swamp. The canal intercepts a majority of the surface water flowing out of the swamp and has breached the artesian aquifer. Lake Drummond is the primary source of water to operate the canal. Water flow through the canal is managed by locks at either end of the canal and by the spillway on Feeder Ditch at Lake Drummond.

Of all available incoming water (precipitation, surface inflow, and ground water), Lake Drummond receives approximately 25 billion gallons; the lake has a capacity for 4.62 billion gallons. 3.5% of outflow from the lake is used for the operation of the two locks on the Dismal Swamp Canal. The remaining 96.5% of available water is discharged as it exceeds the holding capacity of the swamp.

The effects of the roads on ground water are not clearly understood, but it is assumed that associated soil disturbance, compaction, and addition of outside materials to swamp soils have significantly altered historical patterns of ground water movement through the swamp. Questions remain as to the permanence and irreversibility of these subsurface dams.

Prior to federal acquisition of the Great Dismal Swamp, the private owners recognized the need for water conservation and control to reduce water losses. Previous owners installed 115 water control devices and culverts over the years. Many of the structures deteriorated over time, but the Service has repaired or replaced most of the critical water control structures since the refuge's establishment. These control structures have reduced water losses in the swamp .

Surface water levels and the ground water table are highest from December through April and lowest from May through November.



Feeder Ditch . *Water from Lake Drummond spills into the Feeder Ditch and then into the Dismal Swamp Canal.*

Photo:Waverley Traylor.

Lake Drummond

Lake Drummond, located near the center of the refuge, is one of only two naturally occurring lakes in Virginia. This 3,108-acre lake is shallow and nearly circular in shape (2.7 miles north-to-south and 2.4 miles east-to-west). At its deepest point, Lake Drummond is only 6 to 7 feet deep. It is perhaps the most widely recognized feature of the Great Dismal Swamp NWR.

The water level in Lake Drummond is intensively managed. A 1977 informal agreement between the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers defines a minimum lake level of 15.75 feet above mean sea level to retain sufficient water in the swamp ecosystem. When the water level is below this, water cannot be released from the lake for Dismal Swamp Canal operations.

Surface water quality is generally good. The dark tannic color and 3.5-6.7 pH level impart a distinct taste and heighten the water's ability to remain fresh.

Water Quality

Fertilizers and pesticides used on corn, soybeans, cotton and peanuts, and runoff from hog operations are potential surface water pollution sources. In addition, sediment flowing into the refuge from upstream agricultural and timber lands may eventually affect the free flow of water through the swamp and diminish water quality.

Water from the Norfolk aquifer is commonly soft with a generally low mineral content, although some areas have excessive iron and free carbon dioxide that may cause corrosion problems. The shallow aquifer is potentially susceptible to contamination from agricultural, industrial, or domestic runoff.

Nansemond NWR Water Quality

According to the Virginia Department of Environmental Quality (DEQ), some water quality problems exist in the Nansemond River. A fish eating advisory for Kepone exists for the James River and all its tributaries from the fall line at Richmond to the Hampton Roads Bridge Tunnel. It became effective on July 1, 1988, but there are no restrictions on fish consumption.

For all tributaries and mainstems of the Nansemond River, the watershed is classified as “nutrient enriched” under Virginia Water Quality Standards. This is likely due to non-point source contributions from agricultural, urban/suburban and forestry activities. DEQ has given the Nansemond River an overall water quality ranking of medium. The U.S. Environmental Protection Agency regulations require the states to give a priority ranking to identify those waters scheduled for Total Maximum Daily Load (TMDL). A ranking of medium identifies those waters scheduled for TMDL development by the year 2006.

Air Quality

The U.S. Environment Protection Agency (EPA) promulgated national ambient air quality standards in 1997 for PM_{2.5} (particulate matter equal to or less than 2.5 microns in diameter), however monitoring devices were not fully installed and operational until January, 1999. PM_{2.5} is one of six “criteria” pollutants for which standards have been established by the EPA Office of Air Quality Planning and Standards. The EPA determined that these standards are necessary to protect human health and the environment (Virginia Department of

Chapter 2
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Environmental Quality website, February, 2003). Primary standards set limits to protect public health, including the health of “sensitive” populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (www.epa.gov/airs/criteria.html). For PM2.5, the threshold for the annual arithmetic mean is 15 ug/m3 for primary and secondary standards, while the threshold for the 24-hour average is 65 ug/m3 for primary and secondary standards (See Figure 2-2).

VIRGINIA 2002
PM2.5 PARTICULATE MATTER SUMMARY BY REGION
METHOD CODE 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL
Micrograms Per Cubic Meter (ug/m3)

LOCATION	NO. OF OBSERVATIONS BY QUARTER				HIGHEST VALUE PER QUARTER				QUARTERLY ARITHMETIC MEAN			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
TIDEWATER REGION												
CHESAPEAKE Oscar Smith Stadium	79	89	82	82	23.3	25.3	49.4	30.1	10.4	12.1	13.7	11.2
HAMPTON Va. School for the Deaf & Blind	28	30	26	30	19.7	17.5	32.9	22.5	10.4	11.0	13.6	11.6
NEWPORT NEWS Pump Station #103	28	30	28	28	17.7	18.8	33.7	33.5	9.8	11.8	14.6	11.4
NORFOLK NOAA Facility	29	27	31	31	19.9	22.1	50.8	21.2	10.7	11.9	16.6	11.4
VIRGINIA BEACH Tidewater Regional Office	28	26	28	31	21.9	22.5	50.2	26.8	10.8	11.2	15.8	12.1

Figure 2-2. Particulate matter is the primary pollutant released during wildfires and during prescribed fire operations. Prescribed fire is used at Great Dismal Swamp NWR to improve wildlife habitat, maintain fire-dependent plant communities, and to reduce hazardous fuel accumulations near buildings and development. The data presented above represents sampling stations that may detect significant PM2.5 emissions from prescribed fire activities on the Refuge (the Chesapeake location is closest). As this data demonstrates for 2002, the threshold value for PM2.5 was never exceeded for the 24-hour average or the annual average.VDEQ.

Contaminants/Hazardous

Great Dismal Swamp NWR Environmental Concerns

Resources of the Great Dismal Swamp NWR may have been (or continue to be) exposed to environmental contaminants from a variety of sources. To investigate the level of contaminants, the U.S. Fish and Wildlife Service sampled for three groups of pollutants: heavy metals, organochlorine pesticides, and alkanes (a constituent of petroleum products). Samples were collected from sediments, surface waters, and from the tissues of fish and small mammals during 1987, 1989, and 1992 (Kane, 1997). None of the sites demonstrated high levels of contaminants, though several areas on the refuge demonstrated higher levels than other sites. The areas exhibiting elevated levels of contaminants include the East Ditch area, where potential sources of contamination are the heavily used US Highway 58 and an automobile junkyard; the Cypress Swamp area demonstrated elevated levels of metals, but a potential source was not identified; and Lake Drummond fish showed elevated levels of mercury, chromium, nickel, and iron. Kane (1997) noted that it is well-documented that wetlands and swamps may act as sinks for metal contaminants, particularly mercury. Mercury is known to bioaccumulate and it is significant that top predators in Lake Drummond demonstrated the highest mercury levels, despite the fact that mercury was not detected in Lake Drummond water samples.

It should be reiterated that no high levels of contaminants were detected, only elevated levels in select areas. Kane (1997) suggests that this data be used as a baseline and that periodic monitoring of sediments and biota be conducted.

Nansemond NWR Environmental Concerns

A site survey was performed on April 15, 1997, by the Virginia Field Office (VAFO), U.S. Fish and Wildlife Service, Division of Ecological Services. During the survey, staff from the VAFO and the Great Dismal Swamp NWR walked the entire perimeter and most of the inner area of the 208 acres transferred to the Service in 1999. The purpose of the survey was to ascertain the likelihood of the presence and/or extent of hazardous substances or other environmental problems associated with the property. As environmental investigations and remediation have been ongoing at this site under the Installation Restoration Program (IRP), the property has been divided into several sites. The following descriptions and restrictions

correspond to designations defined through Defense Base Closure and Realignment Commission (BRAC) activities.

The first area surveyed comprises all of BRAC Sites 5 and 11 and most of the areas adjacent to these sites. Site 5 is the polychlorinated biphenyls (PCB) spill area near Star Creek. Soils in this area were contaminated by leaking transformers that were previously stored there, and historical reports indicate that oil in the transformers was drained into 55 gallon drums before being discarded into the marshy area. Results from soil sampling showed levels of PCB's up to 15,000 parts per million (ppm) in soil and 1 ppm in sediment, levels that are consistent with PCB clean-up goals at Superfund sites in the Environmental Protection Agency's Region 3. Clean fill was layered over site soils to minimize potential exposure of ecological receptors to remaining levels of PCB's in soils.

Restrictions for Site 1 prohibits the extraction of shallow groundwater and any disturbance of the surface and/or subsurface area without prior written approval of the Department of the Navy. Disturbance shall mean any intrusive activity that involves the penetration of the surface soil; such as excavation, trenching, tilling of the soil, and/or any mechanical or manual drilling. These prohibitions are intended to control the risk of direct contact with or consumption of water from the shallow aquifer and to control the risk of direct contact with or consumption of subsurface soils in contact with the groundwater in the shallow aquifer where contamination (124-trichlorobenzene) has been found to exceed the maximum contaminant level for drinking water.

The Site 7 restrictions prohibit disturbance of any surface or subsurface soils as above. The contaminant present in this case is low levels of Polynuclear Aromatic Hydrocarbons (PAH's).

Site 11 is adjacent to Site 5 and is designated as "The Disposal Pits." Construction debris was found at this site during PCB remediation activities at Site 5. The debris included shingles, wood and metal fascia.

During the April 15, 1997, site visit, a large dirt pile with a grass cover was observed. It is likely that this dirt pile is leftover clean fill that was brought in for remedial activities at Site 5. Other debris observed in the vicinity included a telephone pole, a wooden pole, a metal structure with wire conduits on the backside, and a metal container in Star Creek.

Aesthetics

The assessment of the Great Dismal Swamp NWR's aesthetic quality assumes that: (1) Unaltered natural areas possess greater natural scenic potential than modified areas, although some scenic value can be ascribed to the altered landscape if it is in character with the wildlife mission of the refuge; (2) scenic areas that are separated or buffered from intensive development, eyesores, or other unattractive environments are more valuable than those that are not; and (3) while visual resources are important, the policy of habitat protection on the refuge precludes the most visually obtrusive activities.

Visual resources were qualitatively assessed for each of six general zones in the refuge, as follows:

Aerial Views

Great Dismal Swamp NWR is dramatic from the air, as the vast expanse of forest offers a startling contrast to the surrounding mosaic of farms and urban areas. At the center of the refuge, Lake Drummond forms a prominent focal point. Bald cypress snags jut above the general forest canopy. The ecological continuity within the swamp is broken only by the road and ditch network, and even this is seasonally obscured by the canopy. The scarcity of such landscapes on the east coast adds greatly to the refuge's value as an aesthetic resource.



Lake Drummond . *The most significant visual feature in the refuge. USFWS.*

Lake Drummond

The lake is the most significant visual feature in the refuge. Its expanse of water has a shoreline punctuated by cypress snags. The lake possesses qualities of vividness, near/far contrast, and pictorial composition that are unmatched in the rest of the refuge. Colors and light change constantly, and overall wildlife viewing opportunities, especially of resting and wintering waterfowl, are better than elsewhere on the refuge.

Feeder Ditch/Dismal Swamp Canal

These waterways offer some visual interest for visitors entering the refuge by boat from the east. Overhanging branches and views of wildlife balance the visual deficit of artificial ditch banks. Development along these water routes is generally in keeping with their function.

Road/Ditch Corridors

The corridors lacing the swamp are long, narrow, and straight. In many cases, the value of the roads as viewsheds is lessened because care must be taken in negotiating around potholes, eroded edges, obstructions, etc. Views through the trees are possible when the leaves are gone; during the growing season a solid wall of vegetation forms along the roads, creating a tunnel effect. Seasonal color adds to the visual quality of the swamp forests. Wildlife viewing opportunities vary: open areas along the road and open water in the ditches offer the best chance for sighting wildlife. Because of off-road access constraints, refuge public use and resource management activities often coincide along these corridors, making visual management an important factor in retaining the aesthetic values of the refuge.

Wooded Interior

Inaccessible to viewing by most refuge visitors, the forests in the swamp interior add to the mystery of the swamp. They harbor wildlife activity and buffer activity and noise between different swamp areas.

Swamp Periphery

The edge of the swamp offers only a hint of the vast forested area lying beyond. Along most of its periphery, the swamp acts as a backdrop for various landscapes including highways, farms, and residences. Because of the sudden disruption of forest lands by development or clearing, the swamp's essential character as a potential ecological isolate, or "island", is emphasized.

Biological Resources

Refuge Habitats and Regional Context



Birds. *Two hundred and nine avian species have been reported in the Great Dismal Swamp NWR. Woodduck. Waverly Traylor.*

The Great Dismal Swamp NWR is a matrix of unique habitat types, many of which are rare. Within the refuge are found typical pocosins of the southeast (here they exist at the northern extent of their range), some of the largest remaining Atlantic white cedar woodlands to be found anywhere, and potential restorable habitat for the federally-endangered red-cockaded woodpecker.

Fauna

Birds

Two hundred and nine avian species have been reported in the Great Dismal Swamp NWR. Within this group, 92 species nest in the swamp, 49 of which are year-round residents; the remainder are migratory breeders. Most of the breeding birds of Great Dismal Swamp NWR can also be found in smaller wetlands outside the refuge, but not in such abundance and high density. One hundred and eleven migrant bird species use the refuge during fall and spring migrations. See Appendix C.

Insects

Refuge invertebrates include many individual species. Matta (1979) listed 182 species of aquatic and semi-aquatic insects, but little information was provided regarding terrestrial insects. Much of this data gap has been filled by recent surveys of butterflies and skippers (Roble et al., 1999) and damselflies and dragonflies (Roble and Cuyler, 1999). These recent reports include 52 butterflies, 41 skippers, 22 damselflies, and 43 dragonflies from within the current boundaries of the Great Dismal Swamp NWR. Six of these species are dependent upon switchcane as their only larval food plant.

Fish

Twenty-seven species of fish occur in Lake Drummond and the ditches. Seventy-five percent of the total fish population consists of the yellow bullhead. The abundance of yellow bullhead and low recruitment of black crappies, a species preferred by fishermen, may be attributed in part to yellow bullhead eating the eggs of the crappie.

Reptiles and Amphibians

Sixty-two species of herptiles (reptiles and amphibians) have been found at Great Dismal Swamp NWR, and six additional species may be present (Mitchell et al., 1999). These include 19 toad and frog, nine salamander, ten turtle, eight lizard and 22 snake species. Three poisonous snake species are present: the copperhead is the most abundant, while the canebrake rattlesnake and eastern cottonmouth are much less abundant than formerly thought.

Mammals

At least forty-seven species of mammals are found in the Great Dismal Swamp NWR. The first scientific collection of mammals inhabiting the Dismal Swamp was initiated by the U.S. Department of Agriculture in the late 1890's (Handley, 1999). Modern occurrences are described in Bulmer et al. (1999), Handley (1979), Paschal et al. (1979), Rose (1999b), Rose et al. (1999), and Webster (1999).



Mammals. *At least forty-seven species of mammals are found in the Great Dismal Swamp NWR. Red fox.*
Photo: Waverley Traylor.

The most recent studies, occurring in the 1990's, have sought to fill the gaps within the mammal record, particularly small mammals and bats. At least eight studies of small mammals in the Dismal Swamp are reported during the 1980's and 1990's (Rose 1999b), and four studies of bats (Rose et al. , 1999). It should be noted that while study areas often included the Great Dismal Swamp NWR, many studies sampled the historical Great Dismal Swamp and were not limited to the refuge.

Recent studies have recorded 16 species of small mammals in the Great Dismal Swamp (Bulmer et al., 1999, Rose, 1999b). Findings include four species of shrew, six species of mice, one species of rat, two species of mole, two species of vole, and the southern bog lemming (*Synaptomys cooperi helaletes*).

Ten species of bats have been documented in the Great Dismal Swamp

NWR, with one additional species occurring just beyond the margin of the swamp (Rose et al., 1999). Beyond inventory data, little additional information is known about bats in the Great Dismal Swamp. The exception may be the red bat (*Lasiurus borealis*), which was the most numerous species presented in the summary by Rose et al. (1999). The habits of the red bat in the Great Dismal Swamp are better understood thanks to records of bat activity (Rose et al., 1999) and analysis of stomach contents (Whitaker et al., 1997).

Larger mammalian residents of the swamp include nutria (*Myocastor coypus*), river otter (*Lutra canadensis*), beaver (*Castor canadensis*), ground hog (*Marmota monax*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), mink (*Mustela vison*), grey fox (*Urocyon cinereoargenteus*), red fox (*Vulpes fulva*), grey squirrel (*Sciurus carolinensis*), southern flying squirrel (*Glaucomys volans*), white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), and bobcat (*Felis rufus*).

The Great Dismal Swamp contains a significant coastal breeding population of black bears in eastern Virginia and extreme northeastern North Carolina. Hellgren (1988) and Tredick (2005) estimated the population to contain 250 - 350 bears. The refuge's mission of habitat restoration and managing public access into the swamp enables the refuge to sustain a healthy bear population. In addition, the refuge serves as a reservoir to supply bears to colonize privately-owned lands near the refuge.

Harvest data for the cities that contain the refuge has remained relatively unchanged, with an average harvest of 19 bears for the past 11 years. For the cities of Suffolk and Chesapeake, 1998 (33) and 2003 (26) were the two highest harvests and 2001(6) and 2004(11) showing the lowest harvest (VDGIF, 2004). Though harvest rates over the past 11 years do not indicate an increasing bear population, additional data, including nuisance bears, observational data, and age structure indices provide evidence of an increasing black bear population (VDGIF, 2002).

One goal identified in the Virginia Black Bear Management Plan is to stabilize the black bear population at current levels in the cities of Suffolk and Chesapeake. In looking at the two studies (Hellgren, 1988 and Tredick, 2005) that were completed over 15 years apart, both indicating a refuge population of 250 - 350 bears, and coupled with rates for high human population growth and development in southeastern Virginia, the Great Dismal Swamp NWR has begun to examine management alternatives to proactively address potential conflicts.

The refuge's carrying capacity for white-tailed deer increased during

the first half of the century when logging created additional deer habitat. Because there has been little timbering on the Great Dismal Swamp NWR since 1976, the openings that deer depend on for food are reforesting, reducing their value as deer habitat. However, these impacts have been mitigated by the development of experimental forest management plots, prescribed burning, wild fires, and road maintenance (clearing and mowing).

To maintain an appropriate relation between the deer herd and its swamp habitat, white-tailed deer are annually hunted on the refuge. The health of the deer population continues to be evaluated through off-refuge deer hunt check station data (weight, age class distribution, antler development, physical deformities). These data have indicated a gradual but steady improvement in deer health since refuge deer hunts began in 1979.

Flora

The refuge contains several plant communities comprising various associations made up from a total of 340 vascular plant species. Botanically, the swamp is the interface between northern and southeastern coastal plain swamp vegetation types. Current vegetation patterns in the refuge reflect past human activities and associated changes in the water regime. Timbering, ditching, road building, and fire suppression have influenced recent vegetation diversity. In many cases, a vegetation community includes both species typical of historical water regimes and species indicative of the recent hydrologic alteration. However, some areas within the swamp are typical historical communities whose existence predates the extensive development of the 1940's and 1950's (See Figure 2-3).

Classification of the natural communities in the Great Dismal Swamp NWR follows *The Natural Communities of Virginia* (Fleming et al., 2001). These classifications closely follow those used in the North Carolina classification (Schafale and Weakely, 1990). Natural communities present at the Great Dismal Swamp NWR include:

- Mesic Mixed Hardwood Forests
- Natural Lake Draw-Down Shores
- Non-Riverine Pine-Hardwood Forests
- Non-Riverine Swamp Forests
- Pond Pine Woodlands and Pocosins
- Peatland Atlantic White Cedar Forests

Mesic Mixed Hardwood Forests

Mesic (medium-moist site) hardwoods are stands of mixed deciduous tree species occurring at the higher elevations and better-drained mineral soils of the refuge. These forests are situated in the extreme northern end of the refuge near North Ditch and Jericho Ditch, on the Suffolk escarpment along the western boundary, and on a series of sand ridges (mesic “islands” in the midst of the swamp wetlands) near Weyerhaeuser Road.

Tree species in this community include sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), beech (*Fagus grandifolia*), willow oak (*Quercus phellos*), water oak (*Q. nigra*), laurel oak (*Q. laurifolia*), white oak (*Q. alba*), swamp chestnut oak (*Q. michauxii*), cherrybark oak (*Q. pagoda*), southern red oak (*Q. falcata*) on drier sites, blackgum (*Nyssa sylvatica*), ash (*Fraxinus spp.*), elm (*Ulmus spp.*), and red maple (*Acer rubrum*).

Evergreen species occasionally found in this type include American holly (*Ilex opaca*), southern magnolia (*Magnolia grandifolia*), sweetbay (*Magnolia virginiana*), and loblolly pine (*Pinus taeda*).

The highest concentrations of Virginia least trillium (*Trilium pusillum* var. *virginianus*) [globally rare] occur in areas of this forest type near Jericho Ditch and Jericho Lane.

The mesic mixed hardwood community occupies 600-900 acres, or less than 1% of the refuge. It is not known if these species historically occupied any greater area within the refuge, but it is known that most peripheral swamp lands with this habitat type have been converted for agricultural use.

Recently, approximately 50-acres of this forest type has been reestablished, and another 65-acres preserved as part of a wetland restoration effort on private lands along the Suffolk escarpment, immediately south of Jericho Lane.

Natural Lake Draw-Down Shores

The only representation of this community type in Virginia lies along the margins of Lake Drummond in the Great Dismal Swamp NWR.

Non-Riverine Pine-Hardwood Forests

These appear to be successional stands that have replaced the once widespread “canebrakes” because of fire suppression. This community type presents opportunities for restoration of canebrakes. Rare species associated with the Non-Riverine Pine-Hardwood Forests include Virginia least trillium and Swainson’s warbler (*Limnothlypis swainsonii*). Additionally, Roble et al. (1999) identified six species of Lepidoptera that are dependent upon switchcane as their only larval food plant.

Non-Riverine Swamp Forests

This community type is globally uncommon to rare. For the purposes of this document the Non-Riverine Swamp Forests are divided into two cover types: cypress-gum and maple-gum.



Vegetation trends.

Cypress-gum is considered to be relatively stable community in the Dismal Swamp.
USFWS.

Cypress-gum forests are typical southern swamp communities adapted to surface inundation (hydric conditions) for at least part of the growing season. The association covers 12% of the refuge, occurring in western areas of the swamp where standing water is abundant. Principal species include cypress (*Taxodium distichum*), tupelo gum (*Nyssa aquatica*), and Swamp blackgum (*Nyssa biflora*). Both mineral and organic soils support the community, with the organic layers ranging in depth from a few inches to several feet.

Cypress-gum was formerly the most extensive association in the swamp. Cypress trees now occur in fairly low density, and tupelo gum is present only in scattered areas. Although cypress and tupelo gum are climax species for undisturbed wet sites, blackgum and red maple have replaced them over much of their range due to selective cutting of cypress, drainage, and fire.

Maple-gum forests cover sixty percent of the Great Dismal Swamp NWR and consist primarily of red maple and blackgum (often in association with redbay, sweetbay, sweetgum, and yellow poplar). The range of the maple-gum association has increased in the swamp over the past 30 to 40 years, and it is the only refuge habitat type that is continuing to expand.

Red maple is sensitive to wounding, fungus rot, insect attack, and fire injury (although fire-killed trees sprout vigorously and may flourish as second-growth stands). The species is also susceptible to animal damage. Red maple reproduction may be almost completely suppressed where deer populations are excessive.

Pond Pine Woodlands and Pocosins

These are globally rare community types. Most of the pine woodlands occurring within the Great Dismal Swamp NWR consist of pond pine (*Pinus serotina*). Pond pine occurs on soils of high organic matter content in the swamp interior. Historically, this community type was maintained by fire, limiting hardwood composition. Pond pine woodland still dominates many acres in the southern portion of the refuge, however fire suppression has allowed an increase in the hardwood component.

Pocosin vegetation is commonly found in the understory of pond pine woodlands. A pocosin is a specific successional stage of many coastal palustrine wetlands, dominated by broadleaved evergreen shrub vegetation less than 20 feet tall. Pocosins occur in areas of poorly developed internal drainage on organic soils.

Fleming et al. (2001) does not distinguish between pond pine and pocosin communities because they generally occur together in southeastern Virginia (the northern extent for both communities). North Carolina does distinguish these communities and further separates pocosin into low pocosin and high pocosin (Schafale and Weakely, 1990). This background information is provided because approximately 800 acres of broad-leaved evergreen pocosin is located south of Feeder Ditch and north of Corapeake Ditch. This pocosin habitat covers less than 1% of the refuge, but represents one of the few occurrences of this community type in Virginia.

The community boundaries are indistinct, grading into the pine type. Species commonly found in this type include bitter gallberry (*Ilex coriacea*) or inkberry (*Ilex glabra*), fetterbush (*Lyonia lucida*), downy leucothoe (*Leucothoe axillaris*), titi (*Cyrilla racemiflora*), myrtle (*Myrica cerifera*), redbay (*Persea borbonia*), and scattered pond pine. Much of this community is being overtopped by maple and pine.

Peatland Atlantic White Cedar Forests

Atlantic white cedar forests are a globally rare community type. Atlantic white cedar (*Chamaecyparis thyoides*) occurs in both pure, even-aged stands and in stands mixed with swamp hardwoods such as red maple, blackgum, sweetbay, and redbay (*Persea borbonia*). Pond pine is also often associated with cedar.

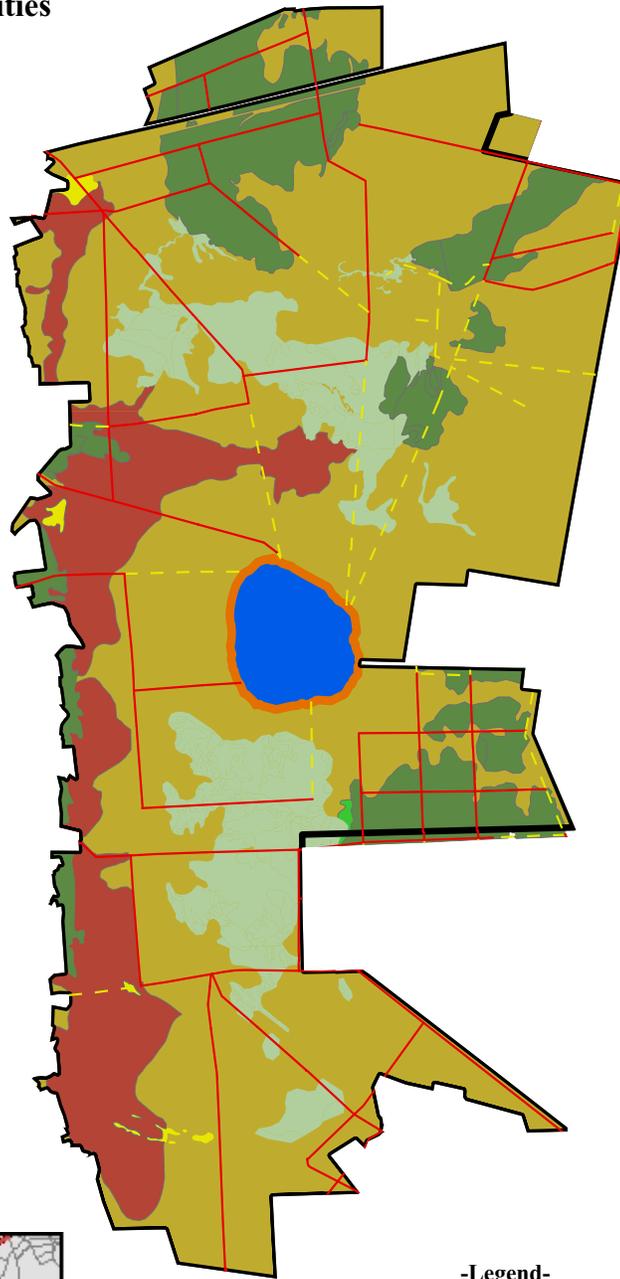
Atlantic white cedar stands are found on deep organic soils where

**Chapter 2
Affected Environment**

**Great Dismal Swamp
National Wildlife Refuge
Forest Cover Communities**



Figure 2-3.



-Legend-

- Mesic Mixed Hardwood Forests
- Non-Riverine Pine Hardwood Forests
- Cypress-Gum Forests
- Peatland Atlantic White Cedar Forests
- Pond Pine Woodlands and Pocosins
- Natural Lake Draw-Down Shores
- Maintained
- Unmaintained



the surface has become elevated above the water table. The species requires a 70-80% moisture level at the root mat, which is maintained by capillary movement of water from the water table through the fine-grained soils. However, the vitality of cedar is severely reduced if it is subjected to surface flooding during the growing season.

Atlantic white cedar is a subclimax but relatively long-lived type, developing after disturbances such as fire, flooding, windthrow, and clear cutting. In general, height growth virtually ceases and diameter growth slows greatly when Atlantic white cedar reaches 100 years old. Individual trees estimated to be nearly 1,000 years old have been recorded, but instances of cedar dominated forest communities reaching 200 years before breaking up and converting to a climax community are rare (Little and Garrett, 1990). Appropriate conditions for regeneration of pure stands of Atlantic white cedar are created either by crown fires in dense stands with little competing understory vegetation, or by surface fires that eliminate competing hardwoods and shrubs and that provide seedbeds above standing water. The lightning fires that burned large areas of the swamp in the past encouraged the regeneration of many more acres of Atlantic white cedar than currently exist.

Atlantic white cedar has been harvested in the swamp since the 18th century when the Dismal Swamp Land Company began operations. Loggers usually cut the Atlantic white cedar but left hardwoods to take over the site, or left so much slash on the ground that Atlantic white cedar seedlings were unable to develop in such shaded conditions. Other important factors in the gradual succession of Atlantic white cedar stands to hardwoods include suppression of wildfire and changes in the swamp's water regime.

In the Great Dismal Swamp NWR, Atlantic white cedar is present in pure stands covering approximately 3,600 acres, primarily in the south central portion of the swamp with a few stands north of Lake Drummond. Atlantic white cedar is also represented in approximately 8,200 acres of mixed cedar-hardwood community.

Unclassified Community Types

Four other wetland areas occur at the Great Dismal Swamp NWR that have a less clear fit following the Virginia natural community classification. Each likely represents Non-Riverine Swamp Forest altered by disturbance. These areas have previously been described as persistent emergent wetlands and occupy a total of less than ½ percent of the refuge. Despite this limited acreage, the emergent wetlands,

along with the pocosin areas, are the only non-forested vegetation communities on the refuge and thus contribute to habitat diversity.

North Ditch Bog (50 acres): An escaped fire, during low water table conditions, consumed several feet of peat from much of this unit. Most over story trees, mostly pine/maple, were killed. Beavers have now impounded this area and it remains flooded year round providing valuable waterfowl and bald eagle habitat.

Remnant Marsh (35 acres): Originally over 300 acres, this open marsh area has become overgrown by red maple. In 1986 the remaining 10 acres were burned to control woody encroachment. Twenty-five additional acres were cleared in 1994. The entire unit has been burned several times and is now maintained as a seasonally flooded open marsh.

Fringe Marsh (75 acres): The natural southward waterflow from the refuge is impounded by U.S. Highway 158 creating this narrow open marsh. A portion of the unit was cleared using heavy equipment in 1987. Additional acreage was converted from maple forest to marsh as the result of an escaped fire.

Railroad and West Marsh (5 acres): This area of maple/gum forest was cleared in 1985 using heavy equipment and has now been burned four times to maintain an open marsh habitat. Since 1996 beavers have impounded the area and are currently doing an excellent job of woody plant control.

Vegetation Development and Trends

Evidence indicates that the Dismal Swamp first began to develop along streams 11,000 to 12,000 years ago. A previous ice advance had left the area with characteristic boreal vegetation of jack pines and spruces. Over a period of 3,000 to 4,000 years the boreal vegetation was replaced by northern hardwood species that, in turn, was replaced by oaks, hickories, and other endemic southeastern species. The swamp gradually expanded westward along watercourses and peat began to accumulate. By 3,500 years ago, peat had blanketed the present-day Dismal Swamp, the water regime was saturated, and the oak-hickory forest was replaced by a cypress-gum swamp. Over time the composition of the swamp forest varied, as is evident today.

Future vegetation succession in the swamp cannot confidently be predicted. Many factors determine which species will gain dominance of a site, including intensity of fire, depth of peat burn, ground water

level, seed sources and methods of cutting, and the time of year. The continuing effects of human activities in the swamp now override natural influences on succession.



Rare Species. *Virginia least trillium.* USFWS.

In general the pioneer types -- Atlantic white cedar, pine, inkberry, cane, and red maple -- result either from fire or clearcutting. Red maple may also be a climax species. The cypress-gum, mesic hardwood, and mixed hardwood types are considered to be relatively stable communities in Dismal Swamp.

Rare Species

Federally-Listed Species

Red-cockaded woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is a cooperative breeding species, meaning that the rearing of young usually involves the efforts of more than just the breeding pair. A 'group' is commonly composed of three or four individuals, but may include as many as nine. Helpers in the group are usually unmated males remaining from the previous breeding season.

The federally endangered red-cockaded woodpecker was observed on the refuge until 1974, though it was last observed nesting in the southeastern portion of the swamp in 1961.

Bald eagle

The bald eagle (*Haliaeetus leucocephalus*) is a federally-listed threatened species. Currently, there is one active bald eagle nest on the refuge. This nest was identified in 1997 and, though not active every year, has produced several young. In addition, over-wintering bald eagles are seen on the refuge almost every year. Guidelines for bald eagle protection have been developed jointly by the Virginia Department of Game and Inland Fisheries and the U.S. Fish and Wildlife Service, Virginia Field Office (VDGIF-USFWS, 2000). Because of the remote location of the bald eagle nest at the refuge, disturbance is highly unlikely. To insure minimal impacts, activities proposed within 1,320 feet (1/4 mile) of the nest will be reviewed by VDGIF and USFWS.

Red wolf

The Great Dismal Swamp NWR is located within the historic range by the federally endangered red wolf (*Canis rufus*), though no red wolves are currently known to inhabit the refuge. One red wolf was seen at the refuge in 1996. It was later trapped and returned to Alligator River NWR in North Carolina. If recovery efforts in North Carolina are successful, it is conceivable that red wolves could colonize the Great Dismal Swamp NWR.

State-Listed Species

Canebrake rattlesnake

The canebrake rattlesnake (*Croatalus horridus atricaudatus*) is a state-endangered species. The canebrake rattlesnake is found in two distinct populations in Virginia, the largest of which includes parts of Suffolk, Chesapeake, Isle of Wight, and Virginia Beach. The Great Dismal Swamp NWR is centered within this distribution.

Dismal Swamp southeastern shrew

Dismal Swamp southeastern shrew (*Sorex longirostris fisheri*) was removed from Endangered Species Act protection on February 28, 2000, however it retains its status as a Virginia state-threatened species. The shrew had held the status of ‘threatened’ since 1986.

Species of Concern

Four sensitive plant species are found in the Great Dismal Swamp NWR: Virginia least trillium (*Trillium pusillum* var. *virginianum*), which is a federal Species of Concern, and silky camellia (*Stewartia malacodendron*), sheep laurel (*Kalmia augustifolia*), and purple bladderwort (*Utricularia purpurea*), on the Virginia Species of Concern and Watch lists.

The Virginia least trillium is restricted to the northwest corner of the refuge, although observations have been reported near the refuge boundary at the head of the Pasquotank River. The silky camellia is found in two locations: the mesic islands and in the northwest corner of the refuge. Great Dismal Swamp NWR is probably the northern limit of this plant’s natural range.

Virginia Department of Conservation, Natural Heritage Program investigators sampling in the refuge during 1995 identified the following additional species warranting special concern from land managers:

Plecotis rafinesquii (eastern big-eared bat)
Megacephala carolina (tiger beetle)
Ilex coriacea (big gallberry)
Ludwigia pilosa (hairy seedbox)
Paspalum dissectum (water paspalum)
Solidago latissimifolia (coastal swamp goldenrod)
Tillandsia usneoides (spanish moss)
Xyris fimbriata (fringed yellow-eyed grass)

Noxious/Invasive Species

No comprehensive survey has been conducted to identify and locate invasive species at the Great Dismal Swamp NWR. The Virginia Natural Heritage Program and the Virginia Native Plant Society have prepared a list of invasive alien plant species of Virginia (<http://www.dcr.state.va.us/dnh/invlist.pdf>). While several may occur on the refuge, only phragmites (*Phragmites communis*) and shrubby bushclover (*Lespedeza bicolor*) have been documented.

Invasive animals on the refuge include coyote (*Canis latrans*) and nutria (*Myocastor coypus*). Coyote, native to the western U.S., have expanded their range to include the entire east coast of the U.S. Coyote have only been observed on two occasions at the Great Dismal Swamp NWR.

Nutria were intentionally introduced to the U.S. in 1899 for fur production. After initial introduction where they were pen-raised for their pelts, nutria were transported to various locations to control unwanted vegetation and enhance trapping opportunities. Ironically, the first nutria were brought to the Chesapeake Bay region in 1943 as part of an experimental fur station at Blackwater NWR on the eastern shore of Maryland. At Great Dismal Swamp NWR, nutria are only known to occur at three locations, in the Railroad and West Marsh, in Cross Canal Ditch, and in Corapeake Ditch.

The Role of Fire

Fire has influenced forest communities of the Great Dismal Swamp dating back to pre-colonial and possibly prehistoric times. Native Americans may have used fire as a vegetation management tool as well as a means of driving game during hunting. Most swamp fires result in the loss of highly combustible organic soils to depths of a few inches to six feet. Lake Drummond is believed to have formed from a large, deep burning peat fire.

Prior to 1900, fires within the Great Dismal Swamp were uncontrolled and usually occurred during droughts. Lightning ignited most of the fires, but Native American hunting parties and loggers may have ignited some fires.

From 1900 to about 1945, railroad and timbering activities brought new sources of ignition and increased the frequency of fires that burned for extended periods. Not only did timbering activity increase sources of ignition, those activities were concentrated during periods of increased flammability. Timbering in the swamp was most easily accomplished during dry periods when men and equipment could maneuver more easily on the peaty soils. This is also when the soils are more susceptible to ignition. Simpson (1990) reported on “The Great Conflagration”, a logging slash fire that burned for years during 1923-1926, eventually burning an area of about 150 square miles (nearly 100,000 acres). Yellow peat smoke filled the air around Hampton, Newport News, and Norfolk during this period.

Since the mid-1940's, fire prevention and suppression techniques have reduced both the number and magnitude of fires within the refuge and adjacent areas. However, several notable fires during this period are summarized as follows:

- 1955 Easter Sunday Fire: started along the railroad within the northern part of the current refuge and burned nearly 150 square miles, reaching the Portsmouth city line.
- 1967 South of Feeder Ditch: Someone burning debris ignited this fire that burned 1,350 acres.
- 1988 April Fools Fire: escaped prescribed fire burned 640 acres along the state boundary south of Lake Drummond.

1993 Clay Hill Road Fire: lightning caused fire that burned 150 acres of pine stands near the refuge's western boundary in Suffolk.

1993 Portsmouth Ditch Fire: fire of unknown origin burned 75 acres adjacent the refuge in Chesapeake.

2004 Corapeake Road Fire: lightning caused fire started on NC State Park land and spilled over onto the refuge burning 286 acres.

Today, lightning is the cause of most wildfires at Great Dismal Swamp NWR. A typical summer afternoon thunderstorm can often result in hundreds of lightning strikes on the refuge. Most of the time, the strikes do not create a wildfire, but surface and ground fires occur on average 2.6 times each year. Analysis of 30 years of fire history at the refuge has identified the wildfire season as March through October, with the peak fire season occurring from July 10 through August 18 (USDI, FWS, 1998).

Threats to human health and safety justify the extinguishment of wildfires, though many of the habitats at the refuge require periodic fire. Fires in the Great Dismal Swamp NWR can greatly affect air quality in surrounding urban centers (Chesapeake, Suffolk, Norfolk, Virginia Beach, and others). The products of fire result in decreased visibility and elevated levels of ozone and particulate matter, which creates poor driving conditions and elevates health risks especially for asthmatics, children and the elderly.

Most fires in the refuge interior cause only minimal damage because they are not threatening to refuge neighbors, are slow to spread, and do relatively little irreparable damage to resources (depending on extent, sensitive plant species, water quality, etc.) Burned areas within maple-gum forests regenerate, in most cases, to the same species or to early successional types.

Intense fires in Atlantic white cedar and pine forests, which generally contain more volatile fuel per acre, result in more damage. Surface fires in AWC are not as damaging, in fact, they are necessary for healthy stands. Ground fires are more threatening to AWC. Although the thick bark of pines offers protection from fire, Atlantic white cedar fairs more poorly. Ground fires often burn under the roots, causing trees to topple. Damage from deep ground fires prevents regeneration of dominant species, although moderately deep fires may provide conditions for wetland species regeneration. The Great Dismal Swamp NWR developed a Fire Management Plan in 1998. The Fire Management Plan identifies the following three priorities in descending order of importance: protection of human life and property losses, protection of fire sensitive refuge resources from wildlands fire

damage, and use of prescribed fire to perpetuate those communities needing periodic fires.



Prescribed fire, *At the Great Dismal Swamp NWR, prescribed fire is used to maintain unique fire-dependent habitats and restore habitats that have suffered from the absence of fire. USFWS.*

Current refuge fire management plans direct that all wildfires will be suppressed as quickly and as economically as safety permits. Wildfires usually occur when refuge water levels are low, creating conditions where long-burning ground fires could emit smoke into populated areas for extended periods. Moreover, the refuge is virtually surrounded by commercial and residential development, major highways, and airports. Therefore, containing the fire and smoke within an area that does not affect the human population adjacent to the refuge is difficult to assure. However, total suppression of wildfires contradicts the natural role of fire in the swamp ecosystem. In the past, periodic surface fires were important in perpetuating a number of early successional communities including Atlantic white cedar, loblolly and pond pine, and evergreen shrub. This critical role of fire as a natural process is increasingly accepted. The current Federal Wildlands Fire Policy states that “wildlands fire, as a critical natural process, must be reintroduced into the ecosystem” (USDA-USDI, 1996).

Prescribed Fire

Prescribed fire was first used successfully at the Great Dismal Swamp NWR in 1982 when 50 acres of loblolly pine on mineral soils were burned for hazard reduction and wildlife habitat improvement. Since then, the use of prescribed fire as a management tool has increased at the refuge. When properly applied, prescribed fire presents few of the health and safety threats associated with wildfire. Prescribed fire is applied under conditions that promote clean burning and the rapid ventilation of smoke and particulates from the lower atmosphere. Furthermore, prescribed fires are of limited size so that operations can be limited to only optimal burning conditions.

Natural resource professionals use prescribed fire for habitat restoration, fuels management, wildlife management, and vegetation management. At the Great Dismal Swamp NWR, prescribed fire is used to maintain unique fire-dependent habitats and restore habitats that have suffered from the absence of fire. These include Atlantic white cedar stands that require fire for regeneration and to prevent succession to maple-gum habitat, controlling invasion of woody plants in the remnant marsh, and creation of habitat for the federally endangered red-cockaded woodpecker. Fire may also be used as a management tool to limit expansion of maple and gum habitat type. These dominant species are not very fire tolerant and the extent of the habitat type in GDSNWR was historically limited by naturally occurring fire.

Prescribed fire is also used to reduce hazardous accumulations of fuels. The use of prescribed fire to reduce fuel accumulations at strategic locations minimizes the threat of wildfire to valuable resources. Fuels reduction fires are most commonly applied to land adjacent to development. This limits the fire intensity and minimizes damage if an accidental fire should occur.

Trial burns are being implemented under current management on organic soil types, emergent wetlands, and deep peat soils to test methods and effectiveness of burning as a habitat management tool.

Cultural Resources

Cultural History

Human occupation of the Great Dismal Swamp area dates back some 13,000 years, 4,000 years before the formation of the swamp began. Four cultural periods -- Paleo-Indian, Archaic, Woodland, and Historic -- represent a continuum of human inhabitation. The lifestyle of each period developed in response to local ecological conditions influenced by technological and sociological elements from other geographic and cultural areas.

By the time European colonists arrived, the area had acquired its swamp-like character and most Indians lived in peripheral settlements. The Nansemond Indians settled along the Suffolk Scarp; the present community of Chuckatuck is the site of one of their main towns. Artifacts of this tribe and others in the Powhatan Confederation as well as at least one independent group have been found throughout lowland Virginia and North Carolina. Their axes and other utensils indicate that they were a forest-oriented people.

Archaeological Resources

Archaeologists have unearthed ancient relics both within the refuge and along its edges. These discoveries have bolstered the theory that prehistoric people used the area as a hunting and fishing range abounding in waterfowl and other sources of food. Extensive prehistoric use of the Dismal Swamp area was possible because in

the remote past the area had a higher water level that prevented timber growth and allowed the existence of grasslands. The finding of corn pollen buried in peat not far from Lake Drummond by Donald Whitehead (1965) tends to confirm the notion that ancient people farmed in the swamp.



Underground Railroad.
The refuge is a designated site on the National Parks Service's Underground Railroad Network to Freedom. "Osman." Harpers Magazine, September, 1856. By permission, Cornell University Library's Making of America Digital Collection.

A cultural resources reconnaissance consisting of archival and background research and specific project impact assessment at Great Dismal Swamp NWR was undertaken during September and November of 1978 (Rappleye and Gardner, 1979). With the exception of noting that prehistoric sites are more likely to occur on well drained land within the confines of the swamp, no adequate predictive model can be developed on the basis of existing information.

Underground Railroad Network to Freedom

The refuge is a designated site on the National Parks Service's Underground Railroad Network to Freedom. Primary source documentation indicates that the Great Dismal Swamp served as a hiding place for African-Americans escaping slavery in the 18th and 19th centuries. Historians believe these peoples established maroon communities in the swamp. As a part of the Underground Railroad, individuals used the swamp as a temporary hiding place until passage to the north could be secured. In 1847, the North Carolina State Assembly went so far as to pass the *Act to Provide for the Apprehension of Runaway Slaves in the Great Dismal Swamp and for other purposes*. In 1842, Henry Wadsworth Longfellow's poem "The Slave of the Dismal Swamp" and, in 1856, Harriet Beecher Stowe's novel *Dred*, highlighted the Swamp's reputation for hiding escaped slaves. At this time, limited archeological research has been completed to determine the location and existence of the maroon communities.

Socio-Economics

Population

Census estimates for 2002 place the population surrounding the Great Dismal Swamp NWR (Hampton Roads, Virginia, and adjacent North Carolina counties) at more than 1.5 million people. Furthermore, the region is continuing to develop rapidly. The cities of Chesapeake and Suffolk, where most of the refuge is located, have the highest growth rates in the region (See Figure 2-4). The City of Suffolk, once a rural tidewater county, is now one of the fastest growing areas in the U.S. Population for the City of Suffolk during the period July 2001-July 2002 grew at an astounding 4.8 percent, ranking it as the 33rd fastest growing city/county in the U.S. (U.S. Census, 2002).

The North Carolina section of the refuge falls within the counties of Gates, Camden, and Pasquotank. Total population in these counties was 52,298 in 2000.

	Population (7/02 Projected)	Population (2000)	Growth Rate (%) 1990-2000	Avg Income	% Below Poverty	Unemploy- ment
Virginia	7,293,542	7,078,515	14.4	40,209	11.6	
City of Chesapeake	206,665	199,184	31.1	45,427	10.1	4.2%
City of Suffolk	69,966	63,677	22.1	34,560	16.4	7.1%
North Carolina	8,320,146	8,049,313	21.4	35,320	12.6	
Camden County	7,465	6,885	16.6	35,423	12.2	6.7%
Gates County	10,635	10,516	13.0	30,087	15.4	5.5%
Pasquotank County	35,445	34,897	11.5	29,305	19.0	6.1%
Elizabeth City						
Surrounding Areas						
Franklin, City of	8,170	8,346	-0.5	31,687	19.8%	7.0%
Hampton, City of	145,921	146,437	9.5	36,297	14.6	5.9%
Isle of Wight County	31,085	29,728	18.7	39,331	11.6	5.3%
Newport News, City of	180,272	180,150	5.1	34,306	16.7	5.9%
Norfolk, City of	239,036	234,403	-10.3	28,350	24.4	6.1%
Portsmouth, City of	99,790	100,565	-3.2	29,815	20.5	7.3%
Virginia Beach	433,934	425,257	8.2	44,714	9.0	3.9%
York County	59,720	56,297	32.7	51,898	6.1	3.8%

Figure 2-4. Population and Employment for GDSNWR region. US Census.

Surrounding areas with the heaviest population concentrations (Chesapeake, Norfolk, Portsmouth, and Virginia Beach, Virginia) are located northeast of the refuge. Suffolk, Virginia is located northwest of the refuge, and Elizabeth City, North Carolina is south of the refuge. With these exceptions, the area immediately surrounding the swamp has a low density rural population. The refuge has no permanent residents.

Employment

The base economy within the refuge's service area is generally dominated by: (1) military bases and defense-related activities in the south-side Hampton Roads area and (2) extensive manufacturing, particularly shipbuilding activities, on the Peninsula. Historically, farming has been a large part of the local economy, and still continues to play an important role west and southeast of the refuge. Other important sectors are food processing, trade, retail sales, and services industries. The tourist industry is important in Virginia Beach, Virginia, and in the Outer Banks of North Carolina.

Agriculture and forestry are primary industries in the outlying rural areas. The major agricultural products are cotton, soybeans, corn, livestock, and poultry. The number of farms has declined, as is the case nationwide.

Public Use

While the primary goal of the Great Dismal Swamp NWR is to 'protect and preserve this unique and outstanding ecosystem,' a secondary goal is to educate the public about the ecosystem functions that the swamp performs. This goal is accomplished through a variety of public use activities:

Education

The Great Dismal Swamp NWR is a huge outdoor laboratory. It has been used since before the creation of the refuge to educate students of all ages. Bulmer (2000) states that vertebrate zoology students from Northern Virginia Community College have visited the Great Dismal Swamp annually since 1971. Researchers from Old Dominion University and Virginia Polytechnical Institute also frequently conduct studies in the refuge.



Wildlife Dependant Recreation. *Trails for hiking/biking, wildlife observation and photography, and limited hunting opportunities are available at the Great Dismal Swamp NWR. Hiking visitors on Railroad Ditch Road. USFWS.*

Area primary and secondary school systems are offered teacher activity/lesson guides and a refuge video for classroom use. Groups are invited to use refuge trails for the outdoor classroom activities. Staff and volunteers visit local schools and libraries to participate in additional educational programs.

Aside from formal educational programs, the Great Dismal Swamp NWR provides informative booklets and brochures to allow visitors to explore and learn at their own pace. The Great Dismal Swamp Coalition (the refuge's Friends group) also routinely schedules nature activities at the refuge.

Wildlife Dependent Recreation

The network of land ownership in the Great Dismal Swamp provides many wildlife and outdoor-related recreation opportunities. Trails for hiking/biking, wildlife observation and photography, and limited hunting opportunities are available at the Great Dismal Swamp NWR. Boating and fishing opportunities are present on Lake Drummond. Adjacent and nearby lands that provide similar opportunities include the Virginia Department of Game and Inland Fisheries (VDGIF) Great Dismal Swamp Wildlife Management Area (WMA), Virginia Natural Area Preserves, Nature Conservancy preserves, Northwest River Park, North Carolina State Natural Areas and State Parks. The Albemarle Region Canoe Trail System includes the Pasquotank River and Dismal Swamp Canal. Camping opportunities exist at Chesapeake's Northwest River Park and at the Lake Drummond Reservation (COE land).

Tourism

There is considerable potential for increased tourism to the Great Dismal Swamp NWR. Approximately 55 percent of the U.S. population resides within 500 miles of Virginia (Virginia Tourism Corporation, 2003a). The Hampton Roads area is already the most heavily visited part of the state. The Williamsburg area attractions accounted for three of the top five tourist attractions in Virginia in 1997-1998 and Williamsburg and Virginia Beach were in the top three cities visited in the state (Virginia Tourism Corporation, 2000). Total traveler spending in the Tidewater and Hampton Roads region of Virginia was nearly \$2.5 billion in 2000 (Virginia Tourism Corporation, 2003a).

Within the Great Dismal Swamp ecosystem, numerous nature-based

recreational opportunities exist. These opportunities include wildlife observation, boating, camping, education, fishing, and hunting on lands of various ownership including natural area preserves, wildlife management areas, and parks, all of which rely heavily on the much larger Great Dismal Swamp NWR and Dismal Swamp State Natural Area (North Carolina) as the core resource areas. In addition, the North Carolina Dismal Swamp Canal Welcome Center is located three miles south of the North Carolina/Virginia state line, on the refuge's eastern boundary.

During the 2002 fiscal year, the Great Dismal Swamp NWR estimated 75,382 visitor-days (GDSNWR RMIS data). Interpretation and nature observation accounts for the vast majority of visits (96.3 percent), while environmental education (0.6 percent), recreation (3.4 percent), and off-site education and outreach (2.6 percent) accounted for the remainder of visitor activities [Since visitors may participate in multiple activities, the visitation by type exceeds 100 percent].

Political Setting

The Great Dismal Swamp NWR occupies portion of two cities in Virginia, Suffolk and Chesapeake, and three counties in North Carolina, Gates, Camden, and Pasquotank. In that, the refuge lies in the 4th Congressional District in Virginia, and the 1st and 3rd Congressional Districts of North Carolina. State representation finds the refuge in the 76th and 77th District for the Virginia House of Delegates, and the 14th and 18th Districts for the Virginia State Senate. In North Carolina, state representation finds the refuge in the 1st District for both the House and the State Senate.

Alternatives, Including the Service's Preferred Alternative

- Introduction
- Formulating Alternatives

Great Dismal Swamp National Wildlife
Refuge

- Management Highlights
Common to All
- Alternative A "Current Management-
No Action"
- Alternative B "Service's Preferred"
- Alternative C "Limited Habitat
Management"
- Considered but Eliminated
from further Consideration
- Matrix of Alternatives

Nansemond National Wildlife Refuge

- Alternative A "Current Management-
No Action"
- Alternative B "Service's Preferred"
- Matrix of Alternatives

3. Alternatives

This chapter describes management alternatives for the Great Dismal Swamp National Wildlife Refuge and the Nansemond National Wildlife Refuge. Each alternative addresses aspects of refuge management, including habitat management and public use. The first section describes

management actions that are common to all the alternatives and that the Service plans to implement no matter which alternative is chosen. The next section describes the three alternatives in the format of goals, objectives, and strategies. Strategies are listed from those common to other alternatives to those specific to each alternative, when applicable. In this section there are three alternatives for the Great Dismal Swamp National Wildlife Refuge and two alternatives for



Lake Drummond.

Thousands of wintering tundra swans and snow geese are attracted to the lake each year. Waverley Traylor.

the Nansemond National Wildlife Refuge. Last is a section that describes major strategies considered but eliminated from further consideration.

Following the text on the alternatives for each refuge you will find a matrix that clearly defines the differences among the alternatives. Each matrix compares and contrasts the alternatives by their specific management actions and strategies. These actions and strategies, in turn, are grouped according to the Refuge Goals. Generally, the matrices are a summary of the alternatives chapter.

Formulating Alternatives

The alternatives are packages of complementary management strategies and specific actions for achieving the missions of the National Wildlife Refuge System (Refuge System) and the Service, the vision and goals of the refuge, and the purpose for which the refuges were established. They propose different ways of supporting the goals and responding to key issues, management concerns, and opportunities identified during the planning process.

Great Dismal Swamp NWR

The alternatives were guided by different approaches to habitat management, public use, and the level of funding and staffing required to support basic refuge operations. *Alternative A* illustrates the current management, or “no action,” of the refuge and provides a baseline for comparing and contrasting other alternatives. *Alternative B* directs the refuge towards an optimal level of habitat management and public use based on the prevailing vision for the refuge at the time of its establishment in 1974. *Alternative C* reduces emphasis on habitat management compared to current levels of operation but retains significant expansion of visitor services and public use.

Nansemond NWR

Nansemond NWR has always been a non-funded, non-staffed satellite refuge of the Great Dismal Swamp NWR. The refuge has been maintained at a custodial level due to its relatively small size and lack of funding and staffing. *Alternative A* will describe the current level of modest, custodial operations. *Alternative B* will maintain the current level of operational support by the Service but direct more emphasis towards developing a partnership that will allow an entity other than the Service to take over the management and stewardship of Nansemond NWR.

The Compatibility Determination

Federal law and Service policy provide the direction and planning framework to protect the System from incompatible or harmful human activities, and to insure that Americans can enjoy Refuge System lands and waters. The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57), is the key legislation regarding management of public uses and compatibility. The compatibility requirements of the Refuge Improvement Act were adopted in the Service's Final Compatibility Regulations and Final Compatibility Policy published October 18, 2000 (Federal Register, Vol. 65, No. 202, pp 62458-62496). This Compatibility Rule changed or modified Service Regulations contained in Chapter 50, Parts 25, 26 and 29 of the Code of Federal Regulation (USFWS 2000c). To view the policy and regulations online, go to <http://policy.fws.gov/library/00fr62483.pdf>.

The National Wildlife Refuge System Improvement Act of 1997 (the Act) and Service Regulations require that an affirmative finding be made of an activity's "compatibility" before such activity or use is allowed on a national wildlife refuge. A compatible use is one, "...that will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." Six priority, wildlife-dependent uses that are to be considered at each refuge are defined in the Act and Regulation. These are: hunting, fishing, wildlife observation and photography, environmental education and interpretation. These priority, wildlife-dependent uses may be authorized on a refuge when they are compatible (as defined above), and not inconsistent with public safety. Not all uses that are determined compatible may be allowed. The refuge has the discretion to allow or disallow any use based on other considerations such as public safety, policy and available funding. However, all uses that are allowed must be determined compatible. Except for consideration of consistency with State laws and regulations as provided for in subsection (m) of the Act, no other determinations or findings are required to be made by the refuge official under this Act or the Refuge Recreation Act for wildlife-dependent recreation to occur (Refuge Improvement Act).

Compatibility determinations for the six priority public uses and other expected activities were completed for the Great Dismal Swamp National Wildlife Refuge (Appendix E). Each use (with some restrictions) was found to be compatible with both the mission of the System and the purposes for which the refuge was established. The compatibility determinations for these activities are being issued as part of this CCP. However, these compatibility determinations may be reviewed sooner

than the mandatory review date, or before the Comprehensive Conservation Plan process is completed, if new information reveals unacceptable impacts or incompatibility with refuge purposes.

Compatibility determinations were not completed for Nansemond National Wildlife Refuge for the refuge is closed to all public use. The Service's proposed action includes pursuit of cooperative management opportunities at Nansemond NWR. In the event that additional wildlife dependent recreational opportunities can be provided, we will issue compatibility determinations as required by compatibility policy, including public comment opportunities.

Great Dismal Swamp National Wildlife Refuge

Management Highlights: Common to All Alternatives

Goal 1: (Habitat)

Habitat Management

- Access for basic research and educational activities related to the habitats within the refuge will be allowed.
- Pine/pocosin habitats will be maintained with prescribed fires to reduce fuel accumulations.

Hydrologic Management

- The existing water control structures throughout the 150-mile network of canals and ditches will be maintained and operated to slow the rate of surface drainage from the refuge.
- Seasonal surface flooding will be monitored to assure that normal flooding patterns are maintained to avoid disruption of ground foraging neotropical migratory birds.
- Ground water levels will be maintained within one foot of the surface in Atlantic white cedar stands where sufficient water management capabilities exist.
- Water levels in the ditches and canals will be monitored to conserve

water for fire suppression operations.

- Water control structures will be adjusted to promote water conservation without flooding and damaging refuge roads or creating drainage problems for adjacent private property.
- Research and survey partnerships will be promoted with research institutions, the Corps of Engineers, and other government organizations to improve basic knowledge and interpretation of the refuge watershed.
- The refuge will support efforts to restore natural surface flow of water in those areas where off-refuge developments (i.e. US Highway 158, Norfolk-Southern Railroad) create abnormally wet conditions on the refuge.
- The refuge will cooperate with adjacent landowners in Pasquotank County to promote the proper operation and maintenance of the Newland flood-control dike.
- The Corps of Engineers will continue to release water from Lake Drummond to supply the Dismal Swamp Canal within the parameters established by the Dismal Swamp Act of 1974. The release of water will cease when lake water levels fall to 15.75 MSL at the Lake Drummond Reservation.

Fire Management

- The refuge will continue to maintain cooperative agreements with the appropriate state and local fire suppression agencies to support basic wildfire suppression operations on the refuge.
- The refuge will maintain fire suppression capabilities necessary to complement state and local fire suppression forces to contain and suppress wildfires within the refuge.
- Prescribed burning and limited mechanical clearing within those areas that are justified by the need to reduce fuel accumulations or address fire management concerns under the Wildlands Urban Interface program will be implemented.

Goal 2: (Trust Resources/Wildlife Species)

Endangered Species

- Pine/pocosin habitat will be restored and maintained for red-cockaded woodpeckers when these areas qualify for funding support for fuel reductions and/or addressing issues under the Wildlands Urban Interface program.
- Red-cockaded woodpeckers will be re-introduced to suitable habitat within the refuge.

- Artificial nesting cavities will be installed to enhance nesting habitat for red-cockaded woodpeckers.
- Nesting success will be monitored.

Neotropical Migratory Birds

- Develop and support research and survey projects to monitor neotropical migratory bird populations and habitat preferences.
- Support banding partnerships for neotropical migratory birds.
- Monitor and adjust water management, road maintenance, and habitat management activities to enhance habitat for neotropical migratory birds.

Waterfowl Management

- Monitor and manage public access to Lake Drummond to allow the area to be used by wintering tundra swans and snow geese.

Black Bears

- Monitor refuge black bear populations in cooperation with the state wildlife management agencies and research/education institutions.
- Provide sites on the refuge for emergency relocation of nuisance bears in partnership with the state wildlife management agencies.

Goal 3: (Land Protection)

Habitat Protection

- The Service will acquire the remaining properties within the approved land acquisition boundary when willing sellers offer these lands to the refuge.
- Staff will cooperate and support efforts by neighboring cities and counties to restore and protect key remnants of restorable Great Dismal Swamp habitat outside the refuge acquisition boundary.
- Staff will collaborate with and provide technical assistance to cities and counties when they are reviewing development proposals adjacent the refuge and within historic range of the Great Dismal Swamp in order to assess the impacts of the development to wildlife associated with the refuge and reduce and/or eliminate adverse impacts to the refuge ecosystem.
- The refuge will promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway engineering.

- The refuge will partner with The Nature Conservancy, state wildlife agencies, and other non-government organizations to protect and restore seasonally flooded wetlands within the refuge watershed.
- The refuge will promote hydrologic restoration to reduce or eliminate hydrologic disruptions created by off-refuge developments (e.g. US Highway 158, Norfolk-Southern Railroad).
- The refuge will maintain and post refuge boundary and resolve boundary disputes as they are discovered.

Goal 4: (Public Use)



Environmental Education.
Educators will be encouraged to use the refuge for wildlife oriented outdoor classrooms. Filming of refuge educational video. USFWS.

Hunting

- White-tailed deer hunting will continue on specified dates in October and November.

Fishing/Boating

- Year-round access to Lake Drummond via the Feeder Ditch will be permitted for canoes, kayaks, and motorized boats of 10 horsepower or less.
- Access to Lake Drummond via the Railroad Ditch entrance will be provided for canoes, kayaks, and motorized boats of 25 horsepower or less during April 1 through June 15.
- The use of watercraft such as jet skis will be prohibited on Lake Drummond.

Environmental Education

- Teacher activity guides and videos will be provided to educators.
- Educators will be encouraged to use the refuge for wildlife-oriented outdoor classrooms.
- Environmental education programs will be conducted at local schools and libraries.
- Refuge will loan field study equipment for use on outdoor classroom sites.
- Teacher training partnerships with universities and colleges will be developed.

Interpretation

- Refuge publications on general refuge information and current issues will be provided to refuge visitors and the general public.
- Staff and volunteers will provide interpretive programs.

- Interpretive media, kiosks, and boardwalks at Washington Ditch and Jericho Lane will be maintained.

Wildlife Observation and Photography

- Approximately 50 miles of roads will be maintained for hiking and bicycling on Washington Ditch and Jericho Lane.
- Limited vehicle access to Lake Drummond via the Railroad Ditch entrance will be provided to nature-based tourism groups, outfitters, local municipalities, and other partners to promote wildlife observation.
- Railroad, West, and Interior Ditch Roads will be maintained for limited vehicle access to Lake Drummond.
- Washington Ditch observation deck and Interior Ditch pier will be maintained on Lake Drummond.
- The Dismal Town Trail will be maintained at the Washington Ditch entrance.

Volunteers

- Staff will work to recruit volunteers through on-site contacts, news releases, and off-refuge programs.
- Develop volunteer opportunities through intern partnerships with educational institutions.
- Conduct volunteer training workshops.

Outreach

- Staff and volunteers will provide off-refuge programs to civic groups.
- Staff will provide technical assistance to local city and county governments in addressing those issues that affect wildlife resources within the refuge watershed.
- Staff will work in partnership with The Nature Conservancy and other conservation groups to enhance outreach concerning common wildlife conservation issues.
- The refuge headquarters will provide basic refuge orientation to refuge visitors Monday-Friday.

Alternative A: Current Management-No Action

Management Focus: In the time since the refuge was established in 1974, the refuge operations have focused on the activities summarized as follows:

Land Acquisition

The Service actively pursued negotiations with willing sellers to acquire land within the approved acquisition boundary after the first 49,097 acre tract was donated by Union Camp Corporation through The Nature Conservancy. The refuge had expanded to over 100,000 acres by the early 1980's, and it now incorporates over 111,200 acres in Virginia and North Carolina.

Most of the land has been purchased with Land and Water Conservation Funds (LWCF). Unfortunately, the refuge was unable to obtain LWCF funding in the early 1990's, and some offers to sell land to the refuge were rescinded when the Service was unable to pursue the negotiations due to the lack of funding. To overcome this funding barrier, the Service began submitting some of the offered tracts to the Migratory Bird Commission to pursue funding generated by the Migratory Bird Hunting and Conservation Stamp Act, as these seasonally-flooded forests offered considerable potential as nesting habitat for wood ducks and neotropical migratory birds. The Commission approved several of these tracts, and about 4,000 acres have been added to the refuge using this funding source since 1998.

Rationale: The Dismal Swamp Act of 1974 authorized the Service to establish the refuge and acquire over 100,000 acres that had been designated for inclusion in the refuge. This approved acquisition boundary had been developed through extensive public input resulting from the Dismal Swamp Study Act of 1972. The seasonally-flooded habitat representative of the Great Dismal Swamp was being cleared and developed at an alarming rate through the mid-1980's. Failure to aggressively pursue the tracts from willing sellers would have greatly diminished the refuge's ultimate potential to restore and protect a unique ecosystem and the wildlife populations associated with these habitats.

Hydrologic Management

Nearly 30 water control structures have been constructed or restored

throughout the 150-mile network of ditches and canals found on the refuge. Most of these structures slow the rate of drainage from the refuge, and some structures can divert water into refuge areas where water may be needed for fire management and other habitat restoration purposes.

Rationale: The landowners who owned the land that is now within the refuge recognized long ago that the 150-mile network of ditches had accelerated drainage of the Great Dismal Swamp, and this drainage was not always beneficial to their stewardship of the land, especially when water was needed for fire suppression. Thus, several water control structures were already in place when the refuge was established.

Water is the life-blood of the Great Dismal Swamp ecosystem as is the case with any wetlands. The refuge incorporates considerable areas of fire-dependent habitats where surface and ground hydrology affect the dynamics of wildfires as well as prescribed fires. Surface water is needed to contain and suppress potentially-destructive wildfires, and ground and surface water is needed to contain prescribed fires and inhibit the ignition of the swamp's peat surface.

Some habitats, such as the rare Atlantic white cedar forests, require a high water table to become established. Accelerated drainage has promoted the conversion of the cedar forest to habitats that favor drier conditions.

Habitat Restoration

The restoration and maintenance of habitats associated with the Great Dismal Swamp ecosystem has supported the diversity of wildlife populations. The restoration of marshes and bogs has provided habitat for waterfowl, marsh and wading birds, and bald eagles. Maintaining fire-dependent communities such as the pine/pocosin habitats has enhanced their value to black bears, neotropical migratory birds, and the planned re-introduction of the federally-listed endangered red-cockaded woodpeckers. The restoration of Atlantic white cedar forests enhances nesting habitat for several species of neotropical migratory birds as well as rare butterflies and moths that favor these areas.

Habitat restoration utilizing a combination of mechanical clearing, timber sales, tree planting, and prescribed burning began in 1985 on representative habitats throughout the refuge including remnant marshes and bogs, Atlantic white cedar forests, cypress stands, and

pine/pocosin habitats. Most of the habitat treatments were in relatively small areas of 50 acres or less. However, aerial ignition of prescribed fires has been used to burn as much as 1,300 acres in a single treatment.

Rationale: Fire has been an important influence on the Great Dismal Swamp ecosystem. Prior to human intervention in the swamp ecosystem, fires created clearings that allowed different types of vegetation and trees to regenerate and thrive, resulting in diverse habitats and wildlife populations. In some instances, fires burned depressions in the peat that collected surface water and formed marshes, bogs, and ponds. Lake Drummond is believed to have been formed by a large peat fire that occurred several thousand years ago.

However, managing fire dependent communities in peat soils has been complicated. As an urban refuge, major wildfires could threaten private property and public safety. In addition, the refuge incorporates only a remnant of the original Great Dismal Swamp, and the refuge hydrology has been disrupted to a point where complete hydrologic restoration would not be likely. Permanent hydrologic changes have made it unlikely that natural wildfires can be relied upon to maintain representative habitats, for the natural hydrology could not be replicated sufficiently to create the hydrologic conditions that used to influence natural wildfires. Therefore, today's wildfires would carry the risk of permanently eliminating some habitats as well as threatening the lives and property of refuge neighbors. As a result of these complications, forest management techniques that included mechanical clearing, timber sales, and herbicide applications have been used to imitate the effects of fire in those areas where the direct use of fire could not be safely utilized.



Road Maintenance. *Culvert installation under road bed to prevent flood damage. USFWS.*

Road Restoration and Maintenance

Approximately 80-100 miles of roads have been restored and maintained to support refuge resource management operations and, to a more limited extent, to provide visitor access for hunting, environmental education, and hiking/bicycling. These roadbeds usually consisted of the spoil provided by the construction of the ditch network, so the reliability and quality of the roads were varied. Restoration of some of the roads required raising the elevation of the roadbeds higher above the swamp surface and placing a considerable amount of gravel on their surface. Trees were removed from the edges of some portions of the road system to expose the roads to sunlight, allowing them to dry more quickly. Culverts had to be installed at numerous locations to prevent erosion damage during floods and to replace old culverts that had deteriorated in the naturally acidic conditions that exist within the refuge. The

roads must be mowed several times during the warmer months, and encroaching trees and shrubs must be cut with heavy-duty side-mounted mowers in 2-3 year cycles.

Rationale: Reasonably dependable roads were needed to support the resource management operations as well as the limited visitor access to the refuge. Most of the roads were constructed of ditch spoil that was of poor quality and turned into a slippery quagmire during wet weather. Although most of the roads are narrow and are not suitable for use during wet weather, several key roads have been restored sufficiently to provide seasonal access for habitat and fire management operations. Annual, seasonal mowing activities reduce the probability that fires will be ignited by the exhaust systems of vehicles and equipment, enhance the roads for use as fire breaks, and reduce wear and tear on refuge vehicles and equipment.

Goal 1: (Habitat) Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein.

Program: Forest Management

Rationale for Program: "A timber management program to include the continuing harvest of select timber species under controlled conditions" is one of the primary objectives of the refuge (USDI 1974). Forest management programs are directed towards restoring and enhancing the natural habitat diversity of the refuge by restoring or mimicking natural forces that once maintained habitat and wildlife diversity of the refuge.

Objective: Restore 2,000 acres of Atlantic white cedar forests by 2006 using helicopters and/or other specialized equipment to remove trees that were destroyed or severely damaged by Hurricane Isabel.

Rational for Objective: Hurricane Isabel inflicted considerable changes to the refuge landscape on September 18, 2003. Several

thousand acres of Atlantic white cedar forests were destroyed. Without restoration, significant Atlantic white cedar acreage will be lost.

Much of the refuge is inaccessible to conventional logging equipment, making it logistically difficult or impossible to salvage forest resource and promote cedar restoration. Helicopters and/or other specialized equipment will make more Atlantic white cedar stands accessible to salvage and restoration as well as be less environmentally disruptive than conventional logging equipment.

Strategies:

- Issue permits to contractors who can use helicopters and/or other specialized equipment to salvage Atlantic white cedar trees that were blown down by Hurricane Isabel.
- Permit conditions will outline "in kind" services that will require the contractors to repair refuge roads and provide other administrative support needed to support salvage and restoration operations.



Forest Management.
Atlantic white cedar stand, a rare forest habitat. USFWS.

Objective: Restore 1,000 acres of Atlantic white cedar by 2019.

Rationale for Objective: Approximately 8,000 acres of Atlantic white cedar (AWC), a rare forest habitat, are 100+ years old and are expected to be lost to natural mortality within the next 20-30 years. If AWC is not regenerated in these areas, red maple and other undesirable species will replace Atlantic white cedar in these stands.

Strategies:

- Utilize commercial harvests of mature Atlantic white cedar to clear areas sufficiently for natural regeneration on a total of 1,000 acres that are reasonably accessible by existing refuge roads.
- Utilize approved herbicides to reduce competition from competing vegetation in mature Atlantic white cedar stands that are not easily accessible to harvesting equipment.
- Promote partnerships with state forest management agencies, research institutions, and non-government resource management organizations to develop and evaluate forest management techniques.

Objective: Improve 10,000 acres of pine/pocosin habitat.

Rationale for Objective: The pine/pocosin forest, a fire dependent habitat, is being encroached on by adjacent pine and hardwood communities. The enhancement of the pine/pocosin habitat addresses the refuge's implementation legislation to maintain and restore habitats.

The pine/pocosin habitat is prime foraging for the black bears and some of the highest densities of female bear ranges include this habitat type. The red-cockaded woodpecker is listed as "endangered" under the Federal Endangered Species Act and once inhabited the area now incorporated into the refuge. Biologists involved with recovery of this endangered species have indicated that the pine/pocosin forests within the refuge are potentially valuable habitat for the re-introduction of the Red-cockaded Woodpecker. Approximately 2000 acres, of the 10,000 acres, pine/pocosin will be managed for the establishment of a viable Red-cockaded Woodpecker breeding population of 10 active clusters. These activities will support the refuge mission of "protecting and preserving a unique and outstanding ecosystem" as well as support agency recovery efforts for endangered species.



Water Management.

Refuge staff makes adjustments to water control structures as needed to inhibit flood damage to refuge roads. USFWS.

Strategies:

- Implement hardwood removal and aggressive prescribed burning on 10,000 acres.
- Maintain these areas with prescribed fires occurring every 3 to 5 years.

Objective: Maintain approximately 30 acres of the Remnant Marsh.

Rationale for Objective: The Remnant Marsh once covered over 250 acres and provided brood and feeding habitat for waterfowl and wading birds. The marsh has evolved into a maple-gum forest over the decades due to the exclusion of fire and mechanical clearing, so that the area is barely recognizable as marsh. Wildlife species associated with this habitat, particularly several species of waterfowl and wading birds, would likely cease to inhabit the refuge with the loss of marsh habitat.

Strategies:

- Maintain approximately 30 acres of the marsh that have already been restored by subjecting the area to prescribed fires every 3 to 5 years.
- Monitor vegetation and ground and surface water conditions to evaluate habitat maintenance techniques.

Program: Hydrologic Management

Rationale for Program: The 150 miles of ditches constructed since 1760 have created a drier forested wetlands system, resulting in significant ecological changes. Reversing this drying trend by slowing the rate of drainage supports the refuge mission of "protecting and perpetuating" the ecosystem. These efforts support refuge operations

to implement prescribed burning, reduce the probability of ground fires and catastrophic wildfires, and improve brood habitat for wood ducks. Moreover, Congress recognized the importance of conserving water for the proper stewardship of the Great Dismal Swamp by directing in the refuge’s establishing legislation that the operation of the Dismal Swamp Canal could not adversely affect the refuge.

Objective: Maintain and/or restore hydrologic conditions to sustain or improve viability of wetland communities and their associated wildlife species.

Rationale for Objective: Water conservation and manipulation is required to support the ecosystem restoration mission. Restoring seasonal flooding of forests supports nesting and brood habitat for migratory waterfowl (e.g. wood ducks). Monitoring surface flooding conditions to assure that conditions are favorable to ground foraging neotropical migratory birds supports refuge and agency objectives. Maintaining higher ground water levels within Atlantic white cedar forest supports restoration and maintenance of this rare habitat.

Strategies:

- Conserve water to restore natural hydrologic conditions within areas where cypress, maple, and gum are the dominant habitats.
- Monitor surface flooding conditions to assure that abnormal flooding conditions do not interfere with ground-foraging neotropical birds.
- Maintain ground-water levels within one foot of the surface within Atlantic white cedar stands.

Objective: Maintain and operate water control structures to support flood control and fire management operations.

Rationale for Objective: Water handling and conservation capabilities support prescribed fire and fire suppression operations.

Strategies:

- Adjust water control structures as needed to inhibit flood damage to refuge roads.
- Promote research and survey partnerships with research institutions, Corps of Engineers, and other government organizations to improve basic knowledge and interpretation of the refuge watershed.
- Cooperate with adjacent landowners along the Pasquotank River to allow proper operation and maintenance of the Newland flood-control dike.

- Assure that refuge water conservation measures do not result in flooding of adjacent neighboring private property.
- Continue current cooperative arrangement with the Corps of Engineers in which water release from Lake Drummond ceases at 15.75 MSL.
- Maintain water levels in ditches to support fire suppression and prescribed fire needs.
- Maintain water levels in ditches to support fire management needs in pine forests and red-cockaded woodpecker recovery areas.
- Support efforts to restore natural surface flow in those areas where off-refuge developments (e.g. US Highway 158, Norfolk-Southern Railroad) create abnormally wet conditions.

Program: Fire Management

Rationale for Program: Fire is known to have been an important natural force in maintaining natural habitat diversity within the refuge ecosystem. Fires ignited by humans and lightning created clearings that allowed different species of plants to flourish and maintained forest stands of varying ages. Fires also created depressions in the organic soils that evolved into marshes, bogs, and lakes. Prescribed burning activities reintroduce fire to the refuge ecosystem, creating habitat diversity that supports the basic mission of the refuge to “protect and perpetuate” the ecosystem; agency objectives to provide habitat for migratory waterfowl and Neotropical migratory birds; and the agency objectives for endangered species recovery.



Fire Management.
Prescribed burning activities reintroduce fire to the ecosystem. USFWS.

Objective: Maintain current capabilities to detect and suppress wildfires.

Rationale for Objective: Fire detection and suppression operations reduce the probability of long-lasting catastrophic wildfires that would threaten human health and property surrounding the refuge. Major highways, three airports, and considerable residential and commercial properties would be threatened if fires escaped from the refuge. Lightning from summer thunderstorms ignites most refuge wildfires, so most wildfires occur when surface and ground water conditions are favorable for ground fires of long duration. Long-lasting peat fires have been known to emit smoke for months and reduce air quality for lengthy periods of time. Early detection/suppression of fires reduces the chances of large fires developing; thus, reducing suppression time and expenses.

Strategies:

- Maintain 80-100 miles of roads to support fire suppression access for the refuge and Dismal Swamp State Natural Area.
- Utilize lightning detection services and aerial surveys to detect wildfires during periods of high fire probability.
- Establish and maintain cooperative agreements with state and local fire suppression agencies to support fire detection and suppression.



Trust Resources. *Pine/pocosin habitat for red-cockaded woodpeckers.*
USFWS.

Objective: Implement hazard reduction prescribed burning within areas that are designated by national fire management parameters.

Rational for Objective: Hazard reduction prescribed burning reduces the amounts of fuels in the forest. In reducing this fuel source, the probability of major fires of long duration, which are difficult and expensive to suppress as well as pose a greater threat to human health and private property, is also reduced.

Strategies:

- Implement hazard reduction burns within designated areas.
- Participate in wildlands urban interface programs that support reduction of fuel accumulations and development of fire breaks where off-refuge development and smoke-sensitive locations are threatened by refuge wildfires.

Goal 2: (Trust Resources/ Wildlife Species) Protect and enhance Service trust resources and other significant species.

Program: Red-cockaded Woodpecker Reintroduction

Rationale for Program: The red-cockaded woodpecker is listed as “endangered” on the Federal endangered species list. This species is known to have once existed within mature pine forests within the refuge, and small colonies have been discovered in southeastern Virginia and northeastern North Carolina. Woodpecker biologist have determined that the refuge’s pine forest hold considerable potential for red-cockaded woodpecker foraging and nesting habitat and the refuge has been identified as a possible RCW recovery site. Habitat management required for the recovery effort will support the basic refuge mission of ecosystem restoration and enhancement.

Objective: Re-introduce a viable population of red-cockaded woodpeckers into appropriate refuge habitat.

Strategies:

- Implement mechanical clearing and prescribed burning to restore habitat in the designated area of approximately 2000 acres appropriate for red-cockaded woodpeckers.
- Translocate red-cockaded woodpeckers from suitable donor population into designated area of the refuge.
- Promote the Safe Harbor program to engage private landowners in recovery efforts.
- Install artificial nesting cavities to support woodpecker nesting.

Program: Neotropical Migratory Birds

Rationale for Program: The large blocks of contiguous forests attract nearly 100 species of neotropical migratory birds to seasonally inhabit the refuge, and nearly 70 species to nest within the refuge. Atlantic coast populations of neotropical migrants are generally declining due to the loss of habitat. The refuge, however, is one of the few areas where populations are stable.

The large populations and number of species of neotropical migratory birds make the refuge an ideal location to support long-term monitoring and studies of these species. Neotropical banding has been ongoing for decades within the refuge, and the Smithsonian Institution has been tracking nesting activities for neotropical migrants, particularly the Swainson's warbler, since 1990. These surveys provide some indications on the status of neotropical migrants within the refuge as well as the mid-Atlantic region of the United States. In addition, these surveys provide feedback that can be useful in adjusting refuge habitat management operations to support neotropical migratory birds.

Objective: Provide basic monitoring and survey support for neotropical migratory bird populations to regularly assess status of refuge populations.

Strategies:

- Develop and support partnerships with the Smithsonian Institution, state wildlife agencies, Natural Heritage programs, and other research institutions to monitor neotropical migrant populations and habitat preferences.

- Support banding partnerships for neotropical migrants.
- Adjust water management and other refuge habitat management operations to enhance habitat for neo-tropical migrants, particularly Swainson's warbler.



Waterfowl Management.

The seasonally flooded forest provides brood habitat for wood ducks. Wood duck.

Waverley Traylor.

Program: Waterfowl Management

Rationale for Program: The large blocks of seasonally flooded forest provide natural cavities for wood duck nesting. Remnant marshes and bogs as well as the man-made ditches provide brood habitat for wood ducks. Lake Drummond provides resting habitat for estimated peak populations of 10,000-15,000 wintering tundra swans and snow geese that feed on agricultural fields within the refuge watershed.

Objective: Insure conditions for breeding and wintering waterfowl currently using the refuge are maintained.

Strategies:

- Monitor and maintain existing marsh and bog restoration sites to support brood habitat for wood ducks.
- Monitor and manage public access to Lake Drummond to allow the area to be used by wintering tundra swans and snow geese.

Program: Black Bear Management

Rationale for Program: The refuge contains one of the largest concentrations of black bears on the east coast of the United States. This large bear population, however, exists within an area that is surrounded by considerable commercial and residential development as well as major highways. The continued development of off-refuge lands has decreased the amount of bear habitat surrounding the refuge. Increased traffic along existing highways and highway improvements along the refuge perimeter may eliminate natural corridors through which bears now traverse to other areas of habitat within the refuge watershed. These developments create nuisance bear issues, as bears visit residential areas, disrupt traffic, and increase crop depredation. Moreover, the off-refuge development may eventually result in a genetically isolated black bear population.

The continued loss of habitat and corridors outside the refuge may eventually create the need to maintain or reduce the black bear population to levels that can be safely supported solely by the refuge.

Due to this concern, collaboration with biologists from the Virginia Department of Game and Inland Fisheries and the North Carolina Wildlife Resources Commission began in 1997 to assess the status of bear populations within the refuge watershed and determine the desirability to controlling the refuge bear population. These collaborations led to planning a two-day recreational hunt in late November or early December that would be conducted to assure no significant reduction of the bear population. This hunt would provide a wildlife-oriented recreational opportunity as well as provide the refuge with information on the physical parameters of the bear population. Thus, the refuge completed compatibility determinations and added “black bears” to the current big game hunting program on the refuge in 1998.



Habitat Protection.

Promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway designs. US Hwy 17. USFWS.

The black bear is symbolic, in the view of the public, of the wildlife associated with the Great Dismal Swamp NWR ecosystem. The habitat and large size of the refuge means that the refuge will likely always contain a large black bear population. Therefore, an expectation exists for the refuge to have significant stewardship responsibilities for this highly visible bear population.

Objective: Maintain a black bear population that is viable and within the carrying capacity of the refuge.

Strategies:

- Continue to monitor black bear populations in cooperation with the state wildlife agencies and research/educational institutions.
- Evaluate monitoring data to measure achievements towards meeting population viability goals.
- Provide sites for emergency relocations of black bears in partnership with state wildlife management agencies.
- Work with states to acquire data on bears harvested under crop depredation permits and bear hunting.
- In partnership with the states and non-governmental organizations, seek funding to conduct studies to compliment previous refuge bear research that focuses on the demography of black bears, their genetics, population size, growth and dispersal patterns.
- Cooperate with state wildlife management agencies in developing and implementing emergency response to nuisance bears and enhancing educational outreach related to bears within the refuge watershed.

Goal 3: (Land Protection) Provide protection of those areas within the Great Dismal Swamp NWR watershed that either are remnants of Great Dismal Swamp habitat or can be restored to Great Dismal Swamp habitat.

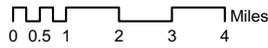
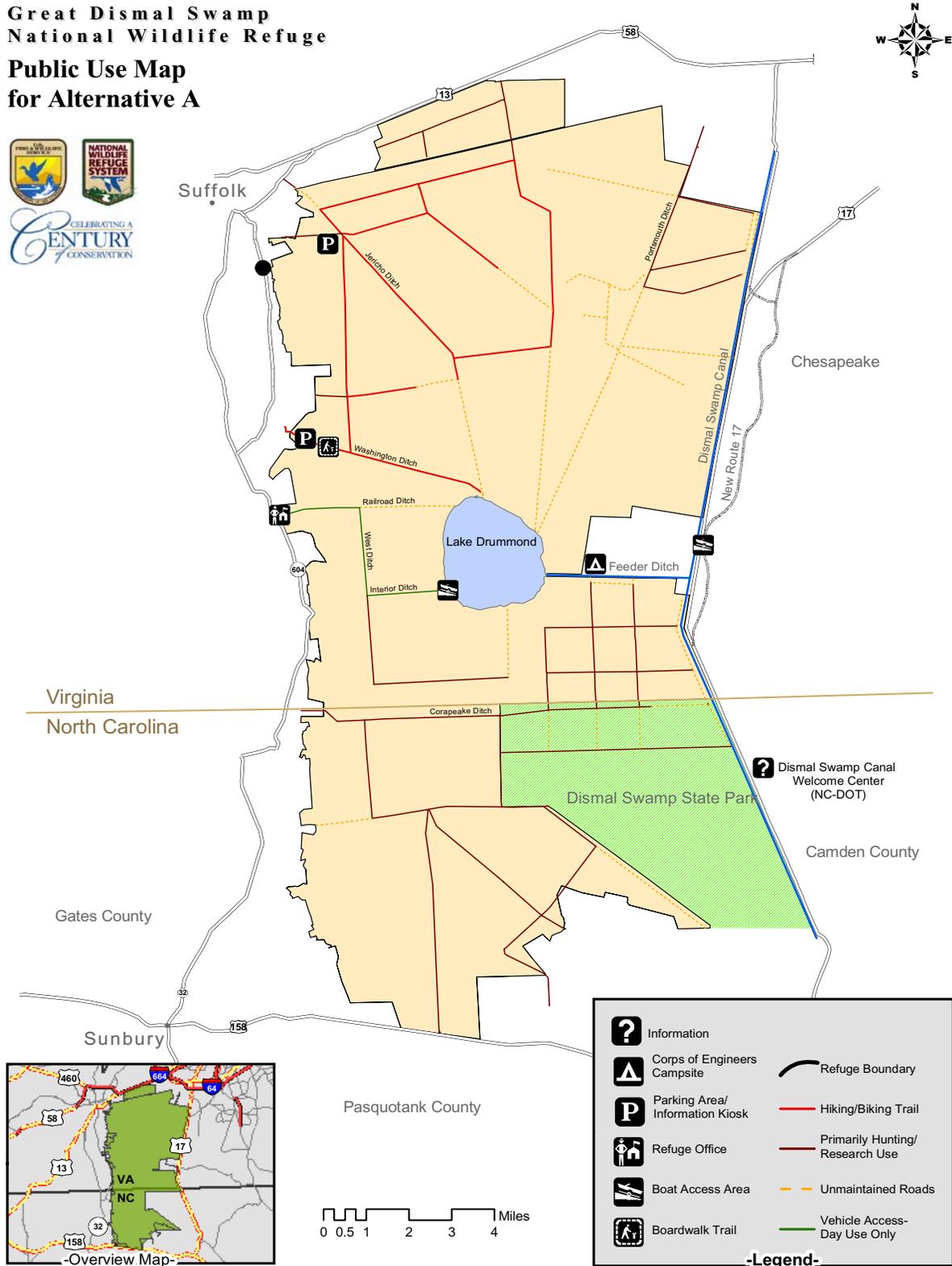
Program: Habitat Protection and Restoration

Rationale for Program: In 1972, the Dismal Swamp Study Act (P.L. 92-478) directed the Secretary of the Interior to study the desirability and feasibility of protecting and preserving the Great Dismal Swamp and Dismal Swamp Canal. Initially, a 210,000-acre study area was delineated to be considered for protection and restoration, and the Secretary ultimately recommended that approximately 123,000 acres be acquired by state and federal agencies for protection and stewardship. Over the past three decades, much of the land that was excluded from recommended public ownership has been developed and converted to other uses. This loss of habitat poses serious adverse ramifications for the refuge and surrounding communities. First, the loss of wildlife corridors threaten to make the refuge an ecological isolate, thus threatening the health of wildlife populations and decreasing "societal carrying capacities" for some wildlife populations such as black bear. Second, the refuge has arguably become the largest urban wildlife refuge in the United States, as nearby development now supports neighboring human population of 1.6 million people. This adjacent human population and development complicates the habitat restoration mission of the refuge, since ecosystem perpetuation will involve hydrologic restoration and aggressive fire management that could potentially affect refuge neighbors. Finally, the continued development of historic "Great Dismal Swamp" habitat threatens the quality of life for humans within the watershed through the development of flood-prone areas where hydrologic disruption is significant, by a reduction of air and water quality, and by the loss of open space.

The protection and restoration of the remaining restorable habitats would mitigate trends of creating an ecologically isolated refuge and creating societal carrying capacities for refuge wildlife populations, thus maintaining a higher quality of life for citizens in neighboring communities.

Figure 3-1.

**Great Dismal Swamp
National Wildlife Refuge
Public Use Map
for Alternative A**





Boating and Fishing

Access. *Many groups travel to Lake Drummond via the Dismal Swamp Canal/Feeder Ditch route. Chesapeake Public boat ramp on US Hwy 17. USFWS.*

Objective: Pursue the protection and restoration of historic Great Dismal Swamp habitat within the refuge watershed, focusing on the area identified within the original 210,000 acre study area.

Strategies:

- Acquire the remaining properties within the current acquisition boundary when they are offered by willing sellers (approximately 4,000 acres).
- Cooperate and support efforts by neighboring cities and counties to restore and protect key remnants of restorable Great Dismal Swamp habitat outside the refuge acquisition boundary.
- Collaborate with and provide technical assistance to cities and counties when they are reviewing development proposals adjacent the refuge and within the historic range of the Great Dismal Swamp.
- Promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway designs.
- Partner with The Nature Conservancy, state wildlife agencies, and other non-government organizations to protect and restore seasonally-flooded areas within the refuge watershed.
- Promote hydrologic restoration when opportunities develop (e.g. US Highway 158, Norfolk and Southern Railroad, Dismal Swamp Canal).

Goal 4: (Public Use) Establish a public use program that will encourage awareness, understanding, appreciation and stewardship of the Great Dismal Swamp NWR ecosystem while complementing the refuge resource management objectives.

Program: Hunting Opportunities

Rationale for Program: Hunting is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

Providing wildlife-dependent recreational opportunities, like hunting, helps to foster an appreciation for wildlife and a sense of stewardship for the environment. There are limited public hunting opportunities in southeastern Virginia and northeastern North Carolina. By continuing to allow hunting on the refuge, we provide the surrounding communities additional hunting opportunities, particularly to those who do not have access to private lands.

The refuge has been deer hunting on the refuge since 1979. In 1998 a Compatibility Determination was completed and black bear hunting was added to the big game hunting program. This bear hunt has not yet been implemented. Our proposal is to implement the bear hunt as a component of Alternative B. The details of this hunt are outlined there.

Objective: Provide a safe, quality hunt program and promote special hunting opportunities on the Great Dismal Swamp NWR.

Strategies

- Provide an annual deer hunt program for archery and shotgun in designated zones of the Great Dismal Swamp NWR during specific days in October and November (13 day shotgun and archery concurrently in October and November).

Program: Boating and Fishing Access

Rationale for Program: Fishing is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

Fishing on Lake Drummond is allowed year round during daylight hours when accessed via the Feeder Ditch (10 horsepower limit). The refuge provides the opportunity for more convenient access through the Railroad Ditch entrance during the height of the fishing season through a special permit process (25 horsepower limit).

Objective: Provide access to Lake Drummond for fishing and boating during designated fishing season.

Strategies:

- Lake Drummond is open for boating and fishing during daylight hours, access via the Feeder Ditch, year round.
- Continue to provide a fishing and boating season permit for April 1 to June 15, to Lake Drummond, access via Interior Ditch

- Road, during daylight hours.
- Promote fishing in southeastern Virginia and northeastern North Carolina by partnering with local municipalities and other organizations for off-site fishing events.

Program: Environmental Education

Rationale for Program: Environmental Education is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

Nature is an excellent vehicle to inspire children to learn. Besides instilling an awareness and appreciation of their local environment, it provides an excellent reason to encourage children to read, it provides “real-life” application of math theory, and introduces children to their local history. Many schools throughout the country have found that when nature was used as a medium of learning math, reading, social studies, and, of course, science, test scores improved and children were excited about learning. In Alternative A, the focus will be specifically on those communities adjacent to the refuge boundary. Programs, outreach, etc., for the environmental education program will center on Suffolk and Chesapeake, Virginia, and Gates, Camden, and Pasquotank Counties in North Carolina.



Wildlife Observation.

Approximately 50 miles of trails are maintained for hiking and biking. Washington Ditch Trail. USFWS.

Objective: Provide a quality comprehensive environmental education program to the communities adjacent to the refuge boundary that incorporates the U.S. Fish & Wildlife Service message, the cultural and natural history of the Great Dismal Swamp NWR, the impact of man on the environment, and the resource management practices used by the refuge staff to protect and preserve the Great Dismal Swamp NWR.

Strategies:

- Continue to offer teacher activity guides and Refuge videos for the classroom.
- Outreach to teachers in the adjacent communities to encourage utilization of the refuge as an outdoor classroom.
- Provide field study equipment and field guides for loan to visiting school trips.
- Continue to participate in occasional environmental education programs at schools in the adjacent communities.

Program: Interpretation

Rationale for Program: Interpretation is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

The Great Dismal Swamp is an integral part of the natural and cultural heritage of the region. Interpretive experiences, including guided walks, display panels, exhibits and other programs will both assist refuge visitors getting oriented to the trails and refuge, and members of the community in understanding the role of the swamp and man's impact on the environment.

Objective: Provide quality interpretive experiences, to the adjacent communities, designed to increase awareness, understanding and support for the swamp's unique ecosystem and the refuge's resource management practices.

Strategies:

- Produce and provide refuge publications on general refuge information and current issues.
- Provide occasional staff/volunteer-led orientation and programs at the refuge headquarters.
- Provide occasional staff/volunteer-led orientation and walks at Washington Ditch and Jericho Lane.
- Provide occasional off-site programs at schools, libraries, and civic meetings.
- Maintain current interpretive panels, boardwalks and kiosks at Washington Ditch and Jericho Lane.
- Continue to exhibit at local festivals and events as staff time permits.

Program: Wildlife Observation and Photography

Rationale for Program: Wildlife observation and photography are two of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

Experiencing the outdoors and seeing wildlife in its natural habitat instills a sense of appreciation in people. Appreciation leads to care, concern and stewardship. By providing opportunities for people to experience the outdoors and observe wildlife, the refuge will gain support for the protection of such a unique ecosystem.

Objective: Provide opportunities for refuge visitors to view, photograph, and appreciate wildlife in the habitat as an effort to promote understanding of the impact of man's footprint on the fragile ecosystem of the Great Dismal Swamp NWR.

Strategies:

- Maintain Washington Ditch Trail and the Lake Drummond observation pier at Washington Ditch.
- Maintain approximately 50 miles of trails for foot or bike touring.
- Continue to provide access permits to nature-based tourism groups and outfitters, such as canoeing and kayaking, as well as local municipalities, to promote wildlife observation.
- Maintain Railroad/ West/Interior Ditch trail and boat ramp.
- Continue to provide auto access permits onto Railroad/ West/ Interior Ditch Roads to Lake Drummond.
- Coordinate with the Army Corps of Engineers to provide year-round water access of Lake Drummond via the Feeder Ditch.



Facilities. Headquarters on Desert Road. USFWS.

Program: Volunteers

Rationale for Program: In all alternatives, volunteers are a valuable asset, bringing a unique local history and knowledge to the refuge's programs and, at times, providing technical assistance to refuge wildlife management activities.

Objective: Provide opportunities for people to donate their time and talents to the Refuge, building community support and providing a financial savings to the Service.

Strategies:

- Identify volunteer opportunities and establish "job descriptions" for those opportunities.
- Distribute volunteer internship opportunities to local colleges and universities.
- Conduct two volunteer training workshops per year.
- Hold an annual volunteer recognition and appreciation event.
- Recruit volunteers through on-site contacts, media releases, on and off-site programs, and volunteer organizations.

Program: Outreach

Rationale for Program: Due to health or "comfort level", many people do not visit the refuge. Some have never really considered visiting the

refuge. These people may be members of civic organizations or enjoy other community events throughout the year. By providing off-site exhibits at local festivals, or evening presentations for various civic organizations, a broader audience can be introduced to the refuge and the wonders of the Great Dismal Swamp NWR. At the current level, outreach is selective as staff time is very limited.

Objective: Coordinate with Virginia and North Carolina state and local partners to participate in community events and provide input on local environmental issues.

Strategies:

- Serve as advisors in regional government conservation planning.
- Continue to work with conservation groups, such as The Nature Conservancy and the Izaak Walton League of America, to partner in finding solutions to area environmental issues.
- Share refuge facilities (e.g. conference room at the refuge headquarters) with state and local agencies.
- Offer off-site outreach programs, by request and as staff schedules permit, to local civic and environmental organizations with special emphasis on providing various audiences information about refuge management issues, including forest management, fire management, bear management, and protection of trust resources.

Program: Facilities

Rationale for Program: The refuge will continue to use the reception area of the headquarters located at 3100 Desert Road, Suffolk, Virginia, as a visitor contact area. The headquarters also includes a small conference room that is used for limited interpretive programs.

Objective: Utilize current refuge headquarters located in Suffolk, Virginia, to orient visitors to the refuge.

Strategies:

- Visitors will continue to be directed to the refuge’s headquarters for orientation and information, Monday through Friday, 7:30 am to 4:00 pm.

Alternative B: Service's Preferred Alternative

Management Focus: Resource management operations and visitor services will be expanded if funds become available to add facilities and staff to support these operations. Phases of expansion would be anticipated as funds are allocated to enhance specific refuge operations that are identified and summarized as follows:

Habitat Management

- Atlantic white cedar restoration, utilizing commercial timber sales and herbicide applications, will occur on a maximum of 8,000 acres.
- Approximately 10,000 acres of pine/pocosin habitat will be restored and maintained utilizing mechanical clearing and prescribed burning.

Rationale:

- An estimated 8,000 acres of mature, mixed Atlantic white cedar forests will be lost to competing species if regeneration of these stands is not initiated within the next two decades.
- Restoration of pine/pocosin habitats will promote the recovery of fire-dependent communities as well as provide potential habitat for the endangered red-cockaded woodpecker.

Land Protection

- Restoration and protection of the remaining remnants of Great Dismal Swamp habitat within the refuge watershed will be encouraged through partnerships.
- Hydrologic restoration will be encouraged in those areas where off-refuge development has disrupted surface and ground water hydrology.

Rationale:

- Restoration and protection of swamp remnants and wildlife corridors will prevent the refuge from becoming an ecological isolate.
- Restoration and protection of prior-converted farmlands within the watershed will provide wintering habitat for tundra swans and snow geese.
- Hydrologic restoration will enhance the refuge's ability to restore habitats on the refuge as well as reduce the potential of off-refuge

flooding of farms, highways, and residential areas.

Public Use

- Wildlife-dependent recreational, interpretive, and educational opportunities will be increased and supported from staffed facilities in Suffolk and Chesapeake, Virginia, and Sunbury, North Carolina.

Rationale:

- The establishing legislation for the refuge implied that providing wildlife-dependent recreational opportunities should be an important secondary management objective for the refuge.
- Neighboring communities in Virginia and North Carolina have clearly demonstrated a demand for wildlife-dependent recreational opportunities.
- Expanded visitor service opportunities would enable the refuge to introduce the public to the National Wildlife Refuge System and the U.S. Fish & Wildlife Service, to better promote the basic mission of ecosystem restoration, and to strengthen the refuge's partnerships with neighbors in the restoration and protection of key resources throughout the large refuge watershed.

Goal 1: (Habitat) Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein.

Program: Great Dismal Swamp National Wildlife Refuge Natural Areas

Rationale for Program: The Great Dismal Swamp NWR has long been recognized for its stewardship of unique habitats. The pond pine woodlands/pocosin and the Atlantic white cedar forests have been viewed by resource management professionals as globally-rare community types. The refuge was established for the primary purpose of restoring and protecting a unique ecosystem, so the refuge incorporates bogs, marshes, and forests that used to be part of a vast seasonally-flooded ecosystem that once covered at least 500,000 acres in Virginia and North Carolina.

The refuge has been assigned several special designations in recognition of the unique natural features incorporated into the refuge as well as to recognize the significant contributions of the refuge to the stewardship of wildlife resources. The refuge has been designated as a National Natural Landmark, requiring periodic status reports to the National Park Service on the overall condition of the refuge habitats. The North Carolina Natural Heritage Program has designated the North Carolina portion of the refuge as a Natural Heritage Area because the refuge incorporates habitats and plants that are rare in that state. Most recently, the Virginia Audubon Council identified the refuge as an Important Bird Area, recognizing the refuge as part of a global network of areas that contribute to the conservation of bird populations.

Research Natural Areas (RNA) on National Wildlife Refuges are part of a national network of reserved areas under various ownerships. This network is the result of a designation system recognized by other federal land management agencies and the Federal Committee on Ecological Reserves. RNA's are intended to represent the full array of North American ecosystems; biological communities, habitats, and phenomena; and geological and hydrologic formation and conditions. They are areas where natural processes are allowed to predominate without human intervention. However, under certain circumstances, deliberate manipulation is used to maintain unique features that the RNA was established to protect.



Forest Management.
Atlantic white cedar
restoration site. USFWS.

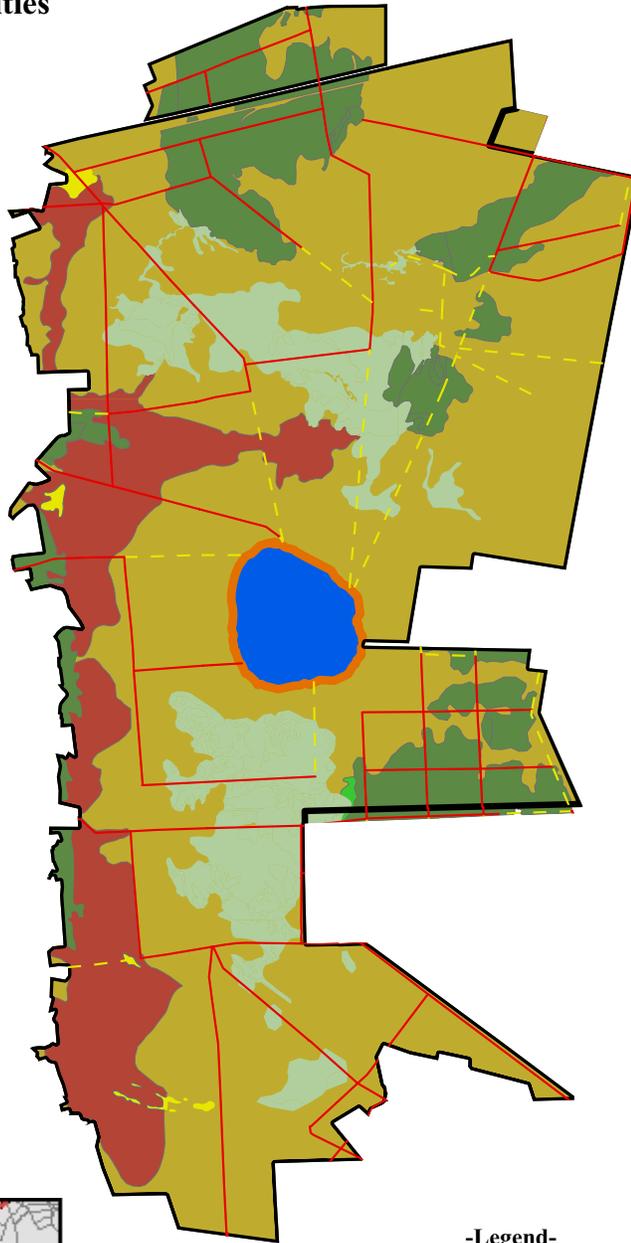
Public Use Natural Areas (PUNA) are relatively undisturbed ecosystems or sub-ecosystems that are available for use by the public with certain restrictions for protecting the area. Such an area must possess exceptional value or quality in illustrating or interpreting an element of the natural heritage of the Nation. This designation is fostered only by the National Wildlife Refuge System, and it is separate and distinct from the RNA designation system.

Objective: Establish Research Natural Areas to include remnant Atlantic white cedar forests and mesic islands within the areas identified as Unit 1 (Northeast) and Unit 2 (Gates County) of the Wilderness Review (see Appendix F) by 2010.

Rationale for Objective: The refuge was established to restore and protect a unique ecosystem. Atlantic white cedar forests and mesic islands are key components that have characterized the historic Great Dismal Swamp ecosystem. While the wilderness review concluded that these areas were not suitable for wilderness designation, these key components should be recognized as being critical to representing remnants of the natural biological diversity of the Great Dismal Swamp.

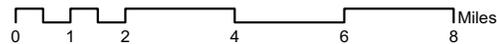
Figure 3-2

**Great Dismal Swamp
National Wildlife Refuge
Forest Cover Communities**



-Legend-

- | | | | |
|--|------------------------------------|--|---------------------------------------|
| | Maple-Gum Forests | | Natural Lake Draw-Down Shores |
| | Mesic Mixed Hardwood Forests | | Peatland Atlantic White Cedar Forests |
| | Non-Riverine Pine Hardwood Forests | | Pond Pine Woodlands and Pocosins |
| | Cypress-Gum Forests | | Maintained |
| | | | Unmaintained |



Strategies:

- Identify and designate a maximum of 1,000 acres of Atlantic white cedar forests within Unit 1 (Northeast) of the Wilderness Review as Research Natural Areas.
- Identify and designate a maximum of 500 acres of mesic islands as Research Natural Areas within Unit 2 (Gates County) of the Wilderness Review.

Objective: Establish Public Use Natural Areas within Unit 4 (Washington Ditch) and Unit 5 (Lake Drummond) of the Wilderness Review by 2010.

Rationale for Objective: The Lake Drummond scenery has remained largely unchanged over the centuries despite the fact that logging, ditching, and road construction have surrounded the lake. The Washington Ditch was originally constructed by George Washington's slaves in the 1760's, and the entire area along the Washington Ditch has been logged prior to the establishment of the refuge. Nevertheless, the history of the area, the fact that the Washington Ditch area was part of the original 49,000 acres that were donated to establish the refuge, and the fact that refuge visitors associate this primary visitor entrance as part of the "natural" Great Dismal Swamp argue for minimal development of this part of the refuge.

Strategies:

- Establish the 3,000 acre Lake Drummond as a Public Use Natural Area.
- Establish the Washington Ditch corridor as a Public use Natural Area.

Program: Forest Management

Rationale for Program: "A timber management program to include the continuing harvest of select timber species under controlled conditions" is one of the primary objectives of the refuge (USDI 1974). Forest management programs are directed towards restoring and enhancing the natural habitat diversity of the refuge by restoring or mimicking natural forces that once maintained habitat and wildlife diversity of the refuge.

Objective: Restore 2,000 acres of Atlantic white cedar forests by 2006 using helicopters and/or other specialized equipment to remove trees that were destroyed or severely damaged by Hurricane Isabel.

Rational for Objective: Hurricane Isabel inflicted considerable changes to the refuge landscape on September 18, 2003. Several thousand acres of Atlantic white cedar forests were destroyed. Without restoration, significant Atlantic white cedar acreage will be lost.

Much of the refuge is inaccessible to conventional logging equipment, making it logistically difficult or impossible to salvage forest resource and promote cedar restoration. Helicopters and/or other specialized equipment will make more Atlantic white cedar stands accessible to salvage and restoration and will be less environmentally disruptive than conventional logging equipment.

Strategies:

- Issue permits to contractors who can use helicopters and/or other specialized equipment to salvage Atlantic white cedar trees that were blown down by Hurricane Isabel.
- Permit conditions will outline "in kind" services that will require the contractors to repairs refuge roads and provide other administrative support needed to support salvage and restoration operations.

Objective: Restoration of 8,000 acres of Atlantic white cedar forest by 2019.

Rationale for Objective: Approximately 8,000 acres of Atlantic white cedar, a rare forest habitat, are 100+ years old and are expected to be lost to natural mortality within the next 20-30 years. If AWC is not regenerated in these areas, red maple and other less desirable species will replace Atlantic white cedar in these stands.

Strategies:

- Utilize commercial harvests of mature Atlantic white cedar to clear areas sufficiently for natural regeneration on 2,000 acres that are reasonably accessible by existing refuge roads.
- Utilize approved herbicides on 6,000 acres to reduce competition from competing vegetation in mature Atlantic white cedar stands that are not easily accessible to harvesting equipment.
- Promote partnerships with state forest management agencies, research institutions, and non-government resource management organizations to develop and evaluate forest management techniques.

Objective: Improve 10,000 acres of pine/pocosin habitat.

Rationale for Objective: The pine/pocosin forest, a fire dependent habitat, is being encroached on by adjacent pine and hardwood communities. The enhancement of the pine/pocosin habitat addresses the refuge’s implementation legislation to maintain and restore habitats. The pine/pocosin habitat is prime foraging for the black bears and some of the highest densities of female bear ranges include this habitat type. The red-cockaded woodpecker is listed as “endangered” under the Federal Endangered Species Act and once inhabited the area now incorporated into the refuge. Biologists involved with recovery of this endangered species have indicated that the pine/pocosin forests within the refuge are potentially valuable habitat for the re-introduction of the Red-cockaded Woodpecker. Approximately 2000 acres, of the 10,000 acres, pine/pocosin will be managed for the establishment of a viable Red-cockaded Woodpecker breeding population of 10 active clusters. These activities will support the refuge mission of “protecting and preserving a unique and outstanding ecosystem” as well as support agency recovery efforts for endangered species.

Strategies:

- Implement hardwood removal and aggressive prescribed burning on 10,000 acres.
- Maintain these areas with prescribed fires occurring every 3 to 5 years.

Objective: Maintain approximately 250 acres of the Remnant Marsh.

Rationale for Objective: The Remnant Marsh once covered over 250 acres and provided brood and feeding habitat for waterfowl and wading birds. The marsh has evolved into a maple-gum forest over the decades due to the exclusion of fire and mechanical clearing, so that the area is barely recognizable as a marsh. Wildlife species associated with this habitat, particularly several species of waterfowl and wading birds, would likely cease to inhabit the refuge with the loss of marsh habitat.

Strategies:

- Maintain approximately 30 acres of the marsh that have already been restored by subjecting the area to prescribed fires every 3 to 5 years.
- Monitor vegetation and ground/surface water conditions to evaluate habitat maintenance techniques.
- Restore remaining acreage of the marsh utilizing mechanical clearing and prescribed burning to expand the total Remnant Marsh to 250 acres.

Program: Hydrologic Management

Rationale for Program: The 150 miles of ditches constructed since 1760 have created a drier forested wetlands system, resulting in significant ecological changes. Reversing this drying trend by slowing the rate of drainage supports the refuge mission of "protecting and perpetuating" the ecosystem. These efforts support refuge operations to implement prescribed burning, reduce the probability of ground fires and catastrophic wildfires, and improve brood habitat for wood ducks. Moreover, Congress recognized the importance of conserving water for the proper stewardship of the Great Dismal Swamp by directing in the refuge's establishing legislation that the operation of the Dismal Swamp Canal could not adversely affect the refuge.

Objective: Maintain and/or restore hydrologic conditions to sustain or improve viability of wetland communities and their associated wildlife species.

Rationale for Objective: Water conservation and manipulation is required to support the ecosystem restoration mission. Restoring seasonal flooding of forests supports nesting and brood habitat for migratory waterfowl (e.g. wood ducks). Monitoring surface flooding conditions to assure that conditions are favorable to ground foraging neotropical migratory birds supports refuge and agency objectives. Maintaining higher ground water levels within Atlantic white cedar forest supports restoration and maintenance of this rare habitat.

Strategies:

- Conserve water to restore natural hydrologic conditions within areas where cypress, maple, and gum are the dominant habitats.
- Monitor surface flooding conditions to assure that surface flooding does not interfere with ground-foraging neotropical migratory birds.
- Maintain ground-water levels within one foot of the surface within Atlantic white cedar stands.

Objective: Maintain and operate water control structures to support flood control and fire management operations.

Rationale for Objective: Water handling and conservation capabilities support prescribed fires and fire suppression operations.

Strategies:

- Adjust water control structures as needed to inhibit flood damage to refuge roads.
- Promote research and survey partnerships with research institutions, Corps of Engineers, and other government organizations to improve basic knowledge and interpretation of the refuge watershed.
- Cooperate with adjacent landowners along the Pasquotank River to allow proper operation and maintenance of the Newland flood-control dike.
- Assure that refuge water conservation measures do not result in flooding of adjacent neighboring private property.
- Continue current cooperative arrangement with the Corps of Engineers in which water release from Lake Drummond ceases at 15.75 MSL.
- Maintain water levels in ditches to support fire suppression and prescribed fire needs.
- Maintain water levels in ditches to support fire management needs in pine forests and red-cockaded woodpecker recovery areas.
- Support efforts to restore natural surface flow in those areas where off-refuge developments (e.g. US Highway 158, Norfolk-Southern Railroad) create abnormally wet conditions.
- Add water control structures to the Portsmouth/East Ditch watersheds if needed to implement prescribed burning operations within pine forests north of Lake Drummond that will restore and maintain fire-dependent habitats.
- Remove beavers and nutria, using lethal means, when habitat damage or interference with water management strategies (e.g. flooding private property) is detected.
- Control invasive plant species if major infestations are detected in waterways and marshes.
- Develop GIS surface flooding models to provide continuous assessment of water management strategies on wildlife populations and habitat conditions.



Fire Management. *Fire is known to have been an important natural force in maintaining natural habitat diversity within the refuge ecosystem. Prescribed burn. USFWS.*

Program: Fire Management

Rationale for Program: Fire is known to have been an important natural force in maintaining natural habitat diversity within the refuge ecosystem. Fires that were ignited by humans and lightning created clearings that allowed different species of plants to flourish and maintained forest stands of varying ages. Fires also created depressions in the organic soils that evolved into marshes, bogs, and

lakes. Prescribed burning activities reintroduces fire to the refuge ecosystem, creating habitat diversity that supports the basic mission of the refuge to "protect and perpetuate" the ecosystem; agency objectives to provide habitat for migratory waterfowl and neotropical migratory birds; and the agency objectives for endangered species recovery. Fire detection/suppression and hazard-reduction burning operations reduce the probability of long lasting catastrophic wildfires that would threaten human health and property surrounding the refuge.

Objective: Maintain current capabilities to detect and suppress wildfires.

Rationale for Objective: Fire detection/suppression operations reduce the probability of long-lasting catastrophic wildfires that would threaten human health and property surrounding the refuge. Major highways, three airports, and considerable residential and commercial properties would be threatened if fires escaped from the refuge. Lightning from summer thunderstorms ignite most refuge wildfires, so most wildfires occur when surface and ground water conditions are favorable for ground fires of long duration. Long-lasting peat fires have been known to emit smoke for months and reduce air quality for lengthy periods of time. Early detection/suppression of fires reduces the chances of large fires developing; thus, reducing suppression time and expenses.

Strategies:

- Maintain 80-100 miles of roads to support fire suppression access for the refuge and Dismal Swamp State Natural Area.
- Utilize lightning detection services and aerial surveys to detect wildfires during periods of high fire probability.
- Establish and maintain cooperative agreements with state and local fire suppression agencies to support fire detection and suppression.
- Acquire additional access easements near the North Ditch and Corapeake Ditch to improve emergency access to isolated portions of the refuge.

Objective: Implement hazard reduction prescribed burning within areas that are designated by national fire management parameters.

Rational for Objective: Hazard reduction prescribed burning reduces the amounts of fuels in the forest. This would reduce the probability of major fires of long duration, which are difficult and expensive to suppress, as well as pose a greater threat to human health and private property.

Strategies:

- Implement hazard reduction burns within designated areas.
- Participate in wildlands urban interface programs that support reduction of fuel accumulations and development of fire breaks where off-refuge development and smoke-sensitive locations are threatened by refuge wildfires.

Goal 2: (Trust Resources/ Wildlife Species) **Protect and enhance Service trust resources and other significant species.**



Reintroduction of red-cockaded woodpeckers.

The red-cockaded woodpecker is a listed species on the Federal endangered species list. USFWS RCW logo. USFWS.

Program: Red-cockaded Woodpecker Reintroduction

Rationale for Program: The red-cockaded woodpecker is listed as “endangered” on the Federal endangered species list. This species is known to have once existed within mature pine forests within the refuge, and small colonies have been discovered in southeastern Virginia and northeastern North Carolina. Woodpecker biologists have determined that the refuge’s pine forests hold considerable potential for red-cockaded woodpecker foraging and nesting habitat and the refuge has been identified as a possible RCW recovery site. Habitat management required for the recovery effort will support the basic refuge mission of ecosystem restoration and enhancement. The woodpecker favors mature pine forest with relatively open understory maintained by frequent fires.

Approximately 2,000 acres of pine/pocosin habitat within the refuge along the Virginia/North Carolina border have been identified as potential woodpecker habitat. A combination of mechanical clearing and prescribed burning will be required to restore and maintain this habitat. This portion of the refuge has an adequate road and ditch system to support equipment access and water transport capabilities to support the habitat restoration operations. Additional potential habitat exists within pine forests on the Dismal Swamp State Natural Area and on the refuge north of Lake Drummond, but these areas are problematic for inclusion into an aggressive prescribed fire program. The state park area contains significant fuel accumulations due to the exclusion of fires for decades, and some of the park’s access roads may require extensive repairs before they can support access for fire equipment. The pine forests north of Lake Drummond may also require road rehabilitation to provide adequate access for fire equipment. In addition, urban interface issues (Norfolk/Southern Railroad, Hampton Roads Regional Airport,

US Highway 58/460, commercial/residential development) along the refuge's northern boundary increase the complexity of prescribed burning in these forests.

Objective: Re-introduce a viable population of red-cockaded woodpeckers into appropriate refuge habitat.

Strategies:

- Implement mechanical clearing and prescribed burning to restore habitat in the designated area of approximately 2000 acres appropriate for red-cockaded woodpeckers.
- Translocate red-cockaded woodpeckers from suitable donor population into designated area of the refuge.
- Promote the Safe Harbor program to engage private landowners in recovery efforts.
- Install artificial nesting cavities to support woodpecker nesting.

Program: Neotropical Migratory Birds

Rationale for Program: The large blocks of contiguous forests attract nearly 100 species of neotropical migratory birds to seasonally inhabit the refuge, and nearly 70 species to nest within the refuge. Atlantic coast populations of neotropical migrants are generally declining due to the loss of habitat. The refuge, however, is one of the few areas where populations are stable. The large populations and number of species of neotropical migratory birds make the refuge an ideal location to support long-term monitoring and studies of these species. Neotropical banding has been ongoing for decades within the refuge, and the Smithsonian Institution has been tracking nesting activities for neotropical migrants, particularly the Swainson's warbler, since 1990.

Objective: Provide basic monitoring and survey support for neotropical migratory bird populations to regularly assess status of refuge populations.

Rationale for Objective: Surveys provide some indications on the status of neotropical migrants within the refuge as well as the mid-Atlantic region of the United States. In addition, these surveys provide feedback that can be useful in adjusting refuge habitat management operations to support neotropical migratory birds.

Strategies:

- Develop and support partnerships with the Smithsonian

Institution, state wildlife agencies, Natural Heritage programs, and other research institutions to monitor neotropical migrant populations and habitat preferences.

- Support banding partnerships for neotropical migrants.
- Adjust water management and other refuge habitat management operations to enhance habitat for neotropical migrants, particularly Swainson's warbler.
- Develop surface flooding and successional models using GIS technology to evaluate habitat conditions that affect neotropical migratory birds.

Objective: Establish a neotropical migratory bird "focus area" by 2019, in which to focus habitat management and modeling, population surveys, and education and interpretation related to neotropical migratory bird populations.

Rationale for Objective: Annual surveys for the Swainson's warbler have been accomplished since the 1960's in the northwestern quadrant of the refuge. Therefore, these surveys actually predate the establishment of the refuge and provide a solid base of data with which to measure population trends and population response to habitat changes. By focusing on a portion of the refuge where considerable data exist, habitat management and monitoring techniques can be refined and be used to identify other areas of the refuge where maximizing neotropical migratory bird population density is feasible.

Strategies:

- Establish a neotropical migratory bird focus area near Jericho Lane.
- Develop clearings of 5-10 acres using tree-girdling or small clear-cuts to establish foraging areas for neotropical migratory birds.
- Develop a trail to one of the habitat management areas to enhance interpretive and educational opportunities for neotropical migratory birds.
- Work with Partners in Flight to promote research, education, and management of migratory birds on the refuge.

Program: Waterfowl Management

Rationale for Program: The large blocks of seasonally flooded forest provide natural cavities for wood duck nesting. Remnant marshes and bogs as well as the man-made ditches provide brood habitat for wood ducks. Lake Drummond provides resting habitat for estimated peak

populations of 10,000-15,000 wintering tundra swans and snow geese that feed on agricultural fields within the refuge watershed.

Objective: Insure conditions for breeding and wintering waterfowl currently using the refuge are maintained.

Rationale for Objective: Waterfowl surveys have proven that the refuge provides significant nesting habitat for wood ducks and can support significant winter populations of swans and geese.

Strategies:

- Monitor and maintain existing marsh and bog restoration sites to support brood habitat for wood ducks.
- Monitor and manage public access to Lake Drummond to allow the area to be used by wintering tundra swans and snow geese.



Black Bear

Management. *Off-site development may eventually create a genetically isolated black bear population. American Black Bear. Waverley Traylor.*

Objective: Promote the protection and restoration of 7,000 acres of prior-converted farmland to maintain feeding habitat for wintering waterfowl.

Rationale for Objective: Development pressures threaten to convert much of the farmland along the refuge's eastern boundary to other uses; thus eliminating these feeding areas for wintering swans and geese.

Strategies:

- Support efforts by The Nature Conservancy, Virginia Department of Game and Inland Fisheries, and other organizations to protect farmlands that are used by waterfowl from development.
- Evaluate the need to expand the refuge acquisition boundary to acquire those farmlands where public ownership would enhance their protection and restoration for waterfowl habitat.

Program: Black Bear Management

Rationale for Program: The refuge contains one of the largest concentrations of black bears on the east coast of the United States. This large bear population, however, exists within an area that is surrounded by considerable commercial and residential development as well as major highways. The continued development of off-refuge lands has decreased the amount of bear habitat surrounding the refuge. Increased traffic along existing highways and highway improvements along the refuge perimeter may eliminate natural corridors through

which bears now traverse to other areas of habitat within the refuge watershed. These developments create nuisance bear issues, as bears visit residential areas, disrupt traffic, and increase crop depredation. Moreover, the off-refuge development may eventually result in a genetically isolated black bear population.

The continued loss of habitat and corridors outside the refuge may eventually create the need to maintain or reduce the black bear population to levels that can be safely supported solely by the refuge. Due to this concern, collaboration with biologists from the Virginia Department of Game and Inland Fisheries and the North Carolina Wildlife Resources Commission began in 1997 to assess the status of bear populations within the refuge watershed and determine the desirability to controlling the refuge bear population. These collaborations led to planning a two-day recreational hunt in late November or early December that would be conducted to assure no significant reduction of the bear population. This hunt would provide a wildlife-oriented recreational opportunity as well as provide the refuge with information on the physical parameters of the bear population. Thus, the refuge completed compatibility determinations and added "black bears" to the current big game hunting program on the refuge in 1998.

The black bear is symbolic, in the view of the public, of the wildlife associated with the Great Dismal Swamp NWR ecosystem. The habitat and large size of the refuge means that the refuge will likely always contain a large black bear population. Therefore, an expectation exists for the refuge to have significant stewardship responsibilities for this highly visible bear population.

Objective: Maintain a black bear population that is viable and within the carrying capacity of the refuge.

Strategies:

- Continue to monitor black bear populations in cooperation with the state wildlife agencies and research/educational institutions to provide adequate demographic data to guide habitat and bear population management decisions on the refuge.
- Provide sites for emergency relocations of black bears in partnership with state wildlife management agencies.
- Work with states to acquire data on bears harvested under crop depredation permits, bear hunting and road kills.
- In partnership with the states and non-governmental organizations, seek funding to conduct studies to compliment previous refuge bear research that focuses on the demography of black bears, their genetics, population size, growth and dispersal patterns.
- Cooperate with state wildlife management agencies in developing

and implementing emergency response to nuisance bears and enhancing educational outreach related to bears within the refuge watershed.

- Initiate limited recreational bear hunting on the refuge (See Goal 4 / Public Use/ Hunting Opportunities).

Goal 3: (Land Protection) Provide protection of those areas within the Great Dismal Swamp NWR watershed that either are remnants of Great Dismal Swamp habitat or can be restored to Great Dismal Swamp habitat.

Program: Habitat Protection and Restoration

Rationale for Program: In 1972, the Dismal Swamp Study Act (P.L. 92-478) directed the Secretary of the Interior to study the desirability and feasibility of protecting and preserving the Great Dismal Swamp and Dismal Swamp Canal. Initially, a 210,000-acre study area was delineated to be considered for protection and restoration, and the Secretary ultimately recommended that approximately 123,000 acres be acquired by state and federal agencies for protection and stewardship. Over the past three decades, much of the land that was excluded from recommended public ownership has been developed and converted to other uses. This loss of habitat poses serious adverse ramifications for the refuge and surrounding communities. First, the loss of wildlife corridors threaten to make the refuge an ecological isolate, thus threatening the health of wildlife populations and decreasing "societal carrying capacities" for some wildlife populations such as black bear. Second, the refuge has arguably become the largest urban wildlife refuge in the United States, as nearby development now supports a neighboring human population of 1.6 million people. This adjacent human population and development complicates the habitat restoration mission of the refuge, since ecosystem perpetuation will involve hydrologic restoration and aggressive fire management that could potentially affect refuge neighbors. Finally, the continued development of historic "Great Dismal Swamp" habitat threatens the quality of life for humans within the watershed through the development of flood-

prone areas where hydrologic disruption is significant, by a reduction of air and water quality, and by the loss of open space.

The protection and restoration of the remaining restorable habitats would mitigate trends of creating an ecologically isolated refuge and creating societal carry capacities for refuge wildlife populations, thus maintaining a higher quality of life for citizens in neighboring communities.

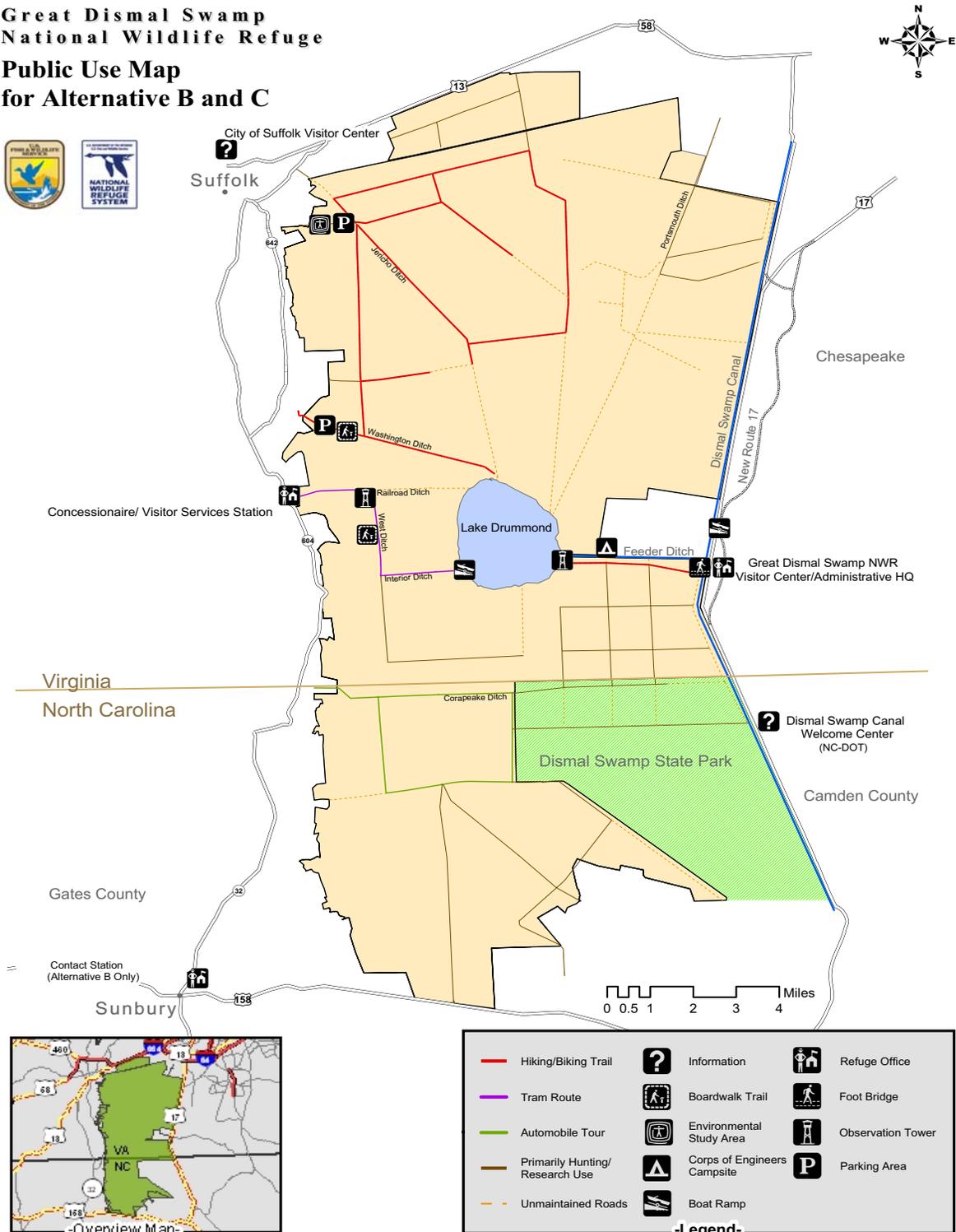
Objective: Pursue the protection and restoration of historic Great Dismal Swamp habitat within the refuge watershed, focusing on the area identified within the original 210,000 acre study area.

Strategies:

- Acquire the remaining properties within the current acquisition boundary when they are offered by willing sellers (approximately 4,000 acres).
- Cooperate and support efforts by neighboring cities and counties to restore and protect key remnants of restorable Great Dismal Swamp habitat outside the refuge acquisition boundary.
- Collaborate with and provide technical assistance to cities and counties when they are reviewing development proposals adjacent to the refuge and within the historic range of the Great Dismal Swamp.
- Promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway designs.
- Partner with The Nature Conservancy, state wildlife agencies, and other non-government organizations to protect and restore seasonally flooded areas within the refuge watershed.
- Promote hydrologic restoration when opportunities develop (e.g. US Highway 158, Norfolk and Southern Railroad, Dismal Swamp Canal).
- Resolve boundary disputes, post the refuge boundary, and patrol/inspect the boundary to detect encroachment on the refuge and criminal activities.
- Cooperate and support protection of 7,000 acres of prior-converted farmland east of the refuge for the purpose of restoring early successional habitat for waterfowl and other wildlife management needs within the watershed.
- Cooperate and support protection of 15,000 acres of seasonally flooded forests south of US Highway 158 to expand habitat for neotropical migratory birds, red-cockaded woodpeckers, and black bears, as well as restore surface hydrology.

Figure 3-3

**Great Dismal Swamp
National Wildlife Refuge
Public Use Map
for Alternative B and C**



Hiking/Biking Trail	Information	Refuge Office
Tram Route	Boardwalk Trail	Foot Bridge
Automobile Tour	Environmental Study Area	Observation Tower
Primarily Hunting/Research Use	Corps of Engineers Campsite	Parking Area
Unmaintained Roads	Boat Ramp	

-Legend-

Goal 4: (Public Use) Establish a public use program that will encourage awareness, understanding, appreciation and stewardship of the Great Dismal Swamp NWR ecosystem while complementing the refuge resource management objectives.

In 2002, an estimated three-million people visited the Virginia Beach/Hampton Roads area. Nearby Colonial Williamsburg, in Williamsburg, Virginia, sold over 929,000 admission tickets to visitors. Several million more visited the Outer Banks of North Carolina, located just to the southeast of the refuge. These areas represent just a few of the locations refuge visitors stay or report visiting when they visit the Great Dismal Swamp NWR.

In Alternative B, public use staff will grow to accommodate the increase in facilities and services. Some facilities will be open seven days a week. This expansion of services will increase the refuge’s visibility as one of the area’s premier tourist destinations. With the additional staff and facilities, the refuge and the Service’s message will reach a wider, more diverse audience. At the same time, wildlife resources within the refuge will be protected through a focus of visitor experiences in specific locations.

Program: Hunting Opportunities

Rationale for Program: Hunting is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997. By providing wildlife-dependent recreational opportunities, like hunting, helps foster an appreciation for wildlife and a sense of stewardship for the environment.

There are limited public hunting opportunities in southeastern Virginia and northeastern North Carolina. By continuing to allow hunting on the refuge, additional hunting opportunities are provided to the surrounding community.

The refuge has been deer hunting on the refuge since 1979. In 1998 a

Figure 3-4.

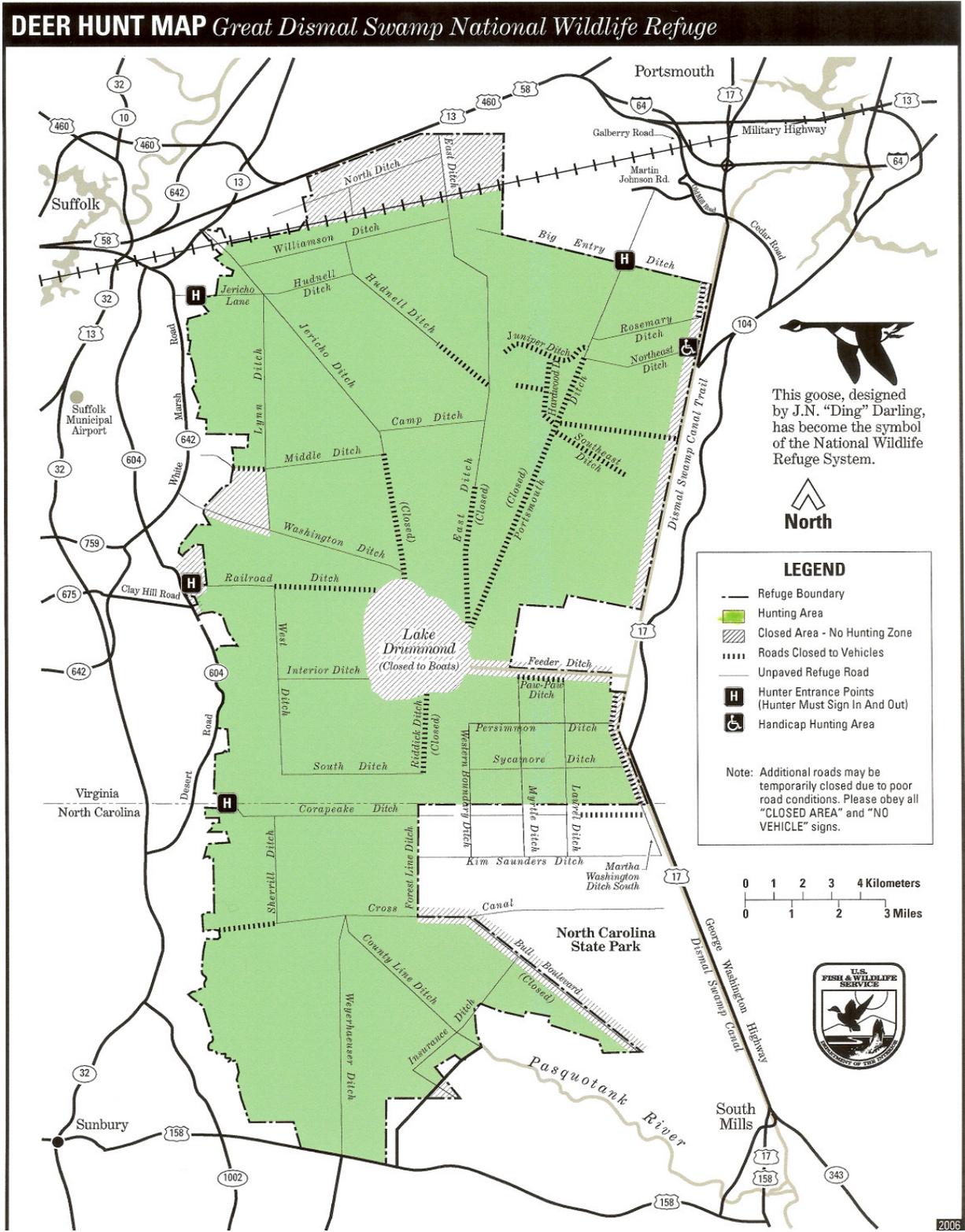
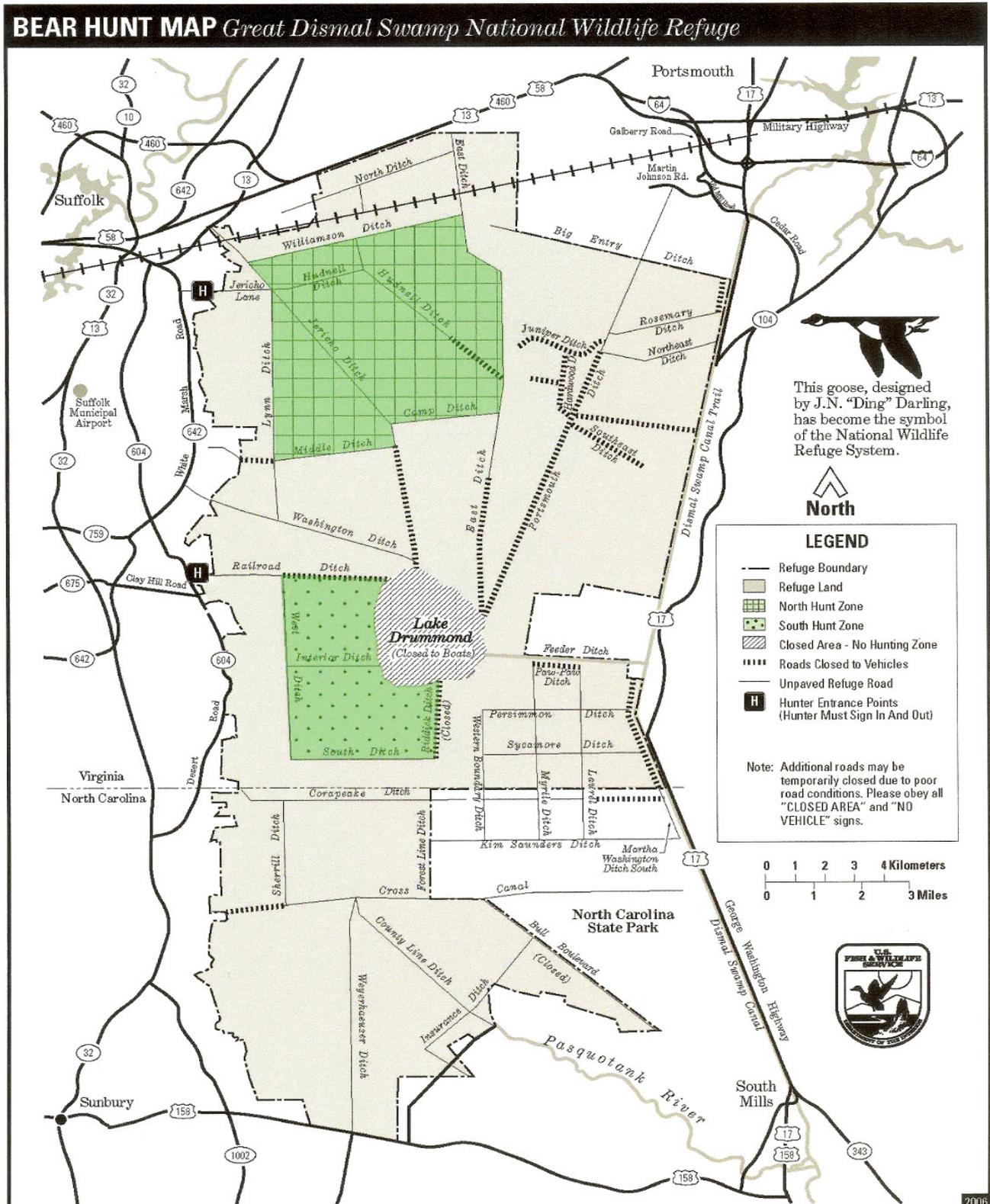


Figure 3-5.



Compatibility Determination was completed and black bear hunting was added to the big game hunting program. This bear hunt has not yet been implemented. Our proposal is to implement this bear hunt as a component of this Alternative.

Objective: Provide a safe, quality big game hunt program and promote special hunting opportunities on the Great Dismal Swamp NWR.

Strategies:

- Provide an annual deer hunt program for archery and shotgun in designated areas of the Great Dismal Swamp NWR on designated days in October and November (see figure 3-4).
- Provide an annual black bear hunt program in designated areas of the Virginia portion of the Great Dismal Swamp NWR on designated days in November and December (see figure 3-5).
 - Bear hunting parameters may be adjusted annually based on changing conditions and data. The initial hunt will be administered within the following guidelines:
 1. Up to two entrances will be designated for the hunt, which will make up less than 25% of the potential hunting area of the refuge. A maximum of 100 permits will be issued.
 2. The hunt will be a maximum of two days.
 3. The harvest limit will be approximately 20 bears. If 10 or more bears are killed the first day, various parameters will be evaluated and the second hunt day may be cancelled.
 4. As with the deer hunt, no dogs will be used to hunt bears.
- Coordinate with special needs organizations to identify ways to provide better hunting access for people with disabilities.
- Host an annual hunter safety program at the refuge.
- Provide for youth hunting opportunities.



Boating and Fishing Access. *Boating and fishing on Lake Drummond is allowed year-round during daylight hours from the Feeder Ditch entrance. Lake Drummond. USFWS.*

Program: Boating and Fishing Access

Rationale for Program: Fishing is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

Fishing on Lake Drummond is allowed year-round during daylight hours when accessed via the Feeder Ditch on the east side of the refuge (10 horsepower limit). Utilizing a boat rental concessionaire, the Railroad Ditch entrance on the west side of the refuge would provide

year-round access for boating and fishing on both sides of the refuge. In addition to concessionaire rentals, a fishing permit will be available April 1 through June 15 to allow access for private fishing boats (25 horsepower limit) to enter Lake Drummond by the Interior boat ramp.

Objective: Provide access to Lake Drummond for fishing and boating year round.

Strategies:

- Lake Drummond is open for boating and fishing during daylight hours, access via Feeder Ditch, year round.
- Continue to provide a fishing season permit, for April 1 to June 15, to Lake Drummond, access via Interior Ditch Road, during daylight hours.
- Promote fishing in southeastern Virginia and northeastern North Carolina by partnering with local municipalities and other organizations for off-site fishing events.
- Recruit and contract a private company to maintain a fleet of canoes/kayaks for rent.
- Provide guided canoe/kayak interpretive tours through the concessionaire.

Program: Environmental Education

Rationale for Program: Environmental education is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

As our population increases, understanding its impact on the natural world is becoming increasingly more important for both our quality of life and our economy. More and more people are removed from the natural world in their daily lives and understand it less. In addition to those audiences served under current management, in this alternative, the focus will be expanded to include the southeastern Virginia and northeastern North Carolina region, reaching both rural, agricultural-based, and urban communities.

Whether it was early efforts to drain the swamp, the establishment of the Dismal Swamp Canal and canal life, or runaway slaves hiding in the swamp, the Great Dismal Swamp is deeply embedded in Virginia and North Carolina history. The swamp’s ecosystem contributed greatly to the history of the region. Details of this cultural contribution will be a part of the refuge’s educational programs along with the biological aspects of the ecosystem.

Objective: Provide a quality comprehensive environmental education program to the Hampton Roads and northeastern North Carolina region that incorporates the U.S. Fish & Wildlife Service message, the cultural and natural history of the Great Dismal Swamp , the impact of man on the environment, and the resource management practices used by the refuge staff to protect and preserve the Great Dismal Swamp NWR.

Strategies:

- Continue to offer teacher activity guides and refuge videos for the classroom.
- Outreach to teachers to encourage utilization of the refuge as an outdoor classroom.
- Provide field study equipment and field guides for loan to visiting school trips.
- Continue to participate in environmental education programs in schools.
- Partner with local universities and community colleges to develop and provide training on the Great Dismal Swamp NWR ecosystem utilizing refuge-specific teacher training for those school districts interested in providing professional development credits to their teachers.
- Purchase land and develop the Jericho Lane Education Pavilion.
- Develop other site-specific biological and historical educational media, utilizing the latest technology and in compliance with Virginia and North Carolina state academic standards.
- Present at local, regional, and national education conferences to encourage teachers to discover the Great Dismal Swamp NWR with their students.
- Establish partnerships with local elder-hostel programs.
- Develop and implement a Junior Naturalist program in the region.
- Establish a cooperating agreement with the region’s school systems to provide specific environmental education programs which incorporate refuge-specific service learning activities.
- Establish a library and resource center for teachers and students.
- Utilize the latest technology to share the refuge environmental education program with those unable to visit.

Program: Interpretation

Rationale for Program: Interpretation is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

The Great Dismal Swamp is an integral part of the natural and cultural heritage of the region. The swamp's role in the timber industry from the 18th to the 20th century and its role in the Underground Railroad are well documented, not to mention the establishment of the Dismal Swamp Canal and canal life. The Hampton Roads/Virginia Beach/Outer Banks region swells with tourists every year. In 2002, Virginia Beach estimated over 3 million visitors to the area. Colonial Williamsburg, approximately one-hour north of the refuge, identified over 929,000 ticketed visitors and countless numbers of people who did not purchase a ticket.

The Outer Banks, in North Carolina, also receives millions of visitors every year. Many of these people either travel past the refuge on their way to Virginia Beach, Colonial Williamsburg or the Outer Banks, or seek out the refuge. According to the North Carolina Department of Transportation, over 16,000 vehicles each day pass through the intersection of US Highway 158 and Rt. 32 in Sunbury, North Carolina. The Dismal Swamp Canal Visitor Center located on US Highway 17 in North Carolina estimates their visitation from 400,000 – 600,000 each year since their opening in 1989. The Center is located on a four lane portion of the highway, but a dangerous two lane section just to the north in Virginia is currently being re-aligned and improved to four lanes. At the completion of the road project, a significant increase in vehicle volume is anticipated.

The refuge will establish a visitor facility on the newly re-aligned US Highway 17, a major access way to Virginia Beach, Hampton Roads and the Outer Banks, and will be incorporated into the Dismal Swamp Canal Recreational Trail being developed by the City of Chesapeake, Virginia. The environmentally-friendly designed facility will include interactive exhibits about the Great Dismal Swamp NWR and the ecology of the region. The facility will inspire visitors to get out onto the refuge. Through coordination with the Army Corps of Engineers to provide access across the Dismal Swamp Canal, the refuge will establish a 3-mile hiking trail along the Feeder Ditch to Lake Drummond. This will make ground access to the refuge from the eastern boundary possible, a new access route about which many people inquire.

Additional staff will provide more opportunities for both on-site and off-site personal interpretation. Interpretive experiences, including guided walks, special events and festivals, display panels, exhibits and other

programs will assist refuge visitors to become oriented to the trails of the refuge, and assist members of the community to understand the natural and cultural role of the swamp and man's impact on the environment.

Interpretive programming will be offered every weekend and include collaborative efforts with other museums and organizations. Gateway facilities (such as contact stations or kiosks), established along major transportation routes and near the "corners" of the refuge- Sunbury and Camden, North Carolina, and the cities of Suffolk and Chesapeake, Virginia, will provide further orientation to visitors traveling around the refuge and looking for the entrances to such a vast area. Program and refuge marketing will extend beyond the immediate boundaries and into Norfolk, Virginia Beach, and the Colonial Williamsburg/Jamestown areas in Virginia, and to Elizabeth City and the Outer Banks in North Carolina.

Objective: Provide quality interpretive experiences to the southeastern Virginia/northeastern North Carolina region, designed to increase awareness, understanding and support for the swamp's unique ecosystem and its role in the cultural landscape of the region and country, and the refuge's resource management practices.

Strategies:

- Produce and provide refuge publications on general refuge information and current issues.
- Provide year-round interpretive programs at several key locations around the refuge, in both North Carolina and Virginia.
- Expand natural history interpretation to include programs focused on resource management issues such as fire, Atlantic white cedar, red cockaded woodpeckers, bears and other urban conflicts of importance to the swamp ecosystem.
- Expand cultural history interpretation to include programs focused on the human impact on the swamp, timber and economic resources of the swamp, the Underground Railroad, and the Dismal Swamp Canal.
- Host annual events highlighting conservation celebrations such as International Migratory Bird Day, National Wildlife Refuge Week, National Public Lands Day and the Great Dismal Swamp NWR anniversaries.
- Update and maintain interpretive panels, boardwalks, and kiosks at Washington Ditch and Jericho Lane.
- Update and maintain interpretive panels and kiosks on Railroad/West/Interior Trail and Feeder Ditch Trail.
- Develop and maintain kiosk at Dismal Swamp Canal Visitor Center (under NCDOT).

- Contract a concessionaire to provide interpretive boat tours on Lake Drummond.
- Partner with the City of Suffolk to develop Great Dismal Swamp NWR exhibits for their visitor center.
- Develop interpretive exhibits and programs for the US Highway 17 complex to serve both the refuge's North Carolina and Virginia communities and the visiting public.
- Develop interpretive exhibits for the Jericho Lane Pavilion.
- Develop and produce interpretive materials for handouts .
- Develop interpretive exhibits and programs for a contact station at Sunbury, North Carolina, to orient visitors traveling east toward Virginia Beach and the Outer Banks.

Program: Wildlife Observation and Photography



Wildlife Observation.

Refuge trails provide opportunities for visitors to view, photograph, and appreciate wildlife in the habitat. Bobcat. :Waverley Traylor.

Rationale for Program: Wildlife observation and photography are two of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

The Great Dismal Swamp NWR is a wonderful place to observe and photograph wildlife; however, it is also very large which can provide an obstacle in getting to some of the more picturesque locations. The refuge will contract a concessionaire to provide interpretive boat and tram tours, and bicycle and boat rentals to refuge visitors allowing them easier access to the refuge. This access will be focused on specific trails to ensure limited wildlife and habitat impact.

An additional hiking trail will be developed along the Feeder Ditch leading to Lake Drummond. An interpretive auto tour route will be established along Corapeake/Sherrill/Cross/Forest Line Ditches to highlight the Atlantic white cedar and other forest-related refuge issues.

Objective: Provide opportunities for refuge visitors to view, photograph, and appreciate wildlife in the habitat as an effort to promote understanding of the impact of man's footprint on the fragile ecosystem of the Great Dismal Swamp NWR.

Strategies:

- Maintain Washington Ditch Trail and the Lake Drummond observation pier at Washington Ditch.
- Maintain approximately 50 miles of trails for foot or bike touring.
- Continue to provide access permits to nature-based tourism groups and outfitters, such as canoeing and kayaking, as well as local



Volunteers. *Volunteers staff Service exhibits at local festivals. USFWS.*

- municipalities, to promote wildlife observation.
- Contract a concessionaire to provide canoe/kayak and bicycle rentals and interpretive boat and tram tours, based at the Desert Road facility (with a satellite at the US Highway 17 visitor facility) using the Railroad/West/Interior Ditch access.
- Using environmentally friendly materials, pave public use access route Railroad/West/Interior and maintain boat ramp.
- Develop observation/photography platform at West/Railroad intersection.
- Develop observation deck and trail at old cypress area on West Ditch Road.
- Develop observation deck and trail at old cypress area on West Ditch Road.
- Coordinate with the Army Corps of Engineers to provide year-round water access of Lake Drummond via Feeder Ditch, to develop a foot-bridge system across the Dismal Swamp Canal to access the Feeder Ditch hiking trail, and to accommodate boat tours to Lake Drummond.
- Develop trail along Feeder Ditch to Lake Drummond.
- Develop observation tower on Feeder Ditch Trail overlooking Lake Drummond.
- Using environmentally friendly materials, establish a paved interpretive auto tour route along Corapeake, Sherrill, Cross and Forest Line Ditches to highlight the Atlantic white cedar and other forest-related refuge issues.
- Using environmentally friendly materials, pave public use access route from White Marsh Road to parking area on Washington Ditch Trail.
- Using environmentally friendly materials, pave public use access route from White Marsh Road to parking area on Jericho Lane.
- As additional visitor facilities are developed, general access for some trails will be restricted to research and hunting only.

Program: Volunteers

Rationale for Program: In all programs volunteers are a valuable asset, bringing a unique element of local history and knowledge and, at times, providing technical assistance to refuge wildlife management activities.

Objective: Provide opportunities for people to donate their time and talents to the refuge, building community support and providing a financial savings to the Service.

Strategies:

- Identify volunteer opportunities and establish “job descriptions” for those opportunities.
- Distribute volunteer internship opportunities to colleges and universities nationally.
- Conduct two volunteer training workshops per year.
- Hold an annual volunteer recognition and appreciation event.
- Expand volunteer recruitment efforts to include local/regional/national levels.
- Develop and implement a Junior Naturalist program to recruit new volunteers.
- Establish RV campsite pads with electric, water and sewer for 2-3 month term volunteers at Sunbury Refuge Operations Station.

Program: Outreach

Rationale for Program: The Williamsburg/ Hampton Roads/Outer Banks region is rapidly becoming a densely populated urban area. Its residential population is experiencing some of the most dramatic rates of growth in Virginia. In addition to the services offered at the current level, it is critical that the refuge reach beyond its immediate borders to educate the region on the Great Dismal Swamp NWR ecosystem and on how the activities around the refuge affect the health of the swamp and, in effect, the health of the surrounding communities.

Objective: Coordinate with Virginia and North Carolina state and local partners to participate in community events and provide input on local environmental issues.

Strategies:

- Continue to serve as advisors in regional government conservation planning.
- Continue to work with conservation groups, such as The Nature Conservancy and the Izaak Walton League of America to partner in finding solutions to area environmental issues.
- Continue to share refuge facilities (e.g. conference room at the refuge headquarters) with state and local agencies.
- Offer off-site outreach programs, by request and as staff schedules permit, to local civic and environmental organizations with special emphasis on providing various audiences information about refuge management issues, including forest management, fire management, bear management, and protection of trust resources.

Facilities for Visitor Services

Rationale for Program: Public demand for improved visitor services was unquestionably the dominant issue presented at the public scoping meetings in January, 2002. Moreover, the establishing legislation for the refuge supported the concept of developing a visitor friendly refuge for wildlife-oriented educational and recreational activities. This concept was further corroborated and supported by the "Public Use Development Plan - Great Dismal Swamp National Wildlife Refuge" that was published by the U.S. Fish and Wildlife Service in 1979. Therefore, the vision that calls for developing major facilities for visitor services addresses a public demand, fulfills the legislated direction for the refuge, supports a long-standing agency position, and would enhance visibility and support for the Great Dismal Swamp National Wildlife Refuge and the National Wildlife Refuge System.

Considering the large size of the refuge and the traveling time required just to traverse the perimeter of the boundary, two locations would be needed for developing adequate visitor service centers. In Suffolk, the present site of the refuge headquarters provides an ideal location to establish a Visitor Service Station to support a variety of concessionaire-operated activities, refuge outreach, and distribution of trail and refuge information. The building, now too small to meet all staffing needs, is of adequate size to allow appropriate alterations to accommodate considerable increases in visitation. In addition, the headquarters is adjacent to the Railroad Ditch Entrance, making it possible to connect this visitor service complex directly to Railroad Ditch Road, providing a safe route for public transportation to Lake Drummond. This direct road linkage would considerably improve the safety of public access to this area, as the present Railroad Ditch Entrance is located in a blind curve on Desert Road. The conversion of the present administrative headquarters facility would create the need to move staff functions to make room for the visitor services. All other staff functions would be distributed appropriately between the administrative headquarters/ Visitor Center Complex on US Highway 17 in Chesapeake, the Field Operations Center at 3216 Desert Road in Suffolk, and the Refuge Contact Station in Sunbury.



Forest Management.

Access provided for educational and research interests in other habitats. Determining GPS reading for old growth cypress. USFWS.

In Chesapeake, the realignment and expansion of US Highway 17 has created an ideal location for a Refuge Visitor Center Complex. Again, this site was previously identified for the same use in the Refuge's 1979 Public Use Plan. The new highway alignment provides an area of approximately 250 acres between the highway and the Dismal Swamp Canal where interpretive and educational facilities would be constructed.

Adjacent to this major highway, this location can easily support the attraction of 500,000+ visitors annually. Moreover, considerable public interest exists in providing broader educational opportunities to develop partnerships with the City of Chesapeake, Virginia Department of Game and Inland Fisheries, The Nature Conservancy, Tidewater Community College, Old Dominion University, and other educational and conservation interest.

Most remaining staff, including those directly related to Operations functions, would be stationed at the Field Operations Center at 3216 Desert Road in Suffolk. Centrally located on the western flank of the refuge, this site would be most convenient for field activities considering most roads to the interior of the refuge access from the west.

The Sunbury Contact Center would house a small group of staff and provide an opportunity to establish a point of contact to serve refuge interest in North Carolina. The physical presence of staff in this area would improve communications, distribution of public information, and foster support for the refuge mission in this area where resource management issues will intensify over the next twenty years. In addition, the proposed site has a substantial and a relatively new sewage treatment system that should be able to accommodate the addition of RV hookups for volunteer housing.

To conclude, this overall development concept places visitor services, logistical operations, and administrative services at locations that would best serve the needs of the refuge. Also important is that this approach reduces the impact of development on the existing refuge land. Most of the development would occur on land already developed for refuge operations (Suffolk), lands procured primarily for administrative/visitor operations (Chesapeake), or moved to existing developments (Sunbury).

Objective: Develop administrative, operational, and visitor facilities to serve as hubs for visitor access to the refuge and administrative/operational support.

Strategies:

- Develop the administrative headquarters/Visitor Center Complex on US Highway 17 in Chesapeake, Virginia.
- Convert the existing refuge headquarters in Suffolk, Virginia, to a Visitor Service Station to support concessionaire operations and serve as a visitor services station.
- Establish a Refuge Contact Station in Sunbury, North Carolina.

Alternative C: Limited Habitat Management

Management Focus: This alternative retains most of the expansion of visitor services described within the Service's Preferred Alternative but limits habitat manipulation to those activities that qualify under existing fire management programs. Thus, habitat manipulation will be limited primarily to fuels reduction, utilizing select timber cutting and prescribed burning.

Rationale: The Great Dismal Swamp NWR incorporates arguably the best remaining remnant of seasonally-flooded habitat that once dominated southeastern Virginia and northeastern North Carolina. Yet, humans have altered even the refuge habitat substantially over the past two centuries. Resource management specialists generally believe that natural habitat diversity and wildlife have suffered as a result. Nevertheless, the public does not universally accept habitat restoration that requires significant manipulation. While refuge management firmly believes that the preponderance of scientific knowledge favors progressive habitat restoration described in the preferred alternative, this option acknowledges an alternative habitat vision for the refuge.

Goal 1: (Habitat) Manage the area for the primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein.

Program: Forest Management

Rationale for Program: "A timber management program to include the continuing harvest of select timber species under controlled

conditions" is one of the primary objectives of the refuge (USDI 1974). Forest management programs are directed towards restoring and enhancing the natural habitat diversity of the refuge by restoring or mimicking natural forces that once maintained habitat and wildlife diversity of the refuge.

The refuge's establishing legislation and supporting documents implies the refuge should pursue a direction that includes habitat manipulation. Nevertheless, a line of thought exists that continued human intervention with the natural forces should be modest for several reasons. Habitat management operations can temporarily disrupt visitor access to the refuge. Prescribed burning and commercial harvest of forests can be temporarily disruptive of the aesthetics of the refuge. Prescribed fires risk disrupting off-refuge human activities and property if fires escape the refuge or smoke drifts to highways, airports, and other populated areas.



Fire Management. *Fire detection/suppression operations reduce the probability of long-lasting catastrophic wildfires. Ground fire suppression. USFWS.*

Under this alternative, habitat manipulation will be restricted to hazard reduction prescribed burning that supports basic stewardship requirements related to legal, political, and societal mandates. Habitat manipulation for other purposes will be eliminated.

Objective: Habitat manipulation will be used for research and hazard fuel reduction prescribed fires only.

Strategies:

- Provide access to research and research interests for Atlantic white cedar forest areas.
- Prescribed fires will be restricted to the reduction of fuel accumulations for pine/pocosin areas.
- Provide access to educational and research interests in other habitats.

Program: Hydrologic Management

Rationale for Program: The 150 miles of ditches constructed since 1760 have created a drier forested wetlands system, resulting in significant ecological changes. Reversing this drying trend by slowing the rate of drainage supports the refuge mission of "protecting and perpetuating" the ecosystem. These efforts support refuge operations to implement prescribed burning, reduce the probability of ground fires and catastrophic wildfires, and improve brood habitat for wood ducks. Moreover, Congress recognized the importance of conserving water for

the proper stewardship of the Great Dismal Swamp by directing in the refuge’s establishing legislation that the operation of the Dismal Swamp Canal could not adversely affect the refuge.

Objective: Maintain and/or restore hydrologic conditions to sustain or improve viability of wetland communities and their associated wildlife species.

Rationale for Objective: Water conservation and manipulation is required to support the ecosystem restoration mission. Restoring seasonal flooding of forests supports nesting and brood habitat for migratory waterfowl (e.g. wood ducks). Monitoring surface flooding conditions to assure that conditions are favorable to ground foraging neotropical migratory birds supports refuge and agency objectives. Maintaining higher ground water levels within Atlantic white cedar forest supports maintenance of this rare habitat. Continued maintenance and operation of the existing water control structures maintains a major capital investment in the refuge.

Strategies:

- Conserve water to restore natural hydrologic conditions within areas where cypress, maple, and gum are the dominant habitats.
- Monitor surface flooding conditions to assure that abnormal surface flooding does not interfere with ground-foraging neotropical migratory birds.
- Maintain ground-water levels within one foot of the surface within Atlantic white cedar stands.

Objective: Maintain and operate water control structures to support flood control and fire management operations.

Rationale for Objective: Water handling and conservation capabilities support flood control and prescribed fire and fire suppression operations.

Strategies:

- Adjust water control structures as needed to inhibit flood damage to refuge roads.
- Promote research and survey partnerships with research institutions, Corps of Engineers, and other government organizations to improve basic knowledge and interpretation of the refuge watershed.
- Cooperate with adjacent landowners along the Pasquotank River to allow proper operation and maintenance of the Newland flood-control dike.
- Assure that refuge water conservation measures not result in

- flooding of adjacent neighboring private property.
- Continue current cooperative arrangement with the Corps of Engineers in which water release from Lake Drummond ceases at 15.75 MSL.
- Maintain water levels in ditches to support fire suppression and prescribed fire needs.

Program: Fire Management

Rationale for Program: Fire is known to have been an important natural force in maintaining natural habitat diversity within the refuge ecosystem. Fires that were ignited by humans and lightning created clearings that allowed different species of plants to flourish and maintained forest stands of varying ages. Fires also created depressions in the organic soils that evolved into marshes, bogs, and lakes.

Fire suppression in areas dominated by organic soils is labor-intensive and can require highly specialized equipment that state and local agencies do not maintain. Therefore, the refuge will need to maintain sufficient detection and suppression capabilities to provide initial attack on refuge wildfires in order to minimize risks to adjacent private property and human health.

Fire detection/suppression operations reduce the probability of long-lasting catastrophic wildfires that would threaten human health and property surrounding the refuge. Major highways, three airports, and considerable residential and commercial properties would be threatened if fires escaped from the refuge. Lightning from summer thunderstorms ignites most refuge wildfires, so most wildfires occur when surface and ground water conditions are favorable for ground fires of long duration. Long-lasting peat fires have been known to emit smoke for months and reduce air quality for lengthy periods. Early detection/suppression of fires reduces the chances of large fires developing; thus, reducing suppression time and expenses.

Objective: Maintain existing capabilities to detect and suppress wildfires.

Strategies:

- Maintain fire suppression capabilities necessary to complement the abilities of state and local fire suppression forces to contain and suppress wildfires within the refuge.

Goal 2: (Trust Resources/ Wildlife Species) Protect and enhance Service trust resources and other significant species.

Program: Red-cockaded Woodpecker Reintroduction

Rationale for Program: The red-cockaded woodpecker is listed as "endangered" on the Federal endangered species list. This species is known to have once existed within mature pine forests within the refuge, and small colonies have been discovered in southeastern Virginia and northeastern North Carolina. The woodpecker favors mature pine forest with relatively open understory maintained by frequent fires.

Woodpecker biologist have determined that the refuge's pine forest hold considerable potential for red-cockaded woodpecker foraging and nesting habitat and the refuge has been identified as a possible RCW recovery site. Habitat management required for the recovery effort will support the basic refuge mission of ecosystem restoration and enhancement.

Approximately 2,000 acres of pine/pocosin habitat within the refuge along the Virginia/North Carolina border have been identified as potential woodpecker habitat. Moreover, this area will likely qualify for funding to reduce fuel accumulations under the Wildlands Urban Interface or other fire management programs. A combination of mechanical clearing and prescribed burning will be required to restore and maintain this habitat. This portion of the refuge has an adequate road and ditch system to support equipment access and water transport capabilities in support of the habitat restoration operations.



Black Bear Management.

Enhance interpretive and educational outreach on the bear population within the refuge watershed. American Back Bear. Waverley Traylor.

Objective: Re-introduce a viable population of red-cockaded woodpeckers into appropriate refuge habitat.

Strategies:

- Implement mechanical clearing and prescribed burning to restore habitat in the designated area of approximately 2000 acres appropriate for red-cockaded woodpeckers.
- Translocate red-cockaded woodpeckers from suitable donor population into designated area of the refuge.
- Promote the Safe Harbor program to engage private landowners in recovery efforts.

- Install artificial nesting cavities to support woodpecker nesting.

Program: Neotropical Migratory Birds



Habitat Protection and Restoration. *Promote hydrologic restoration when opportunities develop (e.g. US Highway 158, Norfolk and Southern Railroad, Dismal Swamp Canal). US Hwy 158. USFWS.*

Rationale for Program: The large blocks of contiguous forests attract nearly 100 species of neotropical migratory birds to seasonally inhabit the refuge, and nearly 70 species to nest within the refuge. Atlantic coast populations of neotropical migrants are generally declining due to the loss of habitat. The refuge, however, is one of the few areas where populations are stable.

The large populations and number of species of neotropical migratory birds make the refuge an ideal location to support long-term monitoring and studies of these species. Neotropical banding has been ongoing for decades within the refuge, and the Smithsonian Institution has been tracking nesting activities for neotropical migrants, particularly the Swainson's warbler, since 1990. These surveys provide some indications on the status of neotropical migrants within the refuge as well as the mid-Atlantic region of the United States. In addition, these surveys provide feedback that can be useful in adjusting refuge habitat management operations to support neotropical migratory birds.

Objective: Provide basic monitoring and survey support for neotropical migratory bird populations to regularly assess status of refuge populations.

Strategies:

- Develop and support partnerships with the Smithsonian Institution, state wildlife agencies, Natural Heritage programs, and other research institutions to monitor neotropical migrant populations and habitat preferences.
- Support banding partnerships for neotropical migrants.
- Adjust water management and other refuge habitat management operations to enhance habitat for neotropical migrants.

Program: Waterfowl Management

Rationale for Program: The large blocks of seasonally flooded forest provide natural cavities for wood duck nesting. Remnant marshes and bogs as well as the man-made ditches provide brood habitat for wood

ducks. Lake Drummond provides resting habitat for estimated peak populations of 10,000-15,000 wintering tundra swans and snow geese that feed on agricultural fields within the refuge watershed.

Waterfowl surveys have proven that the refuge provides significant nesting habitat for wood ducks and can support significant winter populations of swans and geese.

Objective: Insure conditions for breeding and wintering waterfowl currently using the refuge are maintained.

Strategies:

- Monitor and maintain existing marsh and bog restoration sites to support brood habitat for wood ducks.
- Monitor and manage public access to Lake Drummond to allow the area to be used by wintering tundra swans and snow geese.

Program: Black Bear Management

Rationale for Program: The refuge contains one of the largest concentrations of black bears on the east coast of the United States. This large bear population, however, exists within an area that is surrounded by considerable commercial and residential development as well as major highways. The continued development of off-refuge lands has decreased the amount of bear habitat surrounding the refuge. Increased traffic along existing highways and highway improvements along the refuge perimeter may eliminate natural corridors through which bears now traverse to other areas of habitat within the refuge watershed. These developments create nuisance bear issues, as bears visit residential areas, disrupt traffic, and increase crop depredation. Moreover, the off-refuge development may eventually result in a genetically isolated black bear population.

The black bear is symbolic, in the view of the public, of the wildlife associated with the Great Dismal Swamp NWR ecosystem. The habitat and large size of the refuge means that the refuge will likely always contain a large black bear population. Therefore, an expectation exists for the refuge to have significant stewardship responsibilities for this highly visible bear population.

Objective: Maintain a black bear population that is viable and within the carrying capacity of the refuge.

Strategies:

- Continue to monitor black bear populations in cooperation with the state wildlife agencies and research/educational institutions to provide adequate demographic data to guide habitat and bear population management decisions on the refuge.
- Provide sites for emergency relocations of black bears in partnership with state wildlife management agencies.
- Work with states to acquire data on bears harvested under crop depredation permits, bear hunting and road kills.
- In partnership with the states and non-governmental organizations, seek funding to conduct studies to compliment previous refuge bear research that focuses on the demography of black bears, their genetics, population size, growth and dispersal patterns.
- Cooperate with state wildlife management agencies in developing and implementing emergency response to nuisance bears and enhancing educational outreach related to bears within the refuge watershed.

Goal 3: (Land Protection)

Provide protection of those areas within the Great Dismal Swamp watershed that either are remnants of Dismal Swamp habitat or can be restored to Dismal Swamp habitat.

Program: Habitat Protection and Restoration

Rationale for Program: In 1972, the Dismal Swamp Study Act (PL. 92-478) directed the Secretary of the Interior to study the desirability and feasibility of protecting and preserving the Great Dismal Swamp and Dismal Swamp Canal. Initially, a 210,000-acre study area was delineated to be considered for protection and restoration, and the Secretary ultimately recommended that approximately 123,000 acres be acquired by state and federal agencies for protection and stewardship. Over the past three decades, much of the land that was excluded from recommended public ownership has been developed and converted to other uses. This loss of habitat poses serious adverse ramifications for the refuge and surrounding communities. First, the loss of wildlife corridors threaten to make the refuge an ecological isolate, thus threatening the health of wildlife populations and decreasing “societal

carrying capacities” for some wildlife populations such as black bear. Second, the refuge has arguably become the largest urban wildlife refuge in the United States, as nearby development now supports neighboring human population of 1.5 million people. This adjacent human population and development complicates the habitat restoration mission of the refuge, since ecosystem perpetuation will involve hydrologic restoration and aggressive fire management that could potentially affect refuge neighbors. Finally, the continued development of historic “Great Dismal Swamp” habitat threatens the quality of life for humans within the watershed through the development of flood-prone areas where hydrologic disruption is significant, by a reduction of air and water quality, and by the loss of open space.

The protection and restoration of the remaining restorable habitats would mitigate trends of creating an ecologically isolated refuge and creating societal carry capacities for refuge wildlife populations, thus maintaining a higher quality of life for citizens in neighboring communities.

Objective: Pursue the protection and restoration of historic Great Dismal Swamp habitat within the refuge watershed, focusing on the area identified within the original 210,000 acre study area.

Strategies:

- Acquire the remaining properties within the current acquisition boundary when they are offered by willing sellers (approximately 4,000 acres).
- Cooperate and support efforts by neighboring cities and counties to restore and protect key remnants of restorable Great Dismal Swamp habitat outside the refuge acquisition boundary.
- Collaborate with and provide technical assistance to cities and counties when they are reviewing development proposals adjacent the refuge and within the historic range of the Great Dismal Swamp.
- Promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway designs.
- Partner with The Nature Conservancy, state wildlife agencies, and other non-government organizations to protect and restore seasonally flooded areas within the refuge watershed.
- Promote hydrologic restoration when opportunities develop (e.g. US Highway 158, Norfolk and Southern Railroad, Dismal Swamp Canal).
- Resolve boundary disputes, post refuge boundary.

Goal 4: (Public Use) Establish a public use program that will encourage awareness, understanding, appreciation and stewardship of the Great Dismal Swamp ecosystem while complementing the refuge resource management objectives.

Program: Hunting Opportunities

Rationale for Program: Hunting is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997. Providing wildlife-dependent recreational opportunities, like hunting, helps to foster an appreciation for wildlife and a sense of stewardship for the environment.

There are limited public hunting opportunities in southeastern Virginia and northeastern North Carolina. By opening the refuge to hunting, we provide the surrounding communities additional hunting opportunities, particularly to those who do not have access to private lands.

Objective: Provide a safe, quality hunt program and promote special hunt opportunities on the Great Dismal Swamp NWR.

Strategies:

- Provide an annual deer hunt program for archery and shotgun in designated zones of the Great Dismal Swamp NWR during specific days in October and November (13 day shotgun and archery concurrently in October and November).
- Coordinate with special needs organizations to identify ways to provide better hunting access for people with disabilities.
- Establish an annual hunter safety program at the refuge which will include map and compass orienteering.
- Provide for youth hunting opportunities.

Program: Boating and Fishing Access

Rationale for Program: Fishing is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

Fishing on Lake Drummond is allowed year-round during daylight hours when accessed via the Feeder Ditch on the east side of the refuge (10 horsepower limit). Utilizing a boat rental concessionaire, the Railroad Ditch entrance on the west side of the refuge would provide year-round access for boating and fishing on both sides of the refuge. In addition to concessionaire rentals, a fishing permit will be available April 1 through June 15 to allow access for private fishing boats (25 horsepower limit) to enter Lake Drummond by the Interior boat ramp.

Objective: Provide access to Lake Drummond for fishing and boating year round.

Strategies:

- Lake Drummond is open for boating and fishing during daylight hours, access via Feeder Ditch, year round.
- Continue to provide a fishing/boating season permit, for April 1 to June 15, to Lake Drummond, access via Interior Ditch Road, during daylight hours.
- Promote fishing in southeastern Virginia and northeastern North Carolina by partnering with local municipalities and other organizations for off-site fishing events.
- Recruit and contract a private company to maintain a fleet of canoes/kayaks for rent.
- Provide guided canoe/kayak interpretive tours through the concessionaire.

Program: Environmental Education

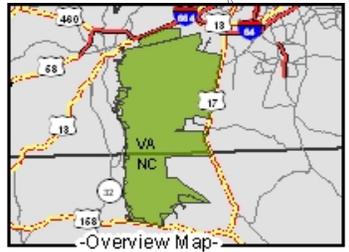
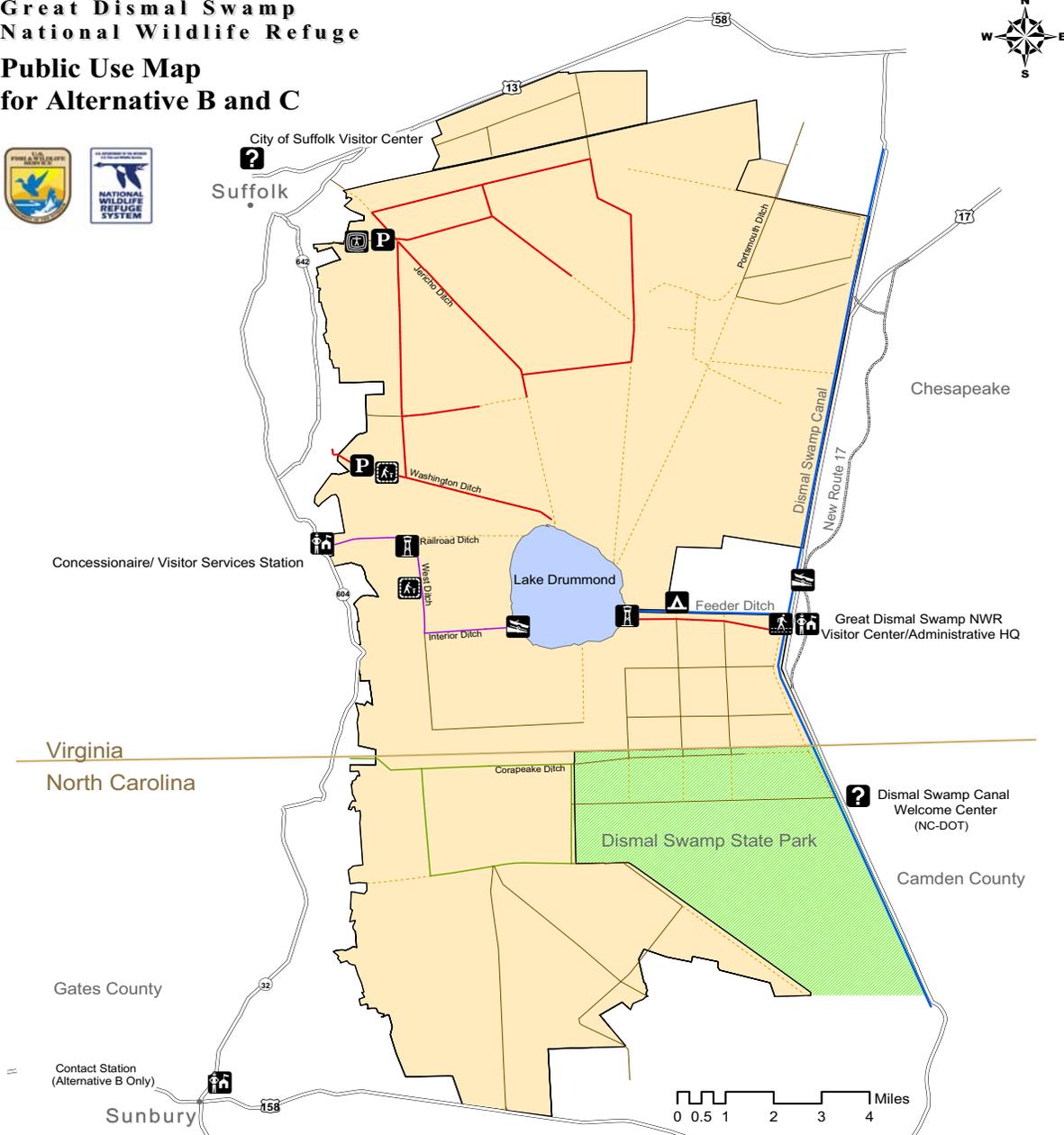
Rationale for Program: Environmental education is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

As our population increases, understanding its impact on the natural world is becoming increasingly more important for both our quality of life and our economy. More and more people are removed from the natural world in their daily lives and understand it less. In addition to those audiences served under current management, in this alternative, the focus will be expanded to include the southeastern Virginia and northeastern North Carolina region, reaching both rural, agricultural-based and urban communities.

Whether it was early efforts to drain the swamp, the establishment of the Dismal Swamp Canal and canal life, or runaway slaves hiding in the swamp, the Great Dismal Swamp is deeply embedded in Virginia and North Carolina history. The swamp’s ecosystem contributed greatly

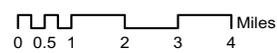
Figure 3-6.

**Great Dismal Swamp
National Wildlife Refuge
Public Use Map
for Alternative B and C**



	Hiking/Biking Trail		Information		Refuge Office
	Tram Route		Boardwalk Trail		Foot Bridge
	Automobile Tour		Environmental Study Area		Observation Tower
	Primarily Hunting/Research Use		Corps of Engineers Campsite		Parking Area
	Unmaintained Roads		Boat Ramp		

-Legend-



to the history of the region. Details of this cultural contribution will be a part of the refuge’s educational programs along with the biological aspects of the ecosystem.

Objective: Provide a quality comprehensive environmental education program to Hampton Roads and northeastern North Carolina region that incorporates the U.S. Fish & Wildlife Service message, the cultural and natural history of the Great Dismal Swamp NWR, the impact of man on the environment, and the resource management practices used by the refuge staff to protect and preserve the Great Dismal Swamp NWR.

Strategies:

- Continue to offer teacher activity guides and refuge videos for the classroom.
- Outreach to teachers to encourage utilization of the refuge as an outdoor classroom.
- Provide field study equipment and field guides for loan to visiting school trips.
- Continue to participate in occasional environmental education programs at various schools.
- Partner with local universities and community colleges to develop and provide teacher training on the Great Dismal Swamp NWR ecosystem utilizing environmental education materials.
- Purchase land and develop the Jericho Lane Education Pavilion.
- Develop other site specific biological and historical educational media, utilizing the latest technology and in compliance with Virginia and North Carolina state academic standards.
- Present at local, regional, and national education conferences to encourage teachers to discover the Great Dismal Swamp NWR with their students.
- Establish partnerships with local elder-hostel programs.
- Develop and implement a Junior Naturalist program in the region.
- Establish a cooperating agreement with the region’s school systems to provide specific environmental education programs which incorporate refuge-specific service learning activities.
- Establish a library and resource center for teachers and students.
- Utilize the latest technology to share the refuge environmental education program with those unable to visit.

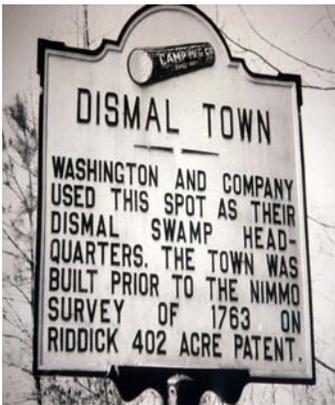
Program: Interpretation

Rationale for Program: Interpretation is one of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

The Great Dismal Swamp NWR is an integral part of the natural and cultural heritage of the region. The swamp's role in the timber industry from the 18th to the 20th century and its role in the Underground Railroad are well documented, not to mention the establishment of the Dismal Swamp Canal and canal life.

The Williamsburg/Hampton Roads/Outer Banks region swells with tourists every year. In 2002, Virginia Beach estimated over 3 million visitors to the area. Colonial Williamsburg, approximately one-hour north of the refuge, identified over 929,000 ticketed visitors and countless numbers of people who did not purchase a ticket. The Outer Banks, in North Carolina, also receives millions of visitors every year.

Many of these people either travel past the refuge on their way to Virginia Beach, Colonial Williamsburg or the Outer Banks, or seek out the refuge. According to the North Carolina Department of Transportation, over 16,000 vehicles each day pass through the intersection of US Highway 158 and Rt. 32 in Sunbury, North Carolina. The Dismal Swamp Canal Visitor Center located on US Highway 17 in North Carolina estimates their visitation from 400,000 – 600,000 each year since their opening in 1989. The Center is located on a four lane portion of the highway, but a dangerous two lane section just to the north in Virginia is currently being re-aligned and improved to four lanes. At the completion of the road project, a significant increase in vehicle volume is anticipated.



Interpretation. *Cultural history interpretation to include programs focused on human impact on the swamp. Dismal Town marker, Washington Ditch Trail. USFWS.*

The refuge will establish a visitor facility on the newly re-aligned US Highway 17, a major access way to Virginia Beach, Hampton Roads and the Outer Banks, and will be incorporated into the Dismal Swamp Canal Recreational Trail being developed by the City of Chesapeake, Virginia. The environmentally-friendly designed facility will include interactive exhibits about the Great Dismal Swamp NWR and the ecology of the region. The facility will inspire visitors to get out onto the refuge. Through coordination with the Army Corps of Engineers to provide access across the Dismal Swamp Canal, the refuge will establish a 3-mile hiking trail along the Feeder Ditch to Lake Drummond. This will make ground access to the refuge from the eastern boundary possible, a new access route about which many people inquire.

Additional staff will provide more opportunities for both on-site and off-site personal interpretation. Interpretive experiences, including guided walks, special events and festivals, display panels, exhibits and other programs will assist refuge visitors to become oriented to the trails on the refuge, and assist members of the community to understand the natural and cultural role of the swamp and man's impact on the environment.

Interpretive programming will be offered every weekend and include collaborative efforts with other museums and organizations. Gateway facilities (such as contact stations or kiosks), established along major transportation routes and near the “corners” of the refuge- Sunbury and Camden, North Carolina, and the cities of Suffolk and Chesapeake, Virginia, will provide further orientation to visitors traveling around the refuge and looking for the entrances to such a vast area. Program and refuge marketing will extend beyond the immediate boundaries and into Norfolk, Virginia Beach, and the Colonial Williamsburg/Jamestown areas in Virginia, and to Elizabeth City and the Outer Banks in North Carolina.

Objective: Provide quality interpretive experiences to the southeastern Virginia/ northeastern North Carolina region, designed to increase awareness, understanding and support for the swamp’s unique ecosystem and its role in the cultural landscape of the region and country, and the refuge’s resource management practices.

Strategies:

- Produce and provide refuge publications on general refuge information and current issues.
- Provide year-round interpretive programs at several key locations around the refuge, in both North Carolina and Virginia.
- Expand natural history interpretation to include programs focused on resource management issues such as fire, Atlantic white cedar, red cockaded woodpeckers, bears and other urban conflicts of importance to the swamp ecosystem.
- Expand cultural history interpretation to include programs focused on human impact on the swamp, timber and economic resources of the swamp, the Underground Railroad, and the Dismal Swamp Canal.
- Host annual events highlighting conservation celebrations such as International Migratory Bird Day, National Wildlife Refuge Week, National Public Lands Day and the Great Dismal Swamp NWR anniversaries.
- Update and maintain interpretive panels, boardwalks, and kiosks at Washington Ditch and Jericho Lane.
- Update and maintain interpretive panels and kiosks on Railroad/ West/Interior Trail and Feeder Ditch Trail.
- Develop and maintain kiosk at Dismal Swamp Canal Visitor Center (NCDOT).
- Contract a concessionaire to provide interpretive boat tours on Lake Drummond.
- Partner with the City of Suffolk to develop Great Dismal Swamp NWR exhibits for their visitor center.
- Develop interpretive exhibits and programs for the US Highway 17 facility to serve both the refuge’s North Carolina and Virginia communities and the visiting public.

- Develop interpretive exhibits for the Jericho Lane Pavilion.
- Develop and produce interpretive materials for handouts.

Program: Wildlife Observation and Photography

Rationale for Program: Wildlife observation and photography are two of the six priority wildlife-dependent recreational uses of the National Wildlife Refuge System, as stipulated in the Refuge Improvement Act of 1997.

The Great Dismal Swamp NWR is a wonderful place to observe and photograph wildlife; however, it is also very large which can provide an obstacle in getting to some of the more picturesque locations. The refuge will contract a concessionaire to provide interpretive boat and tram tours, and bicycle and boat rentals to refuge visitors allowing them easier access to the refuge. This access will be focused on specific trails to ensure limited wildlife and habitat impact.



Wildlife Observation.

Refuge trails provide opportunities for visitors to view, photograph, and appreciate wildlife in the habitat. USFWS.

An additional hiking trail will be developed along the Feeder Ditch leading to Lake Drummond. An interpretive auto tour route will be established along Corapeake/Sherrill/Cross/Forest Line Ditches to highlight the Atlantic white cedar and other forest-related refuge issues.

Objective: Provide opportunities for refuge visitors to view, photograph, and appreciate wildlife in the habitat as an effort to promote understanding of the impact of man's footprint on the fragile ecosystem of the Great Dismal Swamp NWR.

Strategies:

- Maintain Washington Ditch Trail and the Lake Drummond observation pier at Washington Ditch.
- Maintain approximately 50 miles of trails for foot or bike touring.
- Continue to provide access permits to nature-based tourism groups and outfitters, such as canoeing and kayaking, as well as local municipalities, to promote wildlife observation.
- Contract a concessionaire to provide canoe/kayak and bicycle rentals and interpretive boat and tram tours, based at the Desert Road facility (with a satellite at the US Highway 17 visitor facility) using the Railroad/West/Interior Ditch access.
- Using environmentally friendly products, pave public use access route Railroad/West/Interior and maintain boat ramp.
- Develop observation/photography platform at West/Railroad intersection.

- Develop observation deck and trail at old cypress area on West Ditch Road.
- Coordinate with the Army Corps of Engineers to provide year-round water access of Lake Drummond via Feeder Ditch, to develop a foot-bridge system across the Dismal Swamp Canal to access the Feeder Ditch hiking trail, and to accommodate boat tours to Lake Drummond.
- Develop trail along Feeder Ditch to Lake Drummond.
- Develop observation tower on Feeder Ditch Trail overlooking Lake Drummond.
- Established a paved interpretive auto tour route, using environmentally friendly products, along Corapeake/ Sherrill/Cross/ Forest Line Ditches to highlight the Atlantic white cedar and other forest-related refuge issues.
- Using environmentally friendly products, pave public use access route Whitemarsh Road to the parking area on Washington Ditch trail.
- Using environmentally friendly products, pave public use access route Whitemarsh Road to the parking area on Jericho Lane.
- As additional visitor facilities are developed, general access for some trails will be restricted to research and hunting only.

Program: Volunteers

Rationale for Program: In all programs volunteers are a valuable asset, bringing a unique element of local history and knowledge and, at times, providing technical assistance to refuge wildlife management activities.

Objective: Provide opportunities for people to donate their time and talents to the refuge, building community support and providing a financial savings to the Service.

Strategies:

- Identify volunteer opportunities and establish “job descriptions” for those opportunities.
- Distribute volunteer internship opportunities to colleges and universities nationally.
- Conduct two volunteer training workshops per year.
- Hold an annual volunteer recognition and appreciation event.
- Expand volunteer recruitment efforts to include local/regional/national levels.
- Develop and implement a Junior Naturalist program to recruit new volunteers.

Program: Outreach

Rationale for Program: The Williamsburg/ Hampton Roads/Outer Banks region is rapidly becoming a densely populated urban area. Its residential population is experiencing some of the most dramatic rates of growth in Virginia. In addition to the services offered under current management, it is critical that the refuge reach beyond its immediate borders to educate the region on the Great Dismal Swamp NWR ecosystem and on how the activities around the refuge affect the health of the swamp and, in effect, the health of the surrounding communities.

Objective: Coordinate with Virginia and North Carolina state and local partners to participate in community events and provide input on local environmental issues.

Strategies:

- Continue to serve as advisors in regional government conservation planning.
- Continue to work with conservation groups, such as The Nature Conservancy and the Izaak Walton League of America to partner in finding solutions to area environmental issues.
- Continue to share refuge facilities (e.g. conference room at the refuge headquarters) with state and local agencies.
- Continue to offer off-site outreach programs, by request and as staff schedules permit, to local civic and environmental organizations with special emphasis on providing various audiences information about refuge management issues, including forest management, fire management, bear management, and protection of trust resources.

Facilities for Visitor Services

Rationale for Program: Public demand for improved visitor services was unquestionably the dominant issue presented at the public scoping meetings in January, 2002. Moreover, the establishing legislation for the refuge supported the concept of developing a visitor friendly refuge for wildlife-oriented educational and recreational activities. This concept was further corroborated and supported by the "Public Use Development Plan - Great Dismal Swamp National Wildlife Refuge" that was published by the U.S. Fish and Wildlife Service in 1979. Therefore, the vision that calls for developing major facilities for visitor services addresses a public demand, fulfills the legislated direction for the refuge,

supports a long-standing agency position, and would enhance visibility and support for the Great Dismal Swamp National Wildlife Refuge and the National Wildlife Refuge System.

Considering the large size of the refuge and the traveling time required just to traverse the perimeter of the boundary, two locations would be needed for developing adequate visitor service centers. In Suffolk, the present site of the refuge headquarters provides an ideal location to establish a Visitor Service Station to support a variety of concessionaire-operated activities, refuge outreach, and distribution of trail and refuge information. The building, now too small to meet all staffing needs, is of adequate size to allow appropriate alterations to accommodate considerable increases in visitation. In addition, the headquarters is adjacent to the Railroad Ditch Entrance, making it possible to connect this visitor service complex directly to Railroad Ditch Road, providing a safe route for public transportation to Lake Drummond. This direct road linkage would considerably improve the safety of public access to this area, as the present Railroad Ditch Entrance is located in a blind curve on Desert Road. The conversion of the present administrative headquarters facility would create the need to move staff functions to make room for the visitor services. All other staff functions would be distributed appropriately between the administrative headquarters/Visitor Center Complex on US Highway 17 in Chesapeake and the Field Operations Center at 3216 Desert Road in Suffolk.

In Chesapeake, the realignment and expansion of US Highway 17 has created an ideal location for a Refuge Visitor Center Complex. Again, this site was previously identified for the same use in the Refuge's 1979 Public Use Plan. The new highway alignment provides an area of approximately 250 acres between the highway and the Dismal Swamp Canal where interpretive and educational facilities would be constructed. Adjacent to this major highway, this location can easily support the attraction of 500,000+ visitors annually. Moreover, considerable public interest exists in providing broader educational opportunities to develop partnerships with the City of Chesapeake, Virginia Department of Game and Inland Fisheries, The Nature Conservancy, Tidewater Community College, Old Dominion University, and other educational and conservation interest.

Remaining staff, including those directly related to Operations functions, would be stationed at the Field Operations Center at 3216 Desert Road in Suffolk. Centrally located on the western flank of the refuge, this site would be most convenient for field activities considering most roads to the interior of the refuge access from the west.

To conclude, this overall development concept places visitor services, logistical operations, and administrative services at locations that would best serve the needs of the refuge. Also important is that this approach reduces the impact of development on the existing refuge land. Most of the development would occur on land already developed for refuge operations (Suffolk) or on lands procured primarily for administrative/visitor operations (Chesapeake).

Objective: Develop administrative, operational, and visitor facilities to serve as hubs for visitor access to the refuge and administrative and operational support.

Strategies:

- Develop the administrative headquarters/Visitor Center Complex on US Highway 17 in Chesapeake, Virginia.
- Convert the existing refuge headquarters in Suffolk, Virginia, to a Visitor Service Station to support concessionaire operations and serve as a visitor services station.

Activities Considered but Eliminated from Further Consideration

Horseback Riding

The issue of horseback riding generated considerable discussion among the planning team members, since significant interest had been recorded at the scoping meetings. The planning team decided not to recommend horseback riding for inclusion in this plan due to the following issues and concerns:

- Informal discussions with state and federal land administrators revealed that while horseback riding was allowed on some public lands, significant concerns regarding the impacts to road maintenance and the possible introduction of exotic plants through horse manure existed.

- Horses would have to be transported in trailers to those refuge areas that could accommodate horseback riding. Expanded and specialized parking would have to be developed.
- Horseback riding would have to be restricted to a limited season to avoid conflicts with existing public uses and other refuge operations.
- Visitor service developments that likely include horseback riding in areas other than the refuge may be forthcoming, especially as plans for developments along US Highway 17 and the Dismal Swamp State Natural Area are completed.

To conclude, the planning team recognized, through comments provided at the scoping meetings, that horseback riders are challenged to find suitable locations for this activity. However, the management constraints that would be required to accommodate horseback riding to avoid conflicts with existing refuge activities as well as concerns over the environmental and maintenance impacts led the team to conclude that horseback riding would not be a cost-effective means of providing access into the refuge.

Ban Hunting

Some written comments suggested that all hunting be eliminated from the refuge. The Refuge Improvement Act of 1997 declares that hunting is among the priority public uses that are legitimate and appropriate for refuges. In addition, the refuge's establishing legislation inferred that hunting is among the priority public uses to be considered for the refuge. Hunting is necessary for maintaining some wildlife populations, especially white-tailed deer, at levels that can be supported by the existing habitat. Therefore, hunting will continue to be a wildlife-dependent activity on the refuge.

Waterfowl Hunting

A suggestion was contributed at a public scoping meeting to open the refuge to waterfowl hunting. Lake Drummond is the only refuge area that is reasonably accessible to the public and that supports significant populations of wintering waterfowl. Even so, the refuge serves as a sanctuary for the waterfowl with the lake playing a key role in providing resting habitat for an estimated 10,000-15,000 tundra swans and snow geese during November-February. The waterfowl return at night to the lake for use as roost after feeding on agricultural lands east of the lake.

Unlike big game hunting for deer, a waterfowl hunt on Lake Drummond would likely drive most, if not all, tundra swans and snow geese from the refuge, for their use of the refuge is confined to the 3,000 acre lake. In contrast, the movement and use of the refuge by deer during big game hunts are not significantly affected by the hunts, since these animals are spread throughout most of the 111,201 acres of the refuge.

Lake Drummond is a valuable habitat component for wintering tundra swans and snow geese. The lake, in combination with the agricultural land on which the birds feed, has supported an estimated 30 percent of all the wintering tundra swans and snow geese in Virginia. Therefore, it was determined that it would not be desirable to disrupt this valuable component of wintering habitat.

<p>Forest Management continued</p>	<ul style="list-style-type: none"> ▪ Promote partnerships with state forest management agencies, research institutions, and non-government resource management organizations to develop and evaluate forest management techniques. <p><i>Pine/Pocosin</i></p> <ul style="list-style-type: none"> ▪ Implement hardwood removal and aggressive prescribed burning on 10,000 acres. Maintain these areas with prescribed fires occurring every 3 to 5 years. <p><i>Remnant Marsh</i></p> <ul style="list-style-type: none"> ▪ Maintain approximately 30 acres of the marsh that have already been restored by subjecting the area to prescribed fires every 3 to 5 years. ▪ Monitor vegetation and ground and surface water conditions to evaluate habitat maintenance techniques. 	<p><i>Pine/Pocosin</i></p> <ul style="list-style-type: none"> ▪ Implement hardwood removal and aggressive prescribed burning on 10,000 acres. ▪ Maintain areas with prescribed fires every 3-5 years. <p><i>Remnant Marsh</i></p> <ul style="list-style-type: none"> ▪ Maintain 30 acres of restored marsh by prescribed burns every 3 to 5 years. ▪ Monitor vegetation and ground/surface water conditions to evaluate habitat maintenance techniques. ▪ Restore remaining acreage of the marsh utilizing mechanical clearing and prescribed burning to expand the total Remnant Marsh to 250 acres. 	
<p>Hydrologic Management</p> <p>cont.</p>	<ul style="list-style-type: none"> ▪ Conserve water to restore natural hydrologic conditions within areas where cypress, maple, and gum are the dominant habitats. ▪ Monitor surface flooding conditions to assure that abnormal flooding conditions do not interfere with ground-foraging neotropical birds. ▪ Maintain ground-water levels within one foot of the surface within Atlantic white cedar stands. 	<p><i>In addition to A</i></p> <ul style="list-style-type: none"> • Add water control structures to the Portsmouth/East Ditch watersheds if needed to implement prescribed burning operations within pine forests north of Lake Drummond that will restore and maintain fire-dependent habitats. 	<ul style="list-style-type: none"> ▪ Conserve water to restore natural hydrologic conditions within areas where cypress, maple, and gum are the dominant habitats. ▪ Monitor surface flooding conditions to assure that abnormal surface flooding does not interfere with ground-foraging neotropical migratory birds.

**Chapter 3 GDSNWR
Matrix of Alternatives**

<p><i>Hydrologic Management</i> <i>continued</i></p>	<ul style="list-style-type: none"> ▪ Adjust water control structures as needed to inhibit flood damage to refuge roads. ▪ Promote research and survey partnerships with research institutions, Corps of Engineers, and other government organizations to improve basic knowledge and interpretation of the refuge watershed. ▪ Cooperate with adjacent landowners along the Pasquotank River to allow proper operation and maintenance of the Newland flood-control dike. ▪ Assure that refuge water conservation measures not result in flooding of adjacent neighboring private property. ▪ Continue current cooperative arrangement with the Corps of Engineers in which water release from Lake Drummond ceases at 15.75 MSL. ▪ Maintain water levels in ditches to support fire suppression and prescribed fire needs. ▪ Maintain water levels in ditches to support fire management needs in pine forests and red-cockaded woodpecker recovery areas. ▪ Support efforts to restore natural surface flow in those areas where off-refuge developments (e.g. US 158, Norfolk-Southern Railroad) create abnormally wet conditions. 	<ul style="list-style-type: none"> • Remove beavers and nutria, using lethal means, when habitat damage or interference with water management strategies (e.g. flooding private property) is detected. • Control invasive plant species if major infestations are detected in waterways and marshes. • Develop GIS surface flooding models to provide continuous assessment of water management strategies on wildlife populations and habitat conditions 	<ul style="list-style-type: none"> • Maintain ground-water levels within one foot of the surface within Atlantic white cedar stands. • Adjust water control structures as needed to inhibit flood damage to refuge roads. • Promote research and survey partnerships with research institutions, Corps of Engineers, and other government organizations to improve basic knowledge and interpretation of the refuge watershed. • Cooperate with adjacent landowners along the Pasquotank River to allow proper operation and maintenance of the Newland flood-control dike. • Assure that refuge water conservation measures not result in flooding of adjacent neighboring private property. • Continue current cooperative arrangement with the Corps of Engineers in which water release from Lake Drummond ceases at 15.75 MSL. • Maintain water levels in ditches to support fire suppression and prescribed fire needs.
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**Chapter 3 GDSNWR
Matrix of Alternatives**

<p>Fire Management</p>	<ul style="list-style-type: none"> ▪ Maintain 80-100 miles of roads to support fire suppression access for the refuge and Dismal Swamp State Park. ▪ Utilize lightning detection services and aerial surveys to detect wildfires during periods of high fire probability. ▪ Establish and maintain cooperative agreements with state and local fire suppression agencies to support fire detection and suppression. ▪ Implement hazard reduction burns within designated areas. ▪ Participate in wildlands urban interface programs that support reduction of fuel accumulations and development of fire breaks where off-refuge development and smoke-sensitive locations are threatened by refuge wildfires. 	<p><i>In addition to A</i></p> <ul style="list-style-type: none"> ▪ Acquire additional access easements near the North Ditch and Corapeake Ditch to improve emergency access to isolated portions of the refuge. 	<ul style="list-style-type: none"> ▪ Maintain fire suppression capabilities necessary to complement the abilities of state and local fire suppression forces to contain and suppress wildfires within the refuge.
<p>Additions to staff (in order of priority) for Goal 1:</p>	<p>Maintenance Worker Facility Manager Forester Tractor Operator Tractor Operator Equipment Operator</p>	<p><i>In additions to A:</i> Forestry Technician Biological Technician</p>	<p>Maintenance Worker Facility Manager Tractor Operator Tractor Operator Equipment Operator</p>

Goal 2:	Protect and enhance Service trust resources and other significant species.		
Program/Issue:	Alternative A “Current Management- No Action”	Alternative B “Service’s Preferred”	Alternative C “Limited Habitat Management”
Red Cockaded Woodpecker Re-introduction	<ul style="list-style-type: none"> ▪ Implement mechanical clearing and prescribed burning to restore habitat in the designated area of approximately 2000 acres appropriate for red-cockaded woodpeckers. ▪ Translocate re-cockaded woodpeckers from suitable donor population into designated areas of the refuge. ▪ Promote the Safe Harbor program to engage private landowners in recovery efforts. ▪ Install artificial nesting cavities to support woodpecker nesting. 	<i>Same as A</i>	<i>Same as A</i>
Neotropical Migratory Birds	<ul style="list-style-type: none"> ▪ Develop and support research and survey projects with partners to monitor neotropical migrant populations and habitat preferences. ▪ Support banding partnerships for neotropical migrants. ▪ Adjust water management and other refuge habitat management operations to enhance habitat for neotropical migrants; particularly Swainson’s warbler. 	<p><i>In addition to A:</i></p> <ul style="list-style-type: none"> ▪ Develop surface flooding and successional models using GIS technology to evaluate habitat conditions that affect neotropical migratory birds. ▪ Establish a neotropical migratory bird focus area near Jericho Lane. ▪ Develop clearings of 5-10 acres using tree-girdling or small clear-cuts to establish foraging areas for neotropical migratory birds. ▪ Develop a trail to the habitat management areas to enhance interpretive and educational opportunities for neotropical migratory birds. ▪ Work with Partners in Flight to promote research, education, and management of migratory birds on the refuge. 	<i>Same as A</i>

**Chapter 3 GDSNWR
Matrix of Alternatives**

<p>Waterfowl Management</p>	<ul style="list-style-type: none"> ▪ Monitor and maintain existing marsh and bog restoration sites to support brood habitat for wood ducks. ▪ Monitor and manage public access to Lake Drummond to allow the area to be used by wintering tundra swans and snow geese. 	<p><i>In addition to A:</i></p> <ul style="list-style-type: none"> ▪ Support efforts by TNC, VDGIF, and other partners to protect farmlands that are used by waterfowl from development. ▪ Evaluate need to expand refuge acquisition boundary to acquire those farmlands for waterfowl habitat. 	<p><i>Same as A</i></p>
<p>Black Bears</p>	<ul style="list-style-type: none"> ▪ Continue to monitor black bear populations in cooperation with the state wildlife agencies and research/educational institutions to provide adequate demographic data to guide habitat and bear population management decisions on the refuge. • Provide sites for emergency relocations of black bears in partnership with state wildlife management agencies. • Work with states to acquire data on bears harvested under crop depredation permits, bear hunting and road kills. • In partnership with the states and non-governmental organizations, seek funding to conduct studies to compliment previous refuge bear research that focuses on the demography of black bears, their genetics, population size, growth and dispersal patterns. • Cooperate with state wildlife management agencies in developing and implementing emergency response to nuisance bears and enhancing educational outreach related to bears within the refuge watershed. 	<p><i>In addition to A:</i></p> <ul style="list-style-type: none"> • Initiate limited <u>recreational</u> bear hunting on the refuge (See Goal 4 / Public Use/ <u>Hunting Opportunities.</u>) 	<p><i>Same as A</i></p>

**Chapter 3 GDSNWR
Matrix of Alternatives**

Additions to staff (in order of priority) for Goal 2:	Park Ranger	Park Ranger	Park Ranger

Goal 3:	Provide protection of those areas within the Great Dismal Swamp watershed that either are remnants of Dismal Swamp habitat or can be restored to Dismal Swamp habitat.		
Program/Issue:	Alternative A “Current Management- No Action”	Alternative B “Service’s Preferred”	Alternative C “Limited Habitat Management”
Habitat Protection and Restoration	<ul style="list-style-type: none"> ▪ Acquire the remaining properties within the current acquisition boundary when they are offered by willing sellers (approximately 4,000 acres). ▪ Cooperate and support efforts by neighboring cities and counties to restore and protect key remnants of restorable Great Dismal Swamp habitat outside the refuge acquisition boundary. ▪ Collaborate with and provide technical assistance to cities and counties when they are reviewing development proposals adjacent the refuge and within the historic range of the Great Dismal Swamp. ▪ Promote the maintenance of key wildlife corridors by recommending appropriate wildlife passages be incorporated into highway designs. 	<p><i>In addition to A:</i></p> <ul style="list-style-type: none"> ▪ Resolve boundary disputes, post refuge boundary, and patrol/inspect boundary to detect encroachment on the refuge and criminal activities. ▪ Cooperate and support protection of 7,000 acres of PC-farmland east of the refuge to provide early successional habitat for waterfowl and other wildlife management needs within the watershed. ▪ Cooperate and support protection of 15,000 acres of seasonally flooded forests south of US 158 for neotropical migratory birds, RCW’s, and black bears, and to restore surface hydrology. 	<p><i>In addition to A:</i></p> <ul style="list-style-type: none"> ▪ Resolve boundary disputes, post refuge boundary.
cont.			

**Chapter 3 GDSNWR
Matrix of Alternatives**

<p><i>Habitat Protection and Restoration continued</i></p>	<ul style="list-style-type: none"> ▪ Partner with The Nature Conservancy, state wildlife agencies, and other non-government organizations to protect and restore seasonally flooded areas within the refuge watershed. ▪ Promote hydrologic restoration when opportunities develop (e.g. US 158, Norfolk and Southern Railroad, Dismal Swamp Canal). 		
<p>Additions to staff (in order of priority) for Goal 3:</p>		<p>GIS Biologist</p>	<p>GIS Biologist</p>

**Chapter 3 GDSNWR
Matrix of Alternatives**

<p><i>Environmental Education continued</i></p>		<ul style="list-style-type: none"> ▪ Establish a cooperating agreement with the region's school systems to provide specific environmental education programs which incorporate refuge-specific service learning activities. ▪ Establish a library and resource center for teachers and students. ▪ Utilize the latest technology to share the refuge environmental education program with those unable to visit. 	
<p>Interpretation</p>	<ul style="list-style-type: none"> ▪ Produce and provide refuge publications on general refuge information and current issues. ▪ Provide occasional staff/volunteer-led orientation & programs at refuge headquarters emphasizing refuge issues. ▪ Provide occasional staff/volunteer-led orientation & walks at Washington Ditch & Jericho Lane. ▪ Provide occasional off-site programs at schools, libraries, and civic meetings. ▪ Maintain current interpretive panels, boardwalks and kiosks at Washington Ditch & Jericho Lane. ▪ Continue to exhibit at local festivals and events as staff time permits. 	<ul style="list-style-type: none"> ▪ Produce and provide refuge publications on general refuge information and current issues. ▪ Provide year-round interpretive programs at several key locations around the refuge, in both North Carolina and Virginia. ▪ Expand natural history interpretation to include programs focused on resource management issues such as fire, Atlantic white cedar, red cockaded woodpeckers, bears and other urban conflicts of importance to the swamp ecosystem. ▪ Expand cultural history interpretation to include programs focused on human impact on the swamp, timber and economic resources of the swamp, the Underground Railroad, and the Dismal Swamp Canal. 	<ul style="list-style-type: none"> ▪ Produce and provide refuge publications on general refuge information and current issues. ▪ Provide year-round interpretive programs at several key locations around the refuge, in both North Carolina and Virginia. ▪ Expand natural history interpretation to include programs focused on resource management issues such as fire, Atlantic white cedar, red cockaded woodpeckers, bears and other urban conflicts of importance to the swamp ecosystem. ▪ Expand cultural history interpretation to include programs focused on human impact on the swamp, timber and economic resources of the swamp, the Underground Railroad, and the Dismal Swamp Canal.

cont.

**Chapter 3 GDSNWR
Matrix of Alternatives**

<p><i>Interpretation continued</i></p>		<ul style="list-style-type: none"> ▪ Host annual events highlighting celebrations such as International Migratory Bird Day, National Wildlife Refuge Week, National Public Lands Day and the Great Dismal Swamp NWR anniversary. ▪ Update and maintain interpretive panels, boardwalks, and kiosks at Washington Ditch and Jericho Lane. ▪ Update and maintain interpretive panels and kiosks on Railroad/West/Interior Trail and Feeder Ditch Trail. ▪ Develop and maintain kiosk at Dismal Swamp Canal Visitor Center (under NCDOT). ▪ Contract a concessionaire to provide interpretive boat tours on Lake Drummond. ▪ Partner with the City of Suffolk to develop Great Dismal Swamp exhibits for their visitor center. ▪ Develop interpretive exhibits and programs for the US 17 facility to serve both the refuge's North Carolina and Virginia communities and the visiting public. ▪ Develop interpretive exhibits and materials for the Jericho Lane Education Pavilion. ▪ Develop and produce interpretive materials for handouts. ▪ Develop interpretive exhibits and programs for a visitor contact station at Sunbury, NC to orient visitors traveling east toward Virginia Beach and the Outer Banks. 	<ul style="list-style-type: none"> ▪ Host annual events highlighting celebrations such as International Migratory Bird Day, National Wildlife Refuge Week, National Public Lands Day and the Great Dismal Swamp NWR anniversary. ▪ Update and maintain interpretive panels, boardwalks, and kiosks at Washington Ditch and Jericho Lane. ▪ Update and maintain interpretive panels and kiosks on Railroad/West/Interior Trail and Feeder Ditch Trail. ▪ Develop and maintain kiosk at Dismal Swamp Canal Visitor Center (under NCDOT). ▪ Contract a concessionaire to provide interpretive boat tours on Lake Drummond. ▪ Partner with the City of Suffolk to develop Great Dismal Swamp exhibits for their City Visitor Center. ▪ Develop interpretive exhibits and materials for the Jericho Lane Education Pavilion. ▪ Develop interpretive exhibits and programs for the US 17 facility to serve both the refuge's North Carolina and Virginia communities and the visiting public. ▪ Develop and produce interpretive materials for handouts.
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**Chapter 3 GDSNWR
Matrix of Alternatives**

<p>Wildlife Observation & Photography</p> <p><i>cont.</i></p>	<ul style="list-style-type: none"> ▪ Maintain Washington Ditch Trail and the Lake Drummond observation pier at Washington Ditch. ▪ Maintain approximately 50 miles of trails for foot or bike touring. ▪ Continue to provide access permits to nature-based tourism groups and outfitters, such as canoeing and kayaking, as well as local municipalities, to promote wildlife observation. ▪ Maintain Railroad/ West/ Interior Ditch trail and boat ramp. ▪ Continue to provide auto access permits onto Railroad/ West/ Interior Ditch Roads to Lake Drummond. ▪ Coordinate with the Army Corps of Engineers to provide year-round water access of Lake Drummond via Feeder Ditch 	<ul style="list-style-type: none"> ▪ Maintain Washington Ditch Trail and the Lake Drummond observation pier at Washington Ditch. ▪ Maintain approximately 50 miles of trails for foot or bike touring. ▪ Continue to provide access permits to nature-based tourism groups and outfitters, such as canoeing and kayaking, as well as local municipalities, to promote wildlife observation. ▪ Contract a concessionaire to provide canoe/kayak and bicycle rentals and interpretive boat tours, based at the Desert Road facility (with a satellite at the US 17 visitor facility) using the Railroad/ West/ Interior Ditch access. ▪ Using environmentally friendly materials, pave public use access route Railroad/West/Interior and maintain boat ramp. ▪ Develop observation/ photography platform at West/Railroad intersection. ▪ Develop observation deck and trail at old cypress area on West Ditch Road. ▪ Coordinate with the Army Corps of Engineers to provide year-round water access of Lake Drummond via Feeder Ditch, to develop a foot-bridge system across the Dismal Swamp Canal to access the Feeder Ditch hiking trail, and to accommodate boat tours to Lake Drummond. ▪ Develop trail along Feeder Ditch to Lake Drummond. 	<p><i>Same as B</i></p>

**Chapter 3 GDSNWR
Matrix of Alternatives**

<p><i>Wildlife observation and photography continued</i></p>		<ul style="list-style-type: none"> ▪ Develop observation tower on Feeder Ditch Trail overlooking Lake Drummond. ▪ Using environmentally friendly materials, establish a paved interpretive auto tour route along Corapeake, Sherrill, Cross and Forest Line Ditches to highlight the Atlantic white cedar and other forest-related refuge issues. ▪ Using environmentally friendly materials, pave public use access route from White Marsh Road to parking area on Washington Ditch Trail. ▪ Using environmentally friendly materials, pave public use access route from White Marsh Road to parking area on Jericho Lane. ▪ As additional visitor facilities are developed, general access for some trails will be restricted to research and hunting only. 	
<p>Volunteers</p>	<ul style="list-style-type: none"> ▪ Establish “job descriptions” for identified volunteer opportunities. ▪ Distribute volunteer internship opportunities to local colleges and universities. ▪ Conduct two volunteer training workshops per year. ▪ Hold an annual volunteer recognition program. ▪ Recruit volunteers through on-site contacts, media releases, and on and off-site programs. 	<ul style="list-style-type: none"> ▪ Identify volunteer opportunities and establish “job descriptions” for those opportunities. ▪ Distribute volunteer internship opportunities to colleges and universities nationally. ▪ Conduct two volunteer training workshops per year. ▪ Hold an annual volunteer recognition and appreciation event. ▪ Expand volunteer recruitment efforts to include local/regional/national levels. ▪ Develop and implement a Junior Naturalist program to recruit new volunteers. ▪ Establish RV campsite pads with electric, water and sewer for 2-3 month term volunteers. 	<ul style="list-style-type: none"> ▪ Identify volunteer opportunities and establish “job descriptions” for those opportunities. ▪ Distribute volunteer internship opportunities to colleges and universities nationally. ▪ Conduct two volunteer training workshops per year. ▪ Hold an annual volunteer recognition and appreciation event. ▪ Expand volunteer recruitment efforts to include local/regional/national levels. ▪ Develop and implement a Junior Naturalist program to recruit new volunteers.

**Chapter 3 GDSNWR
Matrix of Alternatives**

<p>Outreach</p>	<ul style="list-style-type: none"> ▪ Serve as advisors in regional government planning. ▪ Work with conservation groups to partner in finding solutions to area environmental issues. ▪ Share refuge headquarters with state and local agencies. ▪ Offer off-site outreach programs, by request and as staff schedules permit, to local civic and environmental organizations with special emphasis on providing various audiences information about refuge management issues, including forest management, fire management, bear management, and protection of trust resources. 	<p><i>Same as A</i></p>	<p><i>Same as A</i></p>
<p>Facilities</p>	<ul style="list-style-type: none"> ▪ Assist visitors at refuge headquarters for orientation and information; Mon-Fri, 7:30 am- 4:00 pm. 	<ul style="list-style-type: none"> ▪ Develop the administrative headquarters/Visitor Center Complex on US Highway 17 in Chesapeake, VA. ▪ Convert the existing refuge headquarters in Suffolk, VA to support concessionaire operations and serve as a visitor services station. ▪ Establish a Refuge Contact Station in Sunbury, NC. 	<ul style="list-style-type: none"> ▪ Develop the administrative headquarters/Visitor Center Complex on US Highway 17 in Chesapeake, VA. ▪ Convert the existing refuge headquarters in Suffolk, VA to support concessionaire operations and serve as a visitor services station.
<p>Additions to staff (in order of priority) for Goal 4:</p>		<ul style="list-style-type: none"> • Recreation Aid • (2) Assistant Park Rangers • Volunteer Coordinator (Park Ranger) • Lead EE Specialist (Park Ranger) • Director of Visitor Services (Park Ranger) 	<p><i>Same as B</i></p>

Nansemond National Wildlife Refuge

Alternative A: Current Management

Program/Goal: Maintain custodial management of the refuge



Nansemond National Wildlife Refuge.

Opportunities limited to management and preservation of open space.
USFWS.

Rationale: Nansemond NWR was established in 1973 when the Department of Defense transferred 206 acres of land, primarily tidal marsh, to the Department of the Interior. In 1999, the refuge expanded to 423 acres when land was added from the adjacent Driver Naval Transmitter Facility. The addition to the refuge consisted primarily of upland areas that were frequently mown to maintain cleared space for the tall radio transmission towers that once existed on these areas.

The refuge is too small to make a significant contribution to wildlife management priorities of the Service, and expansion of the refuge is not desirable or feasible due to the considerable development that has occurred within the Nansemond River watershed. Therefore, expanding Service operations on this unit is not desirable or feasible.

Strategies:

- Periodically inspect and maintain posted boundaries.
- Respond to any encroachment and violation of refuge regulations on the property.

Alternative B: Service's Preferred Alternative

Program/Goal: Aggressively pursue partnerships to support the management and stewardship of Nansemond NWR

Rationale: Nansemond NWR was established in 1973 when the Department of Defense transferred 206 acres of land, primarily tidal marsh, to the Department of the Interior. In 1999, the refuge expanded to 423 acres when land was added from the adjacent Driver Naval Transmitter Facility. The addition to the refuge consisted primarily of upland areas that were frequently mown to maintain cleared space for the tall radio transmission towers that used to exist on these areas.

The refuge is too small to make a significant contribution to wildlife management priorities of the Service, and expansion of the refuge is not desirable or feasible due to the considerable development that has occurred within the Nansemond River watershed. Therefore, expanding Service operations on this unit is not desirable or feasible. In addition, no formal Wilderness Review has been completed at this time. The refuge's small size and the developed nature of the surrounding landscape make it unsuitable for wilderness designation.

The upland area within the refuge has a history of spot contamination, including PCB contamination, from transformers that used to serve the naval transmitter towers. Therefore, development opportunities would be limited and would likely be confined to management and preservation of open space.

Objective: Pursue partnerships for the management and stewardship of Nansemond National Wildlife Refuge.

Rationale for Objective: Partnerships would expand the range of management options for the refuge beyond the custodial level provided by the Service.

Strategy:

- Periodically inspect and maintain posted boundaries.
- Respond to any encroachment and violation of refuge regulations on the property.
- Pursue partnership discussions with city, state, and Native American representatives who have resource management, interpretive, or educational programs that require relatively undeveloped open space.

Figure 3-8

Nansemond National Wildlife Refuge Matrix of Alternatives		
Program/ Issue:	Alternative A “Current Management-No Action”	Alternative B “Service’s Preferred”
Refuge Management	<ul style="list-style-type: none"> ▪ Periodically inspect and maintain posted boundaries. ▪ Respond to any encroachment and violation of refuge regulations on the property. 	<ul style="list-style-type: none"> ▪ Pursue partnership discussions with city, state, and Native American representatives who have resource management, interpretive, or educational programs that require relatively undeveloped open space.

Environmental Consequences

- **Physical Environment**
 - Soils
 - Water Quality
 - Hydrology
 - Air Quality
 - Contaminants/Hazardous Materials
 - Aesthetics
- **Biological Resources**
 - Fauna
 - Flora
 - Rare Species
 - Fire Regime
- **Cultural Resources**
 - Archeological and Historic Resources
- **Socio-Economics**
 - Staffing and Budgets
 - Public Use
- **Cumulative Impacts**
- **Short-Term Use Versus Long-Term Productivity**
- **Unavoidable Adverse Impacts**
- **Irreversible and Irretrievable Commitments of Resources**

4. Environmental Consequences

This chapter describes the potential environmental impacts that may result from implementation of each of the considered alternatives

described in Chapter 3.

This chapter is the result of scientific, analytical, and qualitative comparisons of the three alternatives for future management of the Great Dismal Swamp NWR. The impacts are discussed for each resource in the order that they are presented in Chapter 2. By comparing the environmental consequences of all the alternatives, the USFWS can determine which alternative results in the best combination of beneficial impacts and the fewest adverse impacts.



Air Quality Impacts. *The primary impacts to air quality from refuge operations results from prescribed burning. Prescribed burning is implemented to restore historic fire frequency, improve habitat, and to reduce hazardous fuel accumulations. USFWS.*

many impacts occur on a small, localized scale (i.e. erosion from soil disturbance), impacts are also discussed at a larger geographic scale (i.e., air quality impacts to Hampton Roads). Impacts may be either adverse or beneficial, or a combination of adverse and beneficial. A summary of criteria used for rating the severity of impacts is presented in Figure 4-1.

There are certain types of actions identified in Chapter 3 that do not require additional NEPA analysis because they do not individually, or cumulatively, have a significant effect on the human environment. These actions are “categorically excluded” from further analysis or review and, as such, their consequences are not further described in this chapter.

These categorically excluded actions include, but are not limited to, the following:

- Environmental education and interpretation programs - unless major construction is involved.
- Research, resource inventories, and other resource information collection activities.
- Operations and maintenance of existing infrastructure and facilities - unless major renovation is involved.
- Routine, recurring management activities and improvement
- Small construction projects (e.g. fences, berms, small water control structures, interpretative kiosks, development of access for routine management purposes).
- Vegetation plantings.
- Reintroduction of native plants and animals.
- Minor changes in amounts or types of public use.
- Issuance of new or revised management plans when only minor changes are planned.

Physical Environment

Soils

A soil impact would be considered significant if it would result in one or more of the following:

- Occurrence of substantial erosion or siltation
- Occurrence of substantial land sliding
- Substantial damage to project structures/facilities
- Contamination of soils such that groundwater resources may be threatened

Alternative A

Impacts to soils would be adverse, minor, short-term, and localized. Impacts would result primarily from limited forest and fire management activities. These activities include commercial harvests of 1,000 acres of Atlantic white cedar, mechanical clearing of hardwoods to restore 2,000 acres of red-cockaded woodpecker (RCW) habitat in a pond pine/pocosin community, and establishment of fire breaks for prescribed burning. Since these activities would take place over organic soils, compaction and

Figure 4-1. *Criteria for Rating Severity of Impacts.*

Impact Severity:	Negligible	Minor	Moderate	Major
<p>Short-term = Less than five years, normally during construction and recovery. Long-term = Longer than five years, normally from operations. Cumulative = Cumulative impacts to environmental resources result from incremental effects of proposed actions when combined with other past, present, and reasonably foreseeable future projects in the area.</p>				
Soil Resources	Impact not perceptible and not measurable; not affecting surroundings.	Impact localized and slightly detectable but would not affect overall structure of any natural community.	Impact clearly detectable; could affect individual species, communities, or natural processes appreciably.	Impact highly noticeable and would substantially influence natural resources, e.g. individuals or groups of species, communities, or natural processes.
Water Quality	Impact not detectable, no discernible effect on water quality.	Impact slightly detectable but would not affect overall water quality.	Impact clearly detectable and could have an appreciable effect on the water quality of the environment.	Impact would have a substantial, highly noticeable, potentially permanent effect on the environment.
Air Quality	Impact not perceptible and not measurable; not affecting surroundings.	Impact perceptible but not measurable; would remain localized.	Impact detectable and possibly affecting integrity of surroundings. Air quality testing would be required.	Impact would have a significant impact on surroundings.
Aesthetics	Impact not perceptible and not measurable; not affecting surroundings.	Impact perceptible but not measurable; would remain localized.	Impact detectable and possibly affecting integrity of surroundings.	Impact would have a significant impact on surroundings.
Biological Resources	Impact localized and not detectable, or at lowest levels of detection.	Impact localized and slightly detectable but would not affect overall structure of any natural community.	Impact clearly detectable; could affect individual species, communities, or natural processes appreciably.	Impact highly noticeable and would substantially influence natural resources, e.g. individuals or groups of species, communities, or natural processes.
Threatened, Endangered, or Candidate Species	Change in a population or individuals of a species; consequences to population not measurable or perceptible, or other changes not measurable or perceptible.	Change in a population or individuals of a species, if measurable, would be small and localized, or other changes would be slight but detectable.	Change in a population or individuals of a species measurable but localized.	Change in a population or individuals of a species measurable and would result in permanent consequence to the population.

**Chapter 4
Environmental Consequences**

Figure 4-1. *Continued; Criteria for Rating Severity of Impacts.*

Impact Severity:	Negligible	Minor	Moderate	Major
<p>Short-term = Less than five years, normally during construction and recovery. Long-term = Longer than five years, normally from operations. Cumulative = Cumulative impacts to environmental resources result from incremental effects of proposed actions when combined with other past, present, and reasonably foreseeable future projects in the area.</p>				
Fire Regime	Impact not perceptible and not measurable; not affecting surroundings.	Impact mostly limited to consumption of surface litter, not significantly impacting vegetation.	Consumption of litter, duff, and live fuels; resulting in compositional changes in herb and shrub layers.	Compositional changes to canopy tree species; would result in development of fire-tolerant over-story.
Cultural Resources	Impact barely perceptible and not measurable; confined to small areas or affecting a single contributing element of a larger National Register District with low data potential.	Impact perceptible and measurable, but would remain localized; affecting a single contributing element of a larger National Register District with low to moderate data potential, or would not affect character-defining features of a National Register eligible or listed property.	Impact sufficient to change a character-defining feature but would not diminish resource's integrity enough to jeopardize its National Register eligibility, or it generally would involve a single or small group of contributing elements with moderate to high data potential.	Substantial, highly noticeable change in character-defining features would diminish resource's integrity so much that it would no longer be eligible for National Register listing, or it would involve a large group of contributing elements or individually significant properties with exceptional data potential.
Socio-economic Resources	Impact not detectable, no discernible effect on socioeconomic environment.	Impact slightly detectable but would not affect overall socioeconomic environment.	Impact clearly detectable and could have an appreciable effect on the socioeconomic environment.	Impact would have a substantial, highly noticeable, potentially permanent influence on socioeconomic environment.

creation of pools and hummocks would likely occur from movement of heavy equipment. The commercial harvests would likely have a greater impact than the restoration of RCW habitat because there would be multiple trips made over the soils to remove the harvested materials. RCW habitat restoration would involve only the removal of hardwoods and a fraction of the pine, therefore less equipment traffic would be required.

Both of the aforementioned forest management impacts would be expected to be of short-term duration. In the case of Atlantic white cedar harvest, the goal is to enhance regeneration of the Atlantic white cedar stand. With successful regeneration, no additional mechanical

manipulation of the stands would be expected to be needed for more than 100 years. Likewise, restoration of the RCW habitat would require this initial disturbance; however, except for prescribed fire activities, no additional mechanical disturbance would be expected. Negligible, long-term, adverse soil impacts would also be expected from the use of more than 50 miles of existing trails as bike routes and from the limited automobile access along existing trails leading to Lake Drummond. These trails would be established on a pre-existing network of access trails. To minimize impacts to existing access routes, automobile traffic is by permit only. The access route to Lake Drummond (Railroad/West/Interior Ditches) is maintained as an all-weather road, vehicle traffic on other routes is limited during wet conditions.

Alternative B

Habitat management activities involving mechanical clearing discussed in Alternative A would be greatly expanded under Alternative B. Commercial harvest of Atlantic white cedar would double to 2,000 acres and pine/pocosin habitat restoration would be increased to 10,000 acres. In addition, the Remnant Marsh would be expanded to 250 acres through mechanical clearing and prescribed fire. Soil impacts from each of these habitat management activities would be adverse, short-term, and minor.

The network of hiking and bicycling trails would be maintained at 50 miles under Alternative B and an automobile tour route would be established along Corapeake/Sherrill/Cross/Forest Line trails. Approximately 20 miles of trails would be paved to support more intensive vehicle use. The paved routes will reduce erosion from frequent vehicle travel. Eighty to 100 miles of roads would also be maintained to support fire suppression activities. Expansion of the bicycle trails would result in adverse, negligible, long-term, localized soil impacts. Pavement of routes to be used by automobiles would result in beneficial, minor, long-term, localized impacts by stabilizing soils.

Minor, adverse, short-term impacts to soils resources would also result from construction of trails to the habitat management areas for neotropical migratory birds and along Feeder Ditch, construction of an environmental education site at Jericho Lane, construction of wildlife observation towers at Feeder Ditch and at the intersection of Railroad and West Ditches, construction of an informational kiosk at the North Carolina Dismal Swamp Canal Welcome Center, and placement of interpretive panels along Railroad/West/Interior and Feeder Ditch.

More substantial soils disturbance would result from development activities. The impacts from facilities development would be localized, moderate, and adverse. These include development of two campsites for recreational vehicles (RVs) with electricity, water, and sewer facilities, construction of a facility on US Highway 17 to serve as a visitor center and administrative headquarters for the refuge, establishment of an environmental education pavilion at Jericho Lane, and conversion of an existing building to house operations sub-headquarters and a visitor contact facility in Sunbury, North Carolina.

Alternative C

Impacts to soils would be less than under Alternative A or B because little forest management requiring the use of heavy equipment would be conducted. Forest management activities that would result in soil impacts would be limited to 2,000 acres of pine/pocosin restoration efforts for RCW habitat. The Atlantic white cedar harvests (in both Alternatives A and B) would not be conducted under Alternative C. Otherwise, forest access would be restricted to educational and/or research related access needs. Soil impacts from forest management activities would be adverse, minor, short-term, and localized.

Development of an outreach and education site would be similar to Alternative B, except the operations sub-headquarters/visitor contact facility in Sunbury, North Carolina would be eliminated. Of the three proposed alternatives, Alternative C would result in the least impact to soil resources. Soil impacts from facilities development would be adverse, moderate, short-term, and localized.

Water Quality

Significance criteria for water quality include:

- An adverse effect on water quality or an endangerment on public health by creating or worsening adverse health hazard conditions; or
- A violation of an established law or regulation that has been adopted to protect or manage water resources of an area.

The effects of water management activities would be similar under all three alternatives. Water management activities would be directed toward retarding channelized outflows and restoring hydrology to the swamp. These actions would increase groundwater infiltration and improve water quality. While water control structures would reduce the drainage effect of ditches, water levels would be monitored to reduce the threat of inundation and erosion of refuge roads.

Alternative A

Impacts to water quality under Alternative A would result from sedimentation from harvesting and mechanical clearing activities, and from sedimentation from biking/hiking trails and automobile access routes.

Adverse, negligible, short-term impacts would result from sedimentation during harvesting and mechanical clearing activities. Adverse impacts would be negligible and long-term from erosion of dirt paths used as

biking/hiking trails and automobile access routes.

Alternative B

Impacts to water quality would be minor and generally short-term. Some negligible long-term impacts would result from runoff of vehicle fluids from paved surfaces and emissions from outboard motor use in Lake Drummond. Water quality impacts would be greatest under Alternative B. Impacts from forest management activities would increase over Alternative A levels only because of the increased acreage being treated.

More notable water quality impacts would result from construction of new facilities, primarily the new refuge administrative headquarters and visitor center on US Highway 17. Other facilities would have negligible water quality impacts because the environmental education pavilion at Jericho Lane would have no sanitary facilities or would use self-contained chemical facilities, and the new sub-headquarters/visitor contact facility in Sunbury, North Carolina would be adapted from an existing structure. Construction impacts should be both temporary and minor, being minimized by proper erosion and sediment control measures. Long-term, localized, adverse impacts may result from sanitary wastes and from runoff from parking areas. These impacts can be minimized through proper waste handling facilities and the use of a stormwater catchment basin for parking areas. Development of campsites for volunteers would be located at the Sunbury facility and existing sanitary facilities would be used.

Potentially the most widespread water quality impacts would result from the pavement of approximately 20 miles of access trails. Paved areas would be installed at Jericho Lane (1.0 miles) and Washington Ditch (2.0 miles) from White Marsh Road to the second gate. The primary access route to Lake Drummond (the Railroad/West/Interior Ditch corridor) would be paved (approximately 6.2 miles). Lastly, the automobile tour route along Corapeake/Sherrill/Cross/Forest Line Ditches would be paved along its 12.5 mile length.

The impacts from paving result from runoff of car fluids (antifreeze, oil, etc.) directly into the ditches. Porous surfaces, such as the current dirt path, provide infiltration into the soil where adsorption sites allow contaminants to be held and decomposed before entering the water or groundwater system. These impacts would be expected to be negligible.

Alternative C

Impacts to water quality would be minor because water quality impacts from forest management activities would be less than Alternatives A and B. Forest harvests and mechanical clearing would only be conducted on 2,000 acres of pond pine/pocosin habitat.

Water quality impacts from facilities development would be similar to Alternative B, except that the Sunbury, North Carolina facility would be eliminated.

Hydrology

Hydrologic impacts would be considered significant if they resulted in:

- A threat or damage to unique hydrological characteristics;
- Altered water availability, quality, or use;
- A reduction in water availability to existing users or interfere with the supply; or
- A creation or contribution to overdraft of groundwater basins or exceeding a safe annual yield of water supply sources.

Perhaps the greatest man-made disturbance in the Great Dismal Swamp NWR is alteration of the natural hydrology. This disturbance results from centuries of efforts to drain the swamp to improve access to timber resources and to improve agricultural productivity. In addition to the direct impact that the ditches have on surface waters, the Dismal Swamp Canal and other ditches were cut to such a depth as to intercept the shallow aquifer allowing ground water to upwell to the surface during droughts.

In addition to the impact of ditches, hydrologic impacts result from the creation of barriers to surface water flow. This is evident in the northern portion of the refuge where the Norfolk and Southern Railroad tracks have prevented drainage and created abnormally wet areas and in the south where US Highway 158 prevents drainage, but also exists throughout the refuge where spoil piles adjacent to ditches prevent mass surface flows.

Alternative A

Impacts to hydrology would be beneficial and minor because Alternative A would result in slight improvement of hydrologic conditions at Great Dismal Swamp NWR. Using existing water control capabilities, water levels would be conserved to restore hydrologic conditions in habitats where cypress, gum, and maple dominate and to maintain groundwater levels within one foot of the ground surface in Atlantic white cedar stands. Water levels would be managed to prevent flooding of refuge roads and to limit surface flooding where these conditions may interfere with ground-foraging neotropical migratory birds.

The refuge would cooperate with landowners to ensure that refuge operations do not result in unwanted flooding of adjacent private property and coordinate with landowners along the Pasquotank River regarding operation and maintenance of the Newland flood control dike

Alternative B

Alternative B would result in improvements to the current hydrology of the refuge. In addition to impacts under Alternative A, hydrologic conditions under Alternative B would be further improved by installation of water control structures along Portsmouth Ditch and East Ditch, and by development of a GIS-based surface flooding models to assess management strategies. Under Alternative B, the refuge would also cooperate and support protection of approximately 15,000 acres of seasonally-flooded forests south of US Highway 158 and efforts to restore surface hydrology.

Under Alternative B, the refuge would also support efforts to restore natural surface flow where off-refuge developments have impeded drainage creating abnormally wet conditions. These combined effects would yield major, long-term, beneficial impacts that would impact areas beyond the refuge boundary.

Alternative C

Impacts to hydrology would be minor and beneficial because they would be the same as those described under Alternative A.

Air Quality

Air quality impacts would be significant if:

- Pollutant emissions associated with the proposed action caused, or contributed to a violation of any national, state, or local ambient air quality standard, exposed sensitive receptors to substantially increased pollutant concentrations, represented an increase of ten percent or more in affected Air Quality Control Region's (AQCR) emissions inventory, or exceeded any significance criteria established by the Virginia State Implementation Plan (SIP).
- In nonattainment areas, the net change in proposed pollutant emissions caused or contributed to a violation of any national, state, or local ambient air quality standard; increased the frequency or severity of a violation of any ambient air quality standard; or delayed the attainment of any standard or other milestone contained in the Virginia SIP.

The primary impacts to air quality from refuge operations results from prescribed burning. Prescribed burning is implemented to restore historic fire frequency, improve habitat, and to reduce hazardous fuel accumulations. The application of prescribed fire is expected to produce long-term benefits; however some short-term negative impacts may result.

Alternative A

Air quality impacts under Alternative A result from heavy equipment emissions and prescribed burns. Localized, minor, adverse, short-term impacts would result from heavy equipment emissions during harvesting and mechanical clearing. Prescribed fire impacts to air quality would be short-term and minor in magnitude because burning would be conducted under conditions that would support rapid dispersion of smoke and while wind directions transported smoke away from heavily populated areas. Prescribed fire directly impacts air quality in three principal ways: decreased visibility, increased particulates, and increased pollutants. Prescribed burning would be used following harvest to remove debris over 1,000 acres of Atlantic white cedar community. A long-term prescribed fire plan would also be implemented to help restore and maintain pond pine/pocosin community to support restoration of red-cockaded woodpecker habitat.

Alternative B

Impacts to air quality under Alternative B would be adverse, minor, and short-term. Impacts are similar to those described under Alternative A, though they apply to a larger area. Air quality impacts resulting from the implementation of Alternative B would be similar to those discussed for Alternative A. Increased (but still minor) adverse impacts would result from increases in harvesting (1,000 acres to 2,000 acres), mechanical clearing (2,000 acres to 10,000 acres), and prescribed fire (an additional 8,000 acres).

Negligible, short-term, adverse air quality impacts would result from the release of volatile organic carbons from the asphalt paving applied to trails that would receive increased vehicle use and from heavy equipment emissions during construction of new facilities. Additional negligible, long-term, adverse impacts would result from increased vehicle emissions from the opening of an automobile tour route and from interpretive tours.

Alternative C

Under Alternative C, impacts to air quality from heavy equipment emissions and prescribed burns would be adverse, minor, and short-term. Impacts from increased vehicle emissions from the opening of an automobile tour route and from interpretive tours would be adverse, negligible, and long-term.

Contaminants/Hazardous Materials

None of the alternatives would likely result in significant impacts to contaminants or hazardous materials at Great Dismal Swamp NWR. Contaminants that have been identified do not occur at high levels.

Aesthetics

Alternative A

Impacts to aesthetics would be moderate, adverse, and short-term; however, they would be limited to a remote section of the refuge. Aesthetic impacts would result from the harvest of 1,000 acres of Atlantic white cedar. The impact results from the visibility of heavy equipment operations and from the loss of solitude resulting from the noise of harvest operations and the frequent travel of log trucks along vehicle corridors.

The helicopter operations to salvage Atlantic white cedar stands will create temporary impacts to aesthetics in remote sections of the refuge. However, the aesthetics of these areas were already altered by the hurricane, and the helicopter operations should be completed by 2006.

Alternative B

Impacts to aesthetics would be moderate and a combination of short-term and long-term impacts. Short-term aesthetic impacts would result from forest management activities associated with habitat restoration. Visual appeal would be impaired from Atlantic white cedar clearcuts totaling 2,000 acres (approximately 100-200 acres each spread over a 15 year period). Hardwood harvesting in the 10,000 acre red-cockaded woodpecker habitat restoration area would result in only negligible impacts since most of the pine canopy would be retained. Aesthetic quality would also be diminished by the noise generated by heavy equipment during these operations.

Visually, the construction of an observation tower overlooking Lake Drummond at Feeder Ditch would have mixed impacts. While the observation tower would have beneficial impacts by expanding viewing opportunities, it would have adverse impacts to the view of the natural shoreline as seen by boaters. The implementation of a canoe/kayak rental would have minor positive impacts by allowing visitors to experience the solitude of the lake. Adverse visual impacts would also result from the paving of access routes. For some visitors who seek a natural area or to see wildlife in their natural setting, paved roads are a symbol of development.

Alternative C

Impacts to aesthetics would be adverse, minor, and long-term. Under Alternative C, forest management impacts would be limited to restoration of 2,000 acres of red-cockaded woodpecker habitat, a negligible short-term impact. Aesthetic impacts around Lake Drummond would be identical to those described in Alternative B and

would result in mixed long-term impacts.

Biological Resources

An impact to the natural biological resources would be considered significant if the actions would:

- Affect a threatened or endangered species;
- Substantially diminish habitat for a plant or animal species;
- Substantially diminish a regionally or locally important plant or animal species;
- Interfere substantially with wildlife movement or reproductive behavior;
- Result in a substantial infusion of exotic plant or animal species.

Fauna

Alternative A

Impact to white-tailed deer populations would be negligible, adverse, and long-term. White-tailed deer are abundant throughout the region and the annual hunt conducted by the refuge is consistent with deer management within Virginia.

The refuge deer hunt is conducted during October-November, so the hunt will not impact the bald eagle nesting that occurs during March-April. The areas in which white-tailed deer hunts are conducted include the potential habitat for red-cockaded woodpeckers, but no woodpeckers are known to exist within the area at this time. Collaboration and consultation with woodpecker recovery specialists to assess potential impacts of the deer hunt will occur upon introduction or discovery of red-cockaded woodpeckers on the refuge.

The habitat protections in Alternative A and C are less aggressive than those proposed in Alternative B. Under Alternative A, the refuge would continue to collaborate with local governments and provide technical assistance regarding development within the historic range of the Great Dismal Swamp and areas adjacent to the refuge. The refuge would also partner with The Nature Conservancy and state wildlife agencies to protect and restore seasonally-flooded areas within the refuge watershed.

Waterfowl would receive minor benefits from managing public access to

Lake Drummond to limit disturbance of overwintering tundra swans and snow geese.

Alternative B

Alternative B would provide major, long-term impacts that would be beneficial to fauna. Impacts would be similar to those discussed under Alternative A. The greatest benefit to fauna is achieved under Alternative B, which includes the greatest amount of habitat restoration, including restoring 10,000 acres of pond pine/pocosin community and restoration of 250 acres of remnant marsh, cooperation in the development of 7,000 acres of prior-converted farmland east of the refuge, and cooperation in the protection of 15,000 acres of seasonally-flooded forests south of US Highway 158. Minor benefits are derived simply from the expansion of available habitat. Major benefits would be expected from the widespread use of prescribed fire. Several studies have shown the benefits to fauna from the use of prescribed fire, including increased species richness and diversity of small mammals and birds (USFWS, 2003, p. 106).

Implementing a limited recreational bear hunt in Virginia would result in negligible adverse, short-term impacts to the black bear population. These impacts would consist of disruption of daily activities such as foraging and resting during the bear hunt. However, these impacts maybe offset by the anticipated benefits to bear habitat of the above mentioned habitat improvements.

An in-depth evaluation of the potential long-term impacts of the bear hunt was conducted. Two studies completed on the bear population within the Great Dismal Swamp, almost 20 years apart, have shown little change in the population density (Hellgren 1988 and Tredick 2005) which indicates a stable population of bears.

The initial harvest recommendation was set based upon consultation with the Virginia Department of Game and Inland Fisheries, the North Carolina Wildlife Resources Commission, and Dr. Michael Vaughan of Virginia Polytechnic Institute and State University (VPI&SU), (the professor involved with both of the above-cited bear studies).

A harvest target of 20 bears for the hunt was based on the conclusion of the researchers that a hunt would not have an adverse impact on the bear population if no more than 20% of the female bears were taken. Both of the above cited studies assume a population of 250-350 bears. A 50:50 male:female sex ratio is generally assumed. Twenty percent of the female bear population would then be 25-35 bears. This hunt proposes a cap of 20.

Additionally, the maximum number of hunters was determined by examining hunter success rates. Nearby states have hunter success rates of up to 5.5% on bear hunts. This rate included hunts with dogs and hunts on previously un-hunted populations as well as hunts on denser populations (2004-2005 Maryland DNR Black Bear Report). If

100 hunters each day are allowed to hunt, using a 5.5% hunter success rate, an approximate take of 11 bears is anticipated.

An additional evaluation of the 2005 study by Catherine Tredick concerning the potential of the hunt creating an isolated population was conducted. Tredick's study states that "Genetic statistics at GDSNWR indicate that this population is isolated to some degree by geography (i.e., the Albemarle Sound) and encroaching urban development (i.e., the towns of Suffolk and Chesapeake) (Tredick 2005, i). Further discussion with both Tredick and Vaughan clarified that the Great Dismal Swamp population is isolated from the other two populations studied on the other side of the Albemarle Sound (Alligator River NWR and Pocosin Lakes NWR). Additionally they agreed that the hunt would not be detrimental to the bear population when held within the described parameters (personal communication, 26 October 2005, Columbia, NC).

Finally, no federal endangered or threatened species would be impacted by the proposed bear hunt. Nor would there be any major impacts to state listed species. Based upon this review of the proposed bear hunt, impacts to the Great Dismal Swamp NWR bear population would be minimal.

The impacts to white-tailed deer would be the same as Alternative A. The refuge deer and bear hunts will be conducted during October-December, so the hunts will not impact the bald eagle nesting that occurs during January -April. The black bear hunts will not be conducted within the area designated for habitat enhancement for the endangered red-cockaded woodpeckers. The white-tailed deer hunt area includes the potential habitat for red-cockaded woodpeckers, but no woodpeckers are known to exist within the area at this time. Collaboration and consultation with woodpecker recovery specialists to assess potential impacts of the deer hunt will occur upon introduction or discovery of red-cockaded woodpeckers on the refuge.

Alternative B would allow lethal control of beaver and nutria when their activities result in habitat damage or interfere with the operation of water control structures. This is a negligible, adverse, short term impact on the beaver population.

Alternative B would allow lethal control of nutria – an invasive, exotic, destructive species.

Waterfowl would benefit from disturbance management (as noted in Alternative A) and from coordination to protect adjacent farmlands that are used by waterfowl.

Alternative C

Alternative C, the Limited Habitat Management alternative, would still provide minor beneficial impacts to fauna. Benefits to a range of fauna would result from the restoration of 2,000 acres of pond pine/pocosin habitat. White-tailed deer impacts would be the same as Alternatives A

and B. Benefits to birds would be similar to Alternative A.

Flora

Alternative A

Alternative A would provide moderate, long-term beneficial impacts on the vegetation communities within the Great Dismal Swamp NWR. Efforts to regenerate Atlantic white cedar would be expected to provide immediate benefits to this rare community type and would also provide valuable information regarding the future management of the remaining Atlantic white cedar stands. (GDSNWR AWC represents 10% of known AWC remaining globally). The pond pine/pocosin habitat, another rare community type, would also benefit from management actions proposed in Alternative A. Alternative A would clear hardwoods and restore fire to its historical frequency in this community that is suffering from fire suppression throughout its range. Removal of hardwoods and restoration of fire would provide long-term stability by preventing hazardous accumulations of peat and mid-story fuels, while promoting the regeneration of pond pine. The remnant marsh would be maintained at its present 30 acres through the use fire and would be monitored to assess habitat maintenance techniques.

Water management practices would restore natural hydrologic conditions to habitats dominated by cypress, gum, and maple providing minor, beneficial impacts; and would support efforts to restore hydrology to areas affected by off-refuge development and encroachment (i.e. US Highway 158 and Norfolk-Southern Railroad).

Alternative B

Moderate, beneficial, long-term benefits would result from the implementation of Alternative B. Alternative B would provide the greatest benefits to the vegetation of the Great Dismal Swamp NWR. Expanded efforts to regenerate Atlantic white cedar would affect twice the area (expanded to 2,000 acres) and restoration efforts in pond pine/pocosin would affect five times the area (expanded to 10,000 acres) proposed in Alternative A. The remnant marsh area would be expanded to 250 acres, a sizeable expansion over the 30 acres that is currently being maintained. Additionally, 5-10 acres patch openings would be created to establish foraging areas for neotropical migratory birds.

Minor, localized, negative impacts to vegetation would occur within the footprint of paths and structures created for education, observation, and outreach. The small amount of vegetation lost to these developments is very minor compared to the benefits of thousands of acres of habitat restoration planned.

Alternative C

Minor, long-term, beneficial impacts to flora would result from implementation of Alternative C. Alternative C would provide the fewest

benefits to vegetation on the refuge. The core pond pine/pocosin area designated for restoration of red-cockaded woodpecker habitat would still receive mechanical treatment and prescribed burning. Water would also be retained to restore hydrology to area dominated by cypress, gum, and maple. These would be the few management activities included under Alternative C, the “Limited Habitat Management” alternative. Minor negative impacts would still result from development associated with expanded education and outreach opportunities, but these impacts would be less than Alternative B.

Rare Species

Alternative A

A major, long-term, beneficial impact would result from creation of a new population of federally-endangered red-cockaded woodpeckers supported by habitat restoration efforts to assure long-term viability. Alternative A would result in habitat enhancements to benefit the restoration of breeding red-cockaded woodpeckers on the refuge. Restoration efforts would include the removal of hardwood and restoration of fire to 2,000 acres of pond pine/pocosin habitat. This would provide core habitat needed to support a sustainable population of reintroduced endangered red-cockaded woodpeckers. Source woodpeckers would be provided from individuals displaced under Safe Harbor agreements. Additional improvements would result from the management of water levels to enhance habitat for neotropical migratory birds.

Alternative B

Major, long-term, beneficial impacts would result from creation of a new population of federally-endangered red-cockaded woodpeckers supported by habitat restoration efforts to assure long-term viability. Alternative B would provide the greatest benefits to rare species. The primary positive effect would result from the removal of hardwood and restoration of fire to 10,000 acres of pond pine/pocosin habitat. This would initially provide core habitat for the reintroduction of endangered red-cockaded woodpeckers. Source woodpeckers would be provided from individuals displaced under Safe Harbor agreements.

Additional benefits to rare species would be achieved by the establishment of clearings to provide foraging habitat for neotropical migratory birds. If managed properly, these clearings would provide habitat for neotropical migrants such as Swainson’s warbler.

Increased activity levels on Interior Ditch include paving and increased traffic from Lake Drummond access for tours and canoe/kayak rentals. Since Interior Ditch is more than 1,320 feet north of the active bald eagle nest, these activities would not be expected to have adverse impacts.

Alternative C

Alternative C would also result in major, long-term, beneficial impacts to rare species, though benefits would be limited to the creation of the minimum habitat area needed to support a viable red-cockaded woodpecker colony.

Fire Regime

Alterations of fire and hydrology are the most immediate threats to the range of habitats present at Great Dismal Swamp NWR. While efforts have already been undertaken (and continue) to restore the natural hydrology of the swamp, the restoration of fire has proven to be much more challenging. The hesitancy to fully return fire to the refuge has many roots, including risks to public health, concerns about damaging a valuable resource, and the ability to control the fire within prescribed boundaries.

The refuge landscape is not static. The frequency and extent of fire 4,000 years ago when much of the swamp was grassland would not be appropriate to habitats present today. However, fire was an important component in the evolution of the swamp we see today. For example, it is widely thought the Lake Drummond, the central feature of the refuge, may have been formed by a deep burning peat fire. The swamp is a matrix of habitats that are created by disturbance and are in various states of recovery: from frequent fires that maintain canebrake or pocosin to infrequent but catastrophic fires that regenerate the Atlantic white cedar stands. Many questions remain to be answered as fire management is integrated with habitat restoration on the refuge. At what level should fire be returned to the refuge? Should fires be suppressed aggressively or allowed to burn to mimic past fire regimes and disturbances? Ultimately, the answers to these questions will be a balance of habitat requirements and social tolerance of the products of fire, mainly smoke and decreased visibility.

Alternative A

Impacts to the fire regime under Alternative A would be major, beneficial, and long-term. Wildfire would be managed in accordance with the 1998 Fire Management Plan. Prescribed fire use would be expanded to manage for red-cockaded woodpecker habitat, Atlantic white cedar regeneration, and maintenance of the remnant marsh.

Alternative B

Implementation of Alternative B would result in major, long-term benefits. Alternative B represents the greatest effort toward restoring fire to habitats where its exclusion threatens their community composition. Prescribed fire use would be expanded under Alternative

B to maintain more than 10,000 acres, including pond pine/pocosin and remnant marsh. Prescribed fire would also be used to more aggressively manage hazardous accumulations of fuels in wildland/urban interface settings and to remove woody debris following AWC harvests. Wildfire suppression capabilities would be enhanced by acquiring easements to improve emergency access and maintaining 80-100 miles of access trails.

Alternative C

Impacts to the fire regime under Alternative C would be the same as Alternative A, major and long-term.

Cultural Resources

Archeological and Historic Resources

Human occupation of the Great Dismal Swamp area dates back some 13,000 years, 4,000 years before the formation of the swamp began. Four cultural periods -- Paleo-Indian, Archaic, Woodland, and Historic -- represent a continuum of human inhabitation. Much of the known evidence has been collected on upland sites along the western margin of the refuge. It is likely that other sites exist within the refuge, but have been covered by the accretion of organic soils during formation of the swamp that is present today.

None of the proposed alternatives would significantly affect cultural resources. Impacts would be limited to the very small footprint of proposed buildings and kiosks, and from the construction of fire lines. No activities are proposed on any known culturally-significant sites and appropriate cultural resource investigations would be conducted prior to any ground disturbing activities to ensure protection of undocumented cultural resources.

The proposed alternatives will not likely negatively impact cultural resources at the Great Dismal Swamp NWR, nor will they provide positive impacts through identification of significant cultural resource areas.

Socio-Economics

Staffing and Budgets

Alternative A

Alternative A would result in minor, long-term, beneficial impacts. Under Alternative A, the Great Dismal Swamp NWR would maintain a staff of 19 persons (Appendix D). The staff salary budget would contribute \$1,051,478 annually to the local economy. In addition, maintenance, development, and projects identified in Alternative A involve approximately \$7 million during the life of this document (Appendix H).

Additional short-term economic benefits would result from employment during timber harvests associated with restoration and habitat regeneration efforts.

Alternative B

Under Alternative B, moderate, long-term, beneficial impacts would result from increased staff at GDSNWR above Alternative A levels. Staffing at Great Dismal Swamp NWR would increase to 27 people. The staff salary budget for Alternative B would be \$1,619,722 annually. Additional projects identified in Alternative B would result in approximately \$41 million in spending during the 15-year life of this document. The additional refuge positions are equally divided between habitat management positions and education/outreach positions.

Additional short-term economic benefits would result from employment during timber harvests associated with restoration and habitat regeneration efforts.

Alternative C

Alternative C would provide 23 staff positions at GDSNWR (an intermediate staffing level between Alternatives A and B). The primary focus of the positions would be education and outreach. Annual staff salary budget for Alternative C would be \$1,382,858; additional expenditures of approximately \$38 million would be needed to fulfill the goals of Alternative C. This would result in moderate, long-term, beneficial impacts.

Additional short-term economic benefits would result from employment during timber harvests associated with habitat restoration.

Public Use (Education, Recreation, Hunting, Tourism)

Public use of the Great Dismal Swamp NWR includes tourism, recreation, hunting, fishing, boating, and wildlife observation. Economic impacts result from purchases such as lodging, meals, gasoline, shopping, transportation, and admission and license fees. The *1997-1998 Virginia Visitor Survey* sampled visitors to assess many criteria. When the study examined spending from both day-use and overnight visitors, mean expenditures per person per day totaled \$52 (Virginia Tourism Corporation 2000). The 2000 Virginia Outdoors Survey indicated that visitors to Virginia state parks spend approximately \$16/day (90 percent of visitors are day-use). When overnight visitor use was examined, expenditures averaged \$54-58 per person per day – a value consistent with the *1997-1998 Virginia Visitor Survey* findings. As an estimate of the economic impact of visitor use at the Great Dismal Swamp NWR, predicted visitor-days is multiplied by the visitor expenditures determined from Virginia state park visitors during the 2000 Virginia Outdoors Survey (\$16/day). This value is used because, like state park visitors, most visitors to the Great Dismal Swamp NWR are day visitors.

Many visitors have multiple visitation objectives including recreation (beaches and theme parks), historic sites (battlefields, Colonial Williamsburg), education and cultural sites (museums), hunting and fishing, and ecotourism. The Great Dismal Swamp NWR is a valuable component of the variety of available opportunities that attracts visitors to the Hampton Roads region.

Alternative A

Under Alternative A, the Great Dismal Swamp NWR would provide negligible benefits to educational opportunities. The benefits would include classroom programs at local schools and libraries, partnerships for teacher training, loaning field equipment to students, developing educational videos, and being available as an outdoor classroom.

Other minor, beneficial public use impacts under Alternative A would result from opportunities for hunting, fishing, and scenic and wildlife observation and photography. A hunting opportunity would include a limited deer hunt in October/November. For fishing, Lake Drummond would be accessible year round during daylight hours via the Feeder

Ditch. Boats may be transported by vehicle to the lake by permit only during the period from April 1 through June 15.

Public access for wildlife observation, hiking, and biking is available via three corridors (Jericho Ditch Trail, Washington Ditch Trail, and the Railroad/West/Interior Ditch).

Total visitor use of 75,000-80,000 visitor-days would be expected. The expected economic impact from this tourism and recreational use would be \$1.2-1.3 million annually.

Alternative B

Alternative B would provide major, long-term benefits to education by expanding the programs under Alternative A to include establishment of a library and resource center for students and teachers, development of biological and historical education media to meet Virginia and North Carolina education standards, establishing refuge-specific teacher training courses, and presentation of educational programs through the development of the US Highway 17 facility. This facility is envisioned as the Great Dismal Swamp Natural Science Center. In addition to refuge staff, it would provide facilities for cooperators, such as The Nature Conservancy, the Great Dismal Swamp Coalition, and other local conservation organizations, and would educate visitors about the entire Great Dismal Swamp ecosystem, which extends far beyond the boundaries of the refuge. The development of such a facility would be expected to have a synergistic effect, combining the resources of conservation organizations to educate the public and local decision makers.

Alternative B would greatly expand other public use opportunities and provide major, beneficial impacts. In addition to hunting opportunities under Alternative A, special opportunities for youth to hunt deer, and a recreational bear hunt would be implemented. Bear hunting opportunities in Chesapeake and Suffolk would increase by 200 hunter days. Hunter densities would be approximately 200 acres per hunter. These hunters would experience a high quality wildlife dependent recreational activity, which is limited in the surrounding area. In addition, we expect many of the hunters would travel from outside the local area, providing additional positive economic impacts. By implementing the bear hunt, we would also contribute to the mission of the NWRS by providing another hunting opportunity. During the bear hunt the entrances used will be closed to other public uses. This impact will be minimal and of short duration, since the hunts would be conducted during a lower use period, and at least one other entrance would be open to accommodate other public uses.

Opportunities for fishing and boating would be expanded by allowing a concessionaire to provide canoe/kayak rentals and to provide interpretive

boat tours on Lake Drummond and tram tours on the Railroad/West/Interior trail. Public access would be enhanced by paving access routes along Jericho Lane and Washington Ditch and associated parking areas; paving the Railroad/West/Interior Ditch access route to Lake Drummond; and establishing an automobile tour route along Corapeake/Sherrill/ Cross/Forest Line Ditches in the North Carolina portion of the refuge.

Major public use benefits would result from expanded visibility of the refuge. The establishment of a natural science center would greatly expand tourism and education opportunities associated with the Great Dismal Swamp ecosystem. Additional information on the refuge would be available at other highly visible locations (City Visitor Center in Suffolk, Virginia and at the sub-headquarters and contact facility in Sunbury, North Carolina). The construction of a Great Dismal Swamp Natural Science Center on US Highway 17 would dramatically increase the exposure and visitor use of the refuge. The new facility would be closer to tourists and readily accessible by a major highway. This would be a critical improvement over the current facilities that can only be accessed by a lengthy drive on small rural back roads. The location of the new facility would greatly increase the visibility of the Great Dismal Swamp NWR. The proposed location is on the eastern side of the refuge and, therefore, more accessible to a larger portion of the population. A new trail along the Feeder Ditch, linking the Center and Lake Drummond, would give the first public access by land from the east. The Great Dismal Swamp Natural Science Center would be strategically located on a major highway corridor to improve accessibility for local students and visitors as well as travelers arriving to the Hampton Roads area.

Economic benefits would result from additional license purchases, additional local employment (both staff and concessionaire), and revenues from boat and bicycle rentals, guided tour fees, and retail sales of guide books, posters, etc.

Under Alternative B the refuge would also seek to cooperatively manage the Nansmond NWR with another agency. This cooperative management would likely result in expanded public use opportunities.

Under Alternative B, total visitor use would be expected to exceed 500,000 visitor-days per year. The new complex on US Highway 17 would be expected to attract approximately 400,000 visitors annually, based on current requests for Great Dismal Swamp NWR information from the Dismal Swamp Canal Welcome Center. Visitation on the western side of the refuge would be expected to increase to approximately 100,000 annually based on expanded trails, interpretive sites, and recreation. Increased visitation from development of a visitor

contact station on the southwest corner at the Sunbury sub-headquarters of the refuge would be approximately 13,000 annually. The total annual economic impact would be approximately \$8.0 million.

Alternative C

Educational impacts under Alternative C would be identical to Alternative B. Under Alternative C, other public use would be slightly less than that proposed under Alternative B; impacts would be beneficial and moderate. Elimination of the bear hunt would decrease hunting opportunities and the elimination of the Sunbury, North Carolina contact station would provide less opportunity to service visitors approaching from the southwest. The economic impact of Alternative C would be approximately \$7.75 million annually.

Cumulative Impacts

Alternative A

Alternative A provides minor benefits to natural resources at Great Dismal Swamp NWR and one major long-term benefit for RCWs. Benefits result from hydrologic regime improvements and restoration of scarce habitats. Direct, negative impacts to natural resources are limited because there are few provisions to expand public use opportunities. Total benefit to the regional economy (including salaries, maintenance, development, and tourism) would be approximately \$2.8 million annually.

Alternative B

Alternative B would provide major benefits to many natural resources at Great Dismal Swamp NWR. These include restoration of hydrology, expanding habitat restoration to aggressively restore more than 10 percent of the refuge. These efforts mostly benefit rare habitat types.

Public use and socio-economics would also benefit under Alternative B. Public access would be expanded through increases in interpretive tours, a new hiking trail, observation towers, and recreation and hunting opportunities. Expansion of the educational program would benefit school systems throughout the Hampton Roads area. Economic benefits would result from expanded staff and maintenance budgets needed to implement the changes, and from increased tourism opportunities. Total benefit to the regional economy would be approximately \$12.4 million annually.

Alternative C

Alternative C would provide only limited benefits to natural resources, similar to Alternative A, but would still include significant habitat restoration to support RCWs. Benefits to public use and socio-economics would be similar to, but slightly less than benefits under Alternative B. Benefits would be less than Alternative B because the staffing level is less. Total benefit to the regional economy (including salaries, maintenance, development, and tourism) would be approximately \$11.7 million annually.

Short -Term Use Versus Long-Term Productivity

Short-term and long-term effects describe the relationship between local short-term uses of the human environment and maintenance of long-term productivity of the environment. All of the alternatives are clearly aimed at enhancing the long-term productivity and sustainability of natural resources on the refuge. To varying degrees, the alternatives propose to implement actions that promote watershed or ecosystem-wide partnerships and additional planning. Outreach and environmental education are a priority to encourage refuge visitors to be better stewards of our environment.

Short-term economic effects would be felt in the immediate impact of land purchases. There would be short-term impacts on tax collections for the year in which a property is acquired. In the long term, however, land protection would reduce local government expenses for infrastructure development of roads, sewers, law enforcement and fire protection, and utilities while providing essential habitat for wildlife and outdoor recreation. Loss of taxes would be partially offset by the annual Refuge Revenue Sharing payments.

In the long run, local economies would be impacted positively by increased spending on environmental programs and visitor services. The programs would attract visitors and positively attract tourism and wildlife-dependent recreation to Hampton Roads. In the long term, most of the adverse effects would be mitigated or offset by positive impact from increased open space and an increase in the quality of life for people as well as wildlife.

General impacts on biological resources are expected to be long-term and beneficial. Habitat for endangered and threatened species, such as the red-cockaded woodpecker, would receive high priority for restoration. Neotropical migratory bird habitat would be protected and restored. The restoration of the rare Atlantic white cedar forests would be emphasized. Resting areas for wintering waterfowl would be monitored and protected. Enhanced interpretation and education about the wildlife resources within the Great Dismal Swamp ecosystem would lead to better public understanding and support for the restoration and protection of natural resources that support people and wildlife.

The development of visitor center facilities, trails, observation platforms and kiosks, and visitor/educational facilities would result in both short-term and long-term physical impacts on soil and vegetation. These impacts would be localized and confined to the immediate construction sites. Increased attention to environmental education and recreation programs would result in more audiences being involved with environmental education and wildlife-dependent recreation, and a more positive land ethic of stewardship throughout the refuge watershed. Moreover, the nature-based tourism opportunities would create economic incentives to conserve key natural resources within the watershed.

Long-term beneficial effects include the increased productivity of threatened and endangered species, waterfowl, neotropical migratory birds, a large black bear population, and a myriad of other species dependent upon refuge habitat. The public would also gain long-term opportunities for wildlife-dependent recreation and education.

Short-term uses of refuge lands include hunting, fishing, management for selected species, wildlife inventories, water quality monitoring, forest regeneration, prescribed burning, and the construction of administration and public use facilities. These activities would be implemented with the primary goal of assuring the sustained productivity of refuge resources.

Unavoidable Adverse Impacts

Unavoidable adverse impacts are projected from the changes in levels of management activities as described in Alternatives B and C relative to the Current Management Alternative (Alternative A).

Construction of visitor facilities and increased visitation would affect local air and water quality and natural vegetation through vehicle

emissions, localized damage to vegetation, and soil compaction. Enhanced visitation would also mean additional disturbances to both resident and migratory wildlife. In a review of the literature, little is available on impacts to forested wildlife species from human visitation. The disturbance from increased visitation will have minor impacts on wildlife populations and plant communities, with less than 1% of the land area of the refuge being accessible to the public.

The addition of bear hunting in Alternative B would force the temporary curtailment of non-hunting visitation in the designated bear hunt areas and would disrupt the daily activities of bears and other wildlife during the hunt.

The expansion of prescribed burning operations in Alternative B would increase the probability that populated areas adjacent to the refuge would be affected by smoke when weather forecasts and fire behavior models fail to accurately predict smoke dispersion.

Atlantic white cedar restoration in Alternative B would force the temporary closure of some areas to general public access to allow heavy equipment and logging trucks to move within these areas. The aesthetic quality of restoration sites would be temporarily degraded during restoration operations that require mechanical clearing and removal of trees.

The acquisition of land within the approved acquisition boundary would remove these areas from the tax base of the cities and counties. This impact, however, would be largely offset by the payments to the cities and counties through refuge revenue sharing.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be reversed. For example, the use of non-renewable resources is irreversible: mineral and fossil fuel consumption are not renewable and therefore not available for future use. An irreversible commitment of resources results when an area is altered in such a way that it cannot be returned to its natural condition for an extended period of time.

Irretrievable commitments of resources occur when a renewable resource is allocated to a given use and cannot be recovered without significant effort.

The cost associated with land acquisition for refuges would be irreversible. Refuge land acquisition removes acreage from private ownership and any potential development benefits associated with it. However, such land, once placed in public ownership under the National Wildlife Refuge System, often provides a new set of wildlife-dependent recreational uses that benefit a much broader group of people. Moreover, refuge ownership protects key natural features within the landscape that enhance the quality of life for people. The concept of “public lands” precludes individual freedom to use those lands according to individual desires. Some traditional uses may change, since public uses on a refuge must be shown to be compatible with the purposes for which the land is acquired. Federal ownership may affect surrounding land-use patterns, local economies, and city/county tax revenues. Generally, these changes are positive: residential homes and property located adjacent to the refuge often increase in value, landscapes are protected, nature-based business ventures develop, and costs to local governments for services decrease.

Management of refuge lands acquired would result in an irreversible and irretrievable commitment of funding for operations, administration, and management. Funding and personnel commitments by the Service to purchasing and managing refuge lands and facilities render those resources unavailable for other Service programs and projects. The more public use activities and facilities provided, the greater operating and maintenance cost involved.

Some irreversible loss of potential wildlife habitat would occur at construction sites for new facilities. However, most of the new construction is proposed on land that is not currently within the refuge, so the effects on existing refuge habitat would be minimal. Moreover, these irreversible impacts of visitor use facilities and improvements would be mitigated somewhat by their function in confining the major impacts of visitors to a relatively few selected areas.

Animal and plant communities are renewable in different degrees. Construction sites, and some habitat management practices, may irretrievably damage natural communities, at least for a period of time. Wildlife taken through hunting, fishing, or nuisance control would no longer be available for wildlife observation and photography. These activities, however, would be managed in such a way that the health and viability of wildlife populations would not be threatened.

Consultation and Coordination with Others

- **Consultation Summary**
- **The Planning Team**

5. Consultation and Coordination with Others

Consultation Summary

The planning process for the Great Dismal Swamp and the Nansemond National Wildlife Refuges began in August, 2001. It was then the core planning team, consisting of field staff and staff from the Service's Northeast Regional Office, began the process of identifying needs and direction for development of the comprehensive plan.

A mailing list was compiled of nearly 600 contacts of individuals and groups including adjacent landowners, federal, state and local governing representatives, North Carolina and Virginia resource agencies, environmental organizations, sportsmen's groups, local businesses and other interested and affected people. In December, 2001, a newsletter was sent to everyone on the mailing list explaining the CCP process and identifying current issues on the refuges. The newsletter was also made available at the refuge headquarters, open house and scoping meetings, and distributed at all refuge outreach events during that winter and spring.

Contained in the newsletter was a workbook which included questions to aid in the collection of the public's ideas, concerns, and suggestions on important issues associated with managing the Great Dismal Swamp and the Nansemond National Wildlife Refuges. More than 100 workbooks were returned with written responses by summer, 2002, with additional written responses received before the close of the year.

Four scoping and open house information meetings were held on January 8, 10, 22, and 24, 2002, in Elizabeth City and Gatesville, North Carolina, and in Suffolk and Chesapeake, Virginia, respectively. Meetings were advertised locally through news releases, paid advertisements, and through our mailing list. Approximately 290 people attended the meetings. Each began with an opportunity for guests to visit a gallery of prepared refuge exhibits and speak with attending staff. This period was followed by a staff presentation on the refuges, the Refuge System, and the planning process. Registered speakers were then allowed to make comments or ask the staff questions before the group. Each meeting concluded with questions and comments from the floor. Participants were encouraged to actively express their opinions

and suggestions. Public Comments and questions included those on forest management, water management, wildlife concerns, and public use. However, public use issues and improvement of visitor services dominated discussion during all four meetings.

The complete planning team, which consisted of the core team with the addition of representatives from FWS Virginia Field Office, the Army Corps of Engineers, North Carolina Wildlife Resources Commission, and Virginia Department of Game and Inland Fisheries, met in February, 2002, to review the public comments and explore management options.

An *Update* newsletter was distributed in March, 2002, summarizing public comments from the workbook, other written comments, and comments from the scoping meetings. Another meeting of the planning team was held in June, 2002, to review considerations for management objectives and strategies, and to discuss a Wilderness Study Area proposal. The core planning team then began working to formulate specific alternatives, objectives, and strategies that addressed each of the envisioned goals.

Additional meetings and workshops were held with Congressional representatives, refuge partners and other interested parties to discuss issues of habitat management and public use, among other topics. This phase of the process lasted into the spring of 2003 when a range of management alternatives was finalized. By June, 2003, the team was ready to consider environmental consequences for each alternative.

Upon release of this draft Environmental Assessment/ Comprehensive Conservation Plan (EA/CCP), public meetings and open houses will be scheduled to provide the opportunity for comment. At the conclusion of the thirty day public review period, all substantive comments will be addressed and the report revised accordingly. Unless a significant issue(s) arise that has not been previously identified, a draft Finding of No Significant Impact (FONSI) will be prepared and issued with the final EA/CCP. A Notice of Availability (NOA) for the final report will be published in the Federal Register. Following the thirty day review period on the final report the FONSI will be finalized for the Regional Director's approval. Another thirty day grace period will be provided before implementation of the preferred alternative.

The Planning Team

Bill Perry
Planning Team Leader
USFWS, Region 5 Regional Office

Coordinated field and regional office communications; Team leader December, 2005, to present.

Gib Chase
Planning Team Leader, Retired
USFWS, Region 5 Regional Office

Facilitated meetings, provided guidance in interpreting the planning policy; coordinated field and regional office communications; reviewed draft sections. Team leader August, 2001, through December, 2005.

Suzanne Baird
Refuge Manager
Great Dismal Swamp National Wildlife Refuge

Participated in all phases and sections. Team member November, 2005, to present.

Lloyd Culp
Former Refuge Manager
Great Dismal Swamp National Wildlife Refuge

Facilitated meetings; co-author of the CCP; participated in all phases and sections. Team member August, 2001, through August, 2005.

Deloras Freeman
CCP Field Planning Team Coordinator
Great Dismal Swamp National Wildlife Refuge

Field project coordinator; coordinated public involvement, participated in development of public use objectives and strategies; co-authored sections of Chapters 1, 3, and 5; draft development, formatting, and editing.

Michelle Banton
Civil Engineer
U.S. Army Corps of Engineers

Provided consultation and coordination with the COE, particularly on strategies regarding the Dismal Swamp Canal, the Lake Drummond Reservation, and hydrology issues.

Jennifer Blount
Former SCEP- Student Trainee
Great Dismal Swamp National Wildlife Refuge

Assisted in development of public use objectives and strategies; assisted with scoping meetings; team member from August, 2001, through August, 2002.

Tim Craig
Fire Management Officer
Great Dismal Swamp National Wildlife Refuge

Provided input on strategies involving prescribed burning and fire suppression.

Teresa Cherry
Outdoor Recreation Planner, Retired
Great Dismal Swamp National Wildlife Refuge

Provided assistance with the development of objectives and strategies for public use; proofing. Team member August, 2001, through January, 2004.

Ralph Keel
Wildlife Biologist, Retired
Great Dismal Swamp National Wildlife Refuge

Provided input on biological elements of the plan; assisted with development of objectives and strategies for wildlife issues. Team member August, 2001, through January, 2004.

Cindy Lane
Deputy Refuge Manager
Great Dismal Swamp National Wildlife Refuge

Provided input on formulation of goals, objectives, strategies; developed cost estimates; reviewing assistance.

Karen Mayne
Biologist, Ecological Services
USFWS, Region 5 Virginia Field Office

Provided assistance regarding strategies for federal-listed species found on or historically occurring on the refuges, and on habitat management issues.

Bryan Poovey
Forester
Great Dismal Swamp National Wildlife Refuge

Provided input for the Wilderness Review; coordinated GIS imagery; assisted in development of resource management objectives and strategies; assisted with scoping meetings; proofing assistance.

Julie Rowand
Northeast Region Environmental Education Coordinator

Provided regional guidance; assisted in formation of public use objectives, strategies; co-authored sections of alternatives pertaining to public use.

David Rowe
District Wildlife Biologist
North Carolina Wildlife Resources Commission

Provided input on hunting and habitat management strategies from a State perspective.

Chapter 5 Consultation and Coordination

Don Schwab
Wildlife Diversity Biologist
Virginia Department of Game and Inland Fisheries
/Great Dismal Swamp National Wildlife Refuge

Provided input on hunting and habitat management strategies from a State perspective. State representative August, 2001, through September, 2004. Refuge wildlife biologist and team member September, 2004, to present.

Joel Scussel
Civil Engineer
U.S. Army Corps of Engineers

Provided consultation and coordination with the COE, particularly on strategies regarding the Dismal Swamp Canal, the Lake Drummond Reservation, and hydrology issues.

Clint Williams
Facility Manager
Great Dismal Swamp National Wildlife Refuge

Provided input on strategies regarding refuge facilities; assisted with scoping meetings.

Others Who Helped in the Planning Process

Jamie Christensen
Graphic Services
Worldview Solutions

Production of GIS imagery.

Bobby Clontz
Environmental Consultant
Garrison Forestry Services

Co-author of Chapter 2, Affected Environment; author of Chapter 4, Environmental Consequences.

Sally Leary
Office Assistant
Great Dismal Swamp National Wildlife Refuge

Proofing assistance; administrative support.

Helen Marlin
Refuge Clerk
Great Dismal Swamp National Wildlife Refuge

Proofing assistance; administrative support.

Appendix A:
**Trust Resources and Other
Species and Habitats of Concern**

Trust species known or suspected to occur on Great Dismal Swamp National Wildlife Refuge and Nansemond National Wildlife Refuge

Global and State ranks

These ranks are determined by the Nature Conservancy's system of measuring rarity and threat status. "Global" refers to worldwide ranks and "State" to statewide ranks. Following each state rank it will be noted "VA" for Virginia listings or "NC" for North Carolina listings.

Global ranking:

- G1 = Extremely rare and critically imperiled; 5 or fewer remaining individuals; or some factor(s) making it especially vulnerable to extinction.
- G2 = Very rare and imperiled; 6 to 20 occurrences or few remaining individuals; or some factor(s) making it vulnerable to extinction.
- G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors. Usually fewer than 100 occurrences are documented.
- G4 = Common and apparently secure globally; may be rare in parts of its range, especially at the periphery.
- G5 = Very common and demonstrably secure globally; may be rare in parts of its range, especially at the periphery.
- GH = Formerly part of the world's biota with expectation that it may be rediscovered.
- GX = Believed extinct throughout its range with virtually no likelihood or rediscovery.
- GU = Possibly rare, but status uncertain and more data needed.
- G? = Unranked, or if following a ranking, rank uncertain (ex. G3?)
- G_Q = the taxon has a questionable taxonomic assignment, such as a G3Q.
- G_T_ = signifies the rank of a subspecies or variety. For example, a G5T1 would apply to a subspecies of a species that is demonstrably secure globally (G5) but the subspecies warrants a rank of T1, critically imperiled.

Virginia Natural Heritage Resources ranking:

- S1 = Extremely rare and critically imperiled; 5 or fewer remaining individuals in Virginia; or some factor(s) making it especially vulnerable to extirpation in Virginia.
- S2 = Very rare and imperiled; 6 to 20 occurrences or few remaining individuals remaining in Virginia; or some factor(s) making it vulnerable to extirpation in Virginia.
- S3 = Rare or uncommon in Virginia with between 20 and 100 occurrences.
- S4 = Common and apparently secure with more than 100 occurrences; may be rare in parts of its range.
- S5 = Very common and demonstrably secure in Virginia.
- SH = Formerly part of the Virginia biota/fauna with expectation of rediscovery.
- SX = Believed extirpated from Virginia with virtually no likelihood of rediscovery.
- SE = Exotic; not believed to be a native component of Virginia's flora.
- SR = Reported for Virginia, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.
- SRF = Reported for Virginia, but with convincing evidence that the report was in error.
- SU = Possibly rare, but status uncertain and more data needed.
- S_? = Rank uncertain.
- S_S_ = Rank uncertain, but considered to be within the indicated range of ranks.
- S_B/S_N = Breeding and non-breeding status of an animal (primarily, birds) in Virginia, when they differ.
- SZN = Long distance migrant whose occurrences outside of the breeding season are not monitored; or species whose wintering populations are transitory and usually do not occur regularly at specific localities.
- SN? = Long distance migrant that has been recorded north and south of Virginia waters and should eventually be found along the coast of Virginia.
- SA = State accidental; not a regular member of the Virginia fauna but recorded in the state at least once.

North Carolina ranking:

S1 = Critically imperiled in North Carolina because of extreme rarity or other wise very vulnerable to extirpation in the state.

S2 = Imperiled in North Carolina because of rarity or other wise vulnerable to extirpation in the state.

S3 = Rare or uncommon in North Carolina.

S4 = Apparently secure in North Carolina with many occurrences.

S5 = Demonstrably secure in North Carolina and essentially ineradicable under present conditions.

SA = Accidental or casual; one to several records for North Carolina, but the state is outside the normal range of the species.

SH = Of historical occurrence in North Carolina, perhaps not having been verified in the past 25 years, and suspected to be still extant in the state.

SR = Reported from North Carolina, but without persuasive documentation for either accepting or rejecting the report.

SX = Believed to be extirpated from North Carolina.

SU = Possibly in peril in North Carolina, but status uncertain.

S? = Unranked, or rank uncertain.

S_B Rank of breeding population in the state. Used for migratory species only.

S_N = Rank of non-breeding population in the state. Used for migratory species only.

SZ_ = Population is not of significant conservation concern; applies to transitory, migratory species.

Federal Status

Federal statuses are designated by the US Fish and Wildlife Service.

LE	Listed Endangered	Threatened with extinction
LT	Listed Threatened	Likely to become endangered in the foreseeable future
PE	Proposed Endangered	Proposed for listing as endangered
PT	Proposed Threatened	Proposed for listing as threatened
C	Candidate	Enough information for listing, but of lesser priority
FSC	Federal "Species of Concern"	Also known as "Species at Risk"; formerly as "Candidate 2"

State Status

Virginia

Virginia statuses are designated under authority of the Virginia Department of Game and Inland Fisheries (all animals except insects) and Virginia Department of Agriculture and Consumer Services (insects and plants).

LE	Listed Endangered
LT	Listed Threatened
PE	Proposed Endangered
PT	Proposed Threatened
C	Candidate for listing as threatened or endangered
SC	Special Concern; animals that merit special concern (not legal category)

North Carolina

North Carolina statuses are provided by the NC Natural Heritage Program and differ for plants and animals.

NC Plant Status determined by the Plant Conservation Program (NC Department of Agriculture) and the Natural Heritage Program (NC Department of Environment and Natural Resources).

E	Endangered	Threatened with extinction
T	Threatened	Likely to become endangered in the foreseeable future
SC	Special Concern	Not listed as Threatened or Endanger; may be collected and sold only under specific regulations
C	Candidate	Very rare in NC and also rare throughout their ranges or disjunct in NC from a main range in a different part of the country or world.
SR	Significantly Rare	Vary rare in NC, but more common else where
-L	Limited	Limited to NC and adjacent states, but fewer than 50 populations rangewide
-T	Throughout	Rare throughout their ranges (fewer than 100 populations total)
-D	Disjunct	Disjunct to NC from a main range in a different part of the country or

		world
-P	Peripheral	At the periphery of its range in NC, more common elsewhere
-O	Other	Sporadic or cannot be described by the other categories
P_	Proposed	Formally proposed for listing as Endangered, Threatened, or Special Concern, but not yet completed listing process

NC animal statuses are determined by the Wildlife Resources Commission and the Natural Heritage Program.

E	Endangered	Threatened with extinction
T	Threatened	Likely to become endangered in the foreseeable future
SC	Special Concern	Not listed as Threatened or Endanger; may be taken only under special regulations
SR	Significantly Rare	Not listed as Endangered, Threatened, or Special Concern, but exist in The state in small numbers and determined to need monitoring
EX	Extirpated	A species which is no longer believed to occur in the state
P	Proposed	Proposed by a Scientific Council as a status different from the current Status, but not yet adopted by the Wildlife Resources Commission

Species of Concern and on State Watch Lists on the: Great Dismal Swamp National Wildlife Refuge

Federally Listed, Proposed and Candidate Species

Bald Eagle, *Haliaeetus leucocephalus* LT
Red-cockaded woodpecker, *Picoides borealis* LE

Federal Species of Concern

Dismal Swamp green stink bug, *Chorochoa dismalia*, G2
Scarce swamp skipper or Duke's skipper, *Duphyes dukesi*, G3
Virginia least trillium, *Trillium pusillum var. virginianum*, G3T2

State Species of Concern and Watch List Species (in addition to above)

Birds

Pied-billed grebe, *Gavia immer* G5 S1S2B/S3N
American bittern, *Botaurus lentiginosus*, G4 S1B/S2N
Great egret, *Ardea alba* G5 S2B/S3N SC
Snowy egret, *Egretta thula*, G5 S2B/S3N
Little blue heron, *Egretta caerulea*, G5 S2B/S2N SC
Yellow crowned night heron, *Nyctanassa violacea*, G5 S2 S3B/S3N SC
White ibis, *Eudocimus albus*, G5 S1B/S4N
Blue-winged teal, *Anas discors*, G5 S1B/S2N
Gadwall, *Anas strepera*, G5 S2B/S3N
Common merganser, *Mergus merganser*, G5 S1B/S4N
Northern Harrier, *Circus cyaneus*, G5 S1B/S3S4N SC
King rail, *Rallus elegans*, G4 G5 S2B/S3N
Sora, *Porzana carolina*, G5 S1B S2N
Common moorhen, *Gallinula chloropus*, G5 S1B/S1N

American coot, *Fulica americana*, G5 S1B/S5N
Spotted sandpiper, *Actitis macularia*, G5 S2B/S2N
Caspian tern, *Sterna caspia*, G5 S1B/S2N SC
Royal tern, *Sterna maxima*, G5 S2B/S2N
Yellow-bellied sapsucker, *Sphyrapicus varius*, G5 S1B/S4N
Red-breasted nuthatch, *Sitta canadensis*, G5 S2B/S4N SC
Winter wren, *Troglodytes troglodytes*
Golden-crowned kinglet, *Regulus satrapa*, G5 S2B/S5N SC
Swainson's thrush, *Catharus ustulatus*, G5 S1B/S2N
Hermit thrush, *Catharus guttatus*, G5 S1B/S5N SC
Loggerhead shrike, *Lanius ludovicianus*, G4 S2B/S3N LT
Magnolia warbler, *Dendroica magnolia*, G5 S2B/S2N
Blackburnian warbler, *Dendroica fusca*, G5, S2B/S2N
Swainson's warbler, *Limnothlypis swainsonii*, G4 S2B/S2N SC
Swamp sparrow, *Melospiza georgiana*, G5, S1B/S4N S5N
Purple finch, *Carpodacus purpureus*, G5 S1B/S5N SC

Butterflies

White-cedar hairstreak, *Callophrys hesseli*, G3 G4 S1

Damselflies

Blackwater bluet, *Enallagma weewa*, G5 S2
Pale bluet, *Enallagma pallidum*, G4 S1
Burgundy bluet, *Enallagma dubium*, G5 S2
Southern sprite, *Nehalennia integricollis*, G5 S2

Dragonflies

Two-striped forceptail, *Aphylla williamsoni* G5 S1
Stripe winged baskettail, *Epitheca costalis*, G4 S2
Robust baskettail, *Epitheca spinosa* G4 S2
Fine lined emerald, *Somatochlora filosa*, G5 S1S2
Treetop emerald, *Somatochlora provocans*, G4 S2
Jane's meadowhawk, *Sympetrum janeae*, G5 SH

Fish

Banded sunfish, *Enneacanthus obesus*, G5 S3

Mammals

Dismal Swamp southeastern shrew, *Sorex longirostris fisheri*, G5T4 S2 LT
Eastern big-eared bat, *Plecotus rafinescruci*, G3G4 S2 LE
Canebrake rattlesnake, *Crotalus horridus articaudatus*, G4 TUQ S1

Frogs and Toads

Oak toad, *Bufo quercicus*, G5 S1S2 SC
Carpenter frog, *Rana virgatipes*, G5 S3

Salamanders

Greater siren, *Siren lacertian*, G5 S3

Many-lined salamander, *Stereochilus marginatus*, G5 S3

Shrubs

Sheep laurel, *Kalmia augustifolia*, G5 S2

Silky Camellia, *Stewartia malacodendron*, G4 S3

Plants

Purple bladderwort, *Utricularia purpurea*, G5 S2

Nansemond National Wildlife Refuge

Northern diamond-backed terrapin, *Malaclemys terrapin terrapin*, G4T4 S4

**Appendix B:
Relevant Federal Laws**

Relevant Federal Laws

American with Disabilities Act of 1992

This Act prohibits discrimination in public accommodations and services.

Architectural Barriers Act of 1968

This Act requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Clean Water Act of 1977

This Act requires consultation with the U.S. Army Corps of Engineers for major wetland modifications.

Dismal Swamp Study Act of 1972

Public Law 92-478 authorized a study of the Great Dismal Swamp area to determine its best disposition. The conclusion resulted in the following recommendations:

Recommendation 1

- Primary purpose of protecting and preserving a unique and outstanding ecosystem, as well as protecting and perpetuating the diversity of animal and plant life therein.
- Refuge management program will include water manipulation and conservation; timber management.
- Secondary management will be to promote a public use program when not in conflict with primary objectives.
- Public use...order of priority: wildlife and wildlands related research, environmental education, nature interpretation and wildlife-oriented recreation to include, but not limited to wildlife observation and photography, nature-oriented hiking and canoeing, hunting and fishing.
- Encourage access to the interior by a land-based transportation system as well as hiking and water transportation.

Recommendation 2

FWS be appropriated \$50,000 to be used in planning for:

- Administration complex
- Rehab of roads
- Water control structures
- Public use facilities including parking areas, rest rooms, shelter, nature trails, rail system or other public transportation from the Suffolk Escarpment to the interior of Great Dismal Swamp (GDS).

Recommendation 3

- Priority use of water from Lake Drummond and other waters...be used to maintain and enhance the ecology of GDS.
- Secondary use of GDS water, after requirements of the GDS have been met, is to be for operation of the Dismal Swamp Canal (DSC).

Recommendation 4

- Water in excess of needs of GDS and DSC, shall be released into the drainages of the Pasquotank River and Northwest River.
- In addition to providing scenic, ecological, and recreational values, the release could augment domestic water supplies.

Recommendation 5

- Army Corp of Engineers (COE) operate and maintain DSC at the depth of canal center 7.2' under a water budget agreed to by the Department of Defense and Department of the Interior.
- Maintain "no wake" speed limit on the canal.

Recommendation 6

- U.S. Geological Survey ...to ascertain hydrological data...to establish a water budget for the GDS and DSC.
- Study will include: estimate of the overland flow of water within the swamp; finding of interaction between surface water and ground water systems; determination of water allocation system; number, location and type of water control structures necessary to regulate surface water movement.

Recommendation 7

- COE acquire approximately 40 acres near Lake Drummond Reservation (LDR) to provide public use facilities for hikers and boaters, including picnic and camp site.

Recommendation 8

- State of North Carolina acquires 13,500 acres... for a state park.
- Construct and maintain a boat ramp on the DSC between South Mills Lock and Hamburg Ditch.

Recommendation 9

- State of Virginia acquires 210 acres near Arbuckle Landing and Feeder Ditch for the purpose of providing basic public use requirements.
- Facilities to include: camping, parking, picnicking, and possible contact center.

Recommendation 10

- City of Suffolk acquires, develops, and manages a park complex to consist of about 1,000 acres within or near the GDS where the Washington Ditch crosses the escarpment.
- Facilities to include: visitor contact facility, drinking water, rest rooms, parking, picnic sites, camp sites.

Recommendation 11

- COE develop a mechanical system to convey small watercraft from the Deep Creek and South Mills Locks to the adjacent water courses.
- Construct a tunnel or bridge over the DSC near the Feeder Ditch to accommodate foot traffic.

Recommendation 12

COE to be funded to:

- Construct a public boat ramp and parking area near the north end of the DSC for subsequent lease to the City of Chesapeake.
- Construct a foot bridge across the east end of the Feeder Ditch.
- Establish a hiking trail along the banks of the Feeder Ditch from the DSC to LDR.
- Hire seasonal employees to maintain the public use facilities associated with the LDR and Feeder Ditch Trail.

Recommendation 13:

- COE should continue to issue leases and permits to the states or other entities to develop and maintain recreational use facilities along the DSC.
- Promote the operation of a boat concession to transport the public from the DSC to Lake Drummond.

Recommendation 14:

City of Chesapeake should pursue:

- Operation and maintenance of boat ramp and parking area (ref: Rec. #12)
- Development of a hiking trail along the west side of the DSC on the canal right-of-way.
- Development of a canoe trail along the Northwest River from Route 17 to Route 168.
- Continue to operate and maintain picnic sites along the DSC.

Recommendation 15:

- ODU should pursue development of a “Dismal Swamp Ecological Education Center” near the refuge to conduct research and education activities.

Recommendation 16:

- A public use program committee consisting of representatives from FWS, COE, States of Virginia and North Carolina, Cities of Chesapeake and Suffolk, Old Dominion University and two citizens at large appointed by the Virginia Commission of Outdoor Recreation and North Carolina Division of Recreation.

Dismal Swamp Act of 1974

Public Law 93-402 established Great Dismal Swamp National Wildlife Refuge and directed that use of the Dismal Swamp Canal would not adversely affect the refuge.

In addition, the 1974 Dismal Swamp Act authorized funding for the acquisition of lands and waters adjacent to the refuge as established in the first section of the Act and within the area known as the Great Dismal Swamp. Although the Act restricted acquisition of these additional lands and waters “without first taking into account such recommendations as may result from the study required under Public Law 92-478.” The Act

also directed the Secretary of the Interior to administer the lands and waters within the refuge in accordance with the National Wildlife Refuge System Administration Act of 1966, thus placing the swamp under the policy direction of the U.S. Fish and Wildlife Service.

Emergency Wetland Resources Act of 1986

This Act authorized the purchase of wetlands from Land and Water Conservation Fund moneys, removing a prior prohibition on such acquisitions. The Act also required the Secretary to establish a National Wetlands Priority Conservation Plan, requires the States to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund amount equal to import duties on arms and ammunition.

Endangered Species Act of 1973 (16U.S.C. 1531-1544, 87 Stat, 884), as amended

Public Law 93-205, repealed the Endangered Species Conservation Act (P.L. 91-135). The 1969 Act had amended the Endangered Species Preservation Act of 1966 (PL 89-669).

The 1973 endangered Species Act provided for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through Federal action and by encouraging the establishment of State programs. The Act:

- Authorized the determination and listing of species as endangered and threatened;
- Prohibits unauthorized taking, possession, sale, and transport of endangered species;
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds;
- Authorized establishment of cooperative agreements and grants-in-aid to states that establish and maintain active and adequate programs for endangered and threatened wildlife and plants;
- Authorizes the assessment of civil and criminal penalties for violating the Act or regulation; and
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violations of the Act of any regulation issued there under.

Environmental Education Act of 1990

Public Law 101-619 established the Office of Environmental Education within the Environmental Protection Agency to develop and administer a Federal environmental education program.

Responsibilities of the Office include developing and supporting programs to improve understand of the natural and developed environment, and the relationships between humans and their environment; supporting the dissemination of educational materials; developing and supporting training programs and environmental education seminars; managing a Federal grant program; and administering an environmental internship and fellowship program. The Office is required to develop and support environmental programs in consultation with other Federal natural resource management agencies, including the Fish and Wildlife Service.

Executive Order 11988, Floodplain Management

The purpose of this Executive Order, signed May 24, 1977, is to prevent Federal agencies from contributing to the “adverse impacts associated with occupancy and modification of floodplains” and the “direct or indirect support of floodplain development.” In the course of fulfilling their respective authorities, Federal agencies “shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System (1996)

The purpose of this Executive Order is to define the mission, purpose and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the system.

Fish and Wildlife Improvement Act of 1978

This Act was passed to improve the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.

Historic Preservation Acts

There are various laws for the preservation of historic sites and objects.

Antiquities Act (16 USC 431-433) The Act of 1906 authorizes the President to designate as National Monuments objects or areas of historic or scientific interest on lands owned or controlled by the United States. The Act required that a permit be obtained for examination of ruins, excavation of archaeological sites and the gathering of objects or antiquity on lands under the jurisdiction of the Secretaries of Interior, Agriculture, and Army and provided penalties for violations.

Archaeological Resources Protection Act (16 U.S.C. 470aa-470ll)

Public Law 96-95 largely supplanted the resource protection provision of the Antiquities Act for archaeological items.

This Act established detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from Federal or Indian Lands. It also established civil and criminal penalties for the unauthorized excavation, removal or damage of any such resources; for any trafficking in such resources removed from Federal or Indian land in violation of any provision of Federal law; and for interstate and foreign commerce in such resources acquired, transported or received in violation of any State or local law.

Public Law 100-588 (1988) lowered the threshold value of artifacts triggering the felony provision of the Act from \$5,000 to \$500, made attempting to commit an action prohibited by the Act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the Nation.

Archeological and Historic Preservation Act (16 USC 469-469c)

Public Law 86-523 (1960), as amended by Public Law 93-291 (1974), to carry out the policy established by the Historic Sites Act (see below), directed Federal agencies to notify the Secretary of the Interior whenever they find a Federal or Federally assisted, licensed or permitted project may cause loss or destruction of significant scientific, prehistoric or archaeological data. The Act authorized use of appropriated, donated and/or transferred funds for the recovery, protection and preservation of such data.

Historic Sites, Buildings and Antiquities Act (16 USC 461-462, 464-467)

The Act popularly known as the Historic Sites Act, as amended by Public Law 89-249 declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this Act.

National Historic Preservation Act of 1966 (16 USC 470-470b, 470c-470n)

Public Law 89-665, approved in 1966, and repeatedly amended, provided for preservation of significant historical features (buildings, objects and sites) through a grant-in-aid program to the States. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 USC 468-468d).

The Act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in Public Law 94-422 (1976). That Act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register.

Land and Water Conservation Fund Act of 1948

This act provides funding through receipts from the sale of surplus federal land, appropriations from oil and gas receipts from the outer continental shelf, and other sources for land acquisition under several authorities. Appropriations from the fund may be used for matching grants to states for outdoor recreation projects and for land acquisition by various federal agencies, including the Fish and Wildlife Service.

Migratory Bird Conservation Act of 1929

This Act established the Migratory Bird Conservation Commission which consists of the Secretaries of the Interior (chairman), Agriculture, and Transportation, two members from the House of Representatives, and an ex-officio member from the state in which a project is located. The commission approves acquisition of land and water, or interests therein, and sets the priorities for acquisition of lands by the Secretary for sanctuaries or for other management.

Migratory Bird Hunting and Conservation Stamp Act, as amended

The “Duck Stamp Act,” as this 1934 authority is commonly called, requires each waterfowl hunters 16 years of age or older to possess a valid Federal hunting stamp. Receipts from the sale of the stamp are deposited in a special Treasury account known as the Migratory Bird Conservation Fund and are not subject to appropriations.

National and Community Service Act of 1990

Public Law 101-610 authorizes several programs to engage citizens of the U.S. in full- and /or part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Several provisions are of particular interest to the U.S. Fish and Wildlife Service.

American Conservation and Youth Service Corps

As a Federal grant program established under Subtitle C of the law, the Corps offers an opportunity for young adults between the ages of 16-25, or in the case of summer programs, 15-21, to engage in approved human and natural resources projects which benefit the public or are carried out on Federal or Indian lands.

To be eligible for assistance, natural resources programs will focus on improvement of wildlife habitat and recreational areas fish culture, fishery assistance, erosion, wetlands protection, pollution control and similar projects. A stipend of not more than 1 percent of the poverty level will be paid to participants. A Commission established to administer the Youth Service Corps will make grants to States, the Secretaries of Agriculture and Interior and the Director of ACTION to carry out these responsibilities.

National and Community Service Act

Will make grants to States for the creation of full-time and/or part-time programs for citizens over 17 years of age. Programs must be designed to fill unmet educational, human, environmental, and public safety needs. Initially, participants will receive post-employment benefits of up to \$1,000 per year for part-time and \$2,500 for full-time participants.

Thousand Points of Light

Creates a non-profit Points of Light Foundation to administer programs to encourage citizens and institutions to volunteer in order to solve critical social issues, and to discover new leaders and develop institutions committed to serving others.

National Environmental Policy Act of 1969, as amended by PL 94-52 (1975) and PL 94-83 (1975)

Title I of the 1969 National Environmental Policy Act (NEPA) requires that all Federal agencies prepare detailed environmental impact statements for ‘every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment.’”

The 1969 statute stipulated the factors to be considered in environmental impact statements, and require that Federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unquantified environmental values are given appropriate consideration, along with economic and technical considerations.

Title II of this statute requires annual reports on environmental quality from the President to the Congress, and established a Council on Environmental Quality in the Executive Office of the President with specific duties and functions.

National Wildlife Refuge System Administration Act of 1966, as amended

This Act defines the National Wildlife Refuge System as including wildlife refuges, areas for protection and conservation of fish and wildlife which are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Secretary is authorized to permit any use of an area provided such use is compatible with the major purposes for which such area was established. The purchase consideration for rights-of-way goes into the Migratory Bird Conservation Fund for the acquisition of lands. By regulation, up to 40% of an area acquired for a migratory bird sanctuary may be opened to migratory bird hunting unless the Secretary finds that the taking of any species of migratory game birds in more than 40% of such area would be beneficial to the species. The Act requires an Act of Congress for the divestiture of lands in the system, except (1) lands acquired with Migratory Bird conservation Commission funds, and (2) lands can be removed from the system by land exchange, or if brought into the system by a cooperative agreement, then pursuant to the terms of the agreement.

National Wildlife Refuge System Centennial Act of 2000

The National Wildlife Refuge System Centennial Act of 2000 paves the way for a special, nationwide outreach campaign. The law calls for a Centennial Commission of distinguished individuals to leverage with partners in carrying out the outreach campaign. The law also calls for a long-term plan to address the major operations, maintenance, and construction needs of the National Wildlife Refuge System. These Centennial activities will help broaden visibility, strengthen partnerships, and fortify facilities and programs for wildlife and habitat conservation and recreation. They will build a stronghold of support for the National Wildlife Refuge System to sustain it in a new era of both challenge and opportunity.

National Wildlife Refuge System Improvement Act of 1997

Public Law 105-57, amends the National Wildlife System Act of 1966, providing guidance for management and public use of the Refuge System. The Act mandates that the Refuge System be consistently directed and managed as a national system of lands and waters devoted to wildlife conservation and management.

The Act established priorities for recreational uses of the Refuge System. Six wildlife-dependent uses are specifically named in the Act: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

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

The Act also requires development of a comprehensive conservation plan for each refuge and management of each refuge consistent with the plan. When writing a CCP, planning for expanded or new refuges, and when making management decisions, the Act requires effective coordination with other Federal agencies, state fish and wildlife or conservation agencies, and refuge neighbors. A refuge must also provide opportunities for public involvement when making a compatibility determination or developing a CCP.

Lands within the National Wildlife Refuge System are closed to public uses unless specifically and legally opened. All programs and uses must be evaluated, or determined compatible, based on mandates set forth in the Act. Those mandates are to:

- Provide for the conservation of fish, wildlife, and plants and their habitats within the System;
- Ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans;
- Plan and direct the continued growth of the System, in a manner that is best designed to accomplish the mission of the System, to contribute to the conservation of the ecosystems of the United States and other Federal agencies to conserve fish and wildlife and their habitats, and to increase support for the System and participation from conservation partners and the public;
- Ensure that the mission of the System and the purposes of each refuge are carried out, except that if a conflict exists between the purposes of a refuge and the mission of the System, the conflict shall be resolved in a manner that first protects the purposes of the refuge, and to the extent practicable, that also achieves the mission of the System;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the States in which the units of the System are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the System and the purposes of each refuge;
- Acquire, under State law, water rights that are needed for refuge purposes;
- Recognize compatible wildlife-dependent recreational uses as the priority general public uses of the System through which the American public can develop an appreciation for fish and wildlife;
- Ensure that opportunities are provided within the System for compatible wildlife-dependent recreational uses;
- Ensure that priority general public uses of the System receive enhanced consideration over other general public uses in planning and management within the System;
- Provide increased opportunities for families to experience compatible wildlife-dependent recreation, particularly opportunities for parents and their children to safely engage in traditional outdoor activities, such as fishing and hunting;
- Continue, consistent with existing laws and interagency agreements, authorized or permitted uses of units of the System by other Federal agencies, including those necessary to facilitate military preparedness;
- Ensure timely and effective cooperation and collaboration with Federal agencies and State fish and wildlife agencies during the course of acquiring and managing refuges; and
- Monitor the status and trends of fish, wildlife, and plants in each refuge.

National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1998

The Volunteer and Community Partnership Enhancement Act (Public Law 105-242) is intended to enhance volunteer programs, community partnerships and educational programs throughout the National Wildlife Refuge System. The Act proposes the use of several tools to accomplish this task, including pilot projects, cooperative agreements, authorization of funds to carry out programs written guidance and status reports. The Act also authorizes the establishment of a Senior Volunteer Corps, consisting of volunteers over 50-years-old.

North American Wetlands Conservations Act

Public Law 101-233, provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, the U.S., and Mexico.

The Act converts the Pittman-Robertson account into a trust fund, with the interest available without appropriation through the year 2006 to carry out the programs authorized by the Act, along with an authorization for annual appropriation of \$15 million plus an amount equal to the fines and forfeitures collected under the Migratory Bird Treaty Act.

Available funds may be expended, upon approval of the Migratory Bird Conservation Commission, for payment of not to exceed 50 percent of the United States share of the cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on Federal lands). At least 50 percent and no more than 70 percent of the funds received are to go to Canada and Mexico each year.

A North American Wetlands Conservation Council is created to recommend projects to be funded under the Act to the Migratory Bird Conservation Commission. The Council is to be composed of the Director of the Service, the Secretary of the National Fish and Wildlife Foundation, a State fish and game agency director from each Flyway, and three representatives of different non-profit organizations participating in projects under the Plan or the Act. The Chairman of the Council and one other member serve *ex officio* on the Commission for consideration of the Council's recommendations.

The Commission must justify in writing to the Council and, annually, to Congress, any decisions not to accept Council recommendations.

Oil Pollution Act of 1990

Public Law 101-380 established new requirements and extensively amended the Federal Water Pollution Control Act to provide enhanced capabilities for oil spill response and natural resource damage assessment for the Service. It required Service consultation on developing a fish and wildlife response plan for the National Contingency Plan, input to Area Contingency Plans, review of Facility and Tank Vessel Contingency Plans, and to conduct damage assessments associated with oil spills. The following are the pertinent provisions.

Title I, section 1006, provided that Federal trustees shall assess natural resource damages for natural resources under their trusteeship. Federal trustees may, upon request from a State or Indian tribe, assess damages to natural resources for them as well. Trustees shall develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of natural resources under their trusteeship.

Title I, section 1011, provides that trustees are to be consulted on the appropriate removal action to be taken in connection with any discharge of oil.

Title I, section 1012, provided for the uses of the oil pollution fund. In addition to response costs, the fund may be used without appropriations to pay the costs of assessments, as well as to pay claims for natural resource damages if there are no funds or insufficient funds from a responsible party. (A claims procedure was to be developed under section 1013.) This section also stipulated deadlines for the submission of removal cost claims and damage claims.

Title IV, section 4202, amended subsection 311(j) of the Federal Water Pollution Control Act with respect to the National Planning and Response System. It defined area committees and area contingency plans, and requirements and deadlines for agencies. Under this section, the Service is required to generate a list of all equipment, including fire fighting equipment, as well as personnel and any other equipment and supplies that could be used to expedite the removal of oil or mitigation of a spill.

One aspect of particular interest to the Service involves the identification of ecologically sensitive areas and the preparation of scientific monitoring and evaluation plans. Research conducted by the Service is to be directed and coordinated by the National Wetland Research Center.

Refuge Recreation Act of 1962

This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

Refuge Revenue Sharing Act

Section 401 of the Act of June 15, 1935, provided for payments to counties in lieu of taxes, using revenues derived from the sale of products from refuges.

Public Law 93-509 (1974), required that moneys remaining in the fund after payments be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act.

Public Law 95-469 (1978), expanded the revenue sharing system to include National Fish Hatcheries and Service research stations. It also included in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Payments to counties were established as:

1. On acquired land, the greatest amount calculated on the basis of 75 cent per acre, three-fourths of one percent of the appraised value, or 25 percent of the net receipts produced from the land; and
2. On land withdrawn from the public domain, 25 percent of net receipts and basic payments under Public Law 94-565, payment in lieu of taxes on public lands.

This amendment also authorized appropriations to make up any difference between the amount in the Fund and the amount scheduled for payment in any year. The stipulation that payments be used for schools and roads was removed, but counties were required to pass payments along to other units of local government within the county which suffer losses in revenues due to the establishment of Refuges.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948

This Act provides that upon determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred, without reimbursement, to the Secretary of the Interior if the land has particular value for migratory birds, or to a State agency for other wildlife conservation purposes.

Rehabilitation Act of 1973, as amended

Title 5 of Public Law 93-112 prohibits discrimination on the basis of handicap under any program or activity receiving Federal financial assistance.

Youth Conservation Corps Act of 1970

Public Law 91-378 declares the YCC pilot program a success and establishes permanent programs within the Department of Interior and Agriculture for young adults who have attained the age of 15, but not the age of 19, to perform specific tasks on lands and waters administered under jurisdiction of these Secretaries. Within the Fish and Wildlife Service, YCC participants perform various tasks on National Wildlife Refuges, National Fish Hatcheries, research stations, and other facilities.

The legislation also authorizes the Secretary of Interior and the Secretary of Agriculture to establish a joint grant program to assist States employing young adults on non-Federal public lands and waters throughout the U.S.

In addition the Act requires the Secretaries of Interior and Agriculture to prepare a joint report to the President and Congress prior to April 1 of each year.

Wilderness Act of 1964

Public Law 88-577 directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within the National Wildlife Refuge and National Park Systems for inclusion in the National Wilderness Preservation System.

Under the Act, federal lands that are declared as Wilderness Areas must be maintained in a natural, undeveloped state in order to “preserve for the American people of present and future generations the benefits of an enduring resource of wilderness.” The Act instructs federal agencies to manage Wilderness Areas in a manner which “preserves the wilderness character of the area,” and provides “outstanding opportunities for solitude, primitive and unconfined recreation.”

Appendix C:
Species List

Birds

Season:

s – Spring	March – May
S – Summer	June – August
F – Fall	September – November
W - Winter	December – February

Relative Abundance

a – abundant	a species which is very numerous
c – common	likely to be seen or heard in suitable habitat
u – uncommon	present, but not certain to be seen
o – occasional	seen only a few times during a season
r – rare	may be present but not every year

Common name	Scientific name	Seasonal Occurrences			
		s	S	F	W
Loons-Grebes					
Common Loon	<i>Gavia immer</i>	o		r	o
Pied-billed Grebe	<i>Podilymbus podiceps</i>	u		o	u
Horned Grebe	<i>Podiceps auritus</i>	r		r	o
Cormorants					
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	u	u	u	u
Bitterns-Herons-Ibises					
American Bittern	<i>Botaurus lentiginosus</i>	o	o	r	r
Great Blue Heron	<i>Ardea herodias</i>	c	c	u	u
Great Egret	<i>Ardea alba</i>	o	o	o	o
Snowy Egret	<i>Egretta thula</i>	o	o		
Little Blue Heron	<i>Egretta caerulea</i>	o	o	r	
Cattle Egret	<i>Bubulcus ibis</i>	o	o	r	
Green Heron	<i>Butorides virescens</i>	c	c	u	
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	u	u		
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>	o	o		
White Ibis	<i>Eudocimus albus</i>	r	r	r	
Swans-Geese-Ducks					
Tundra Swan	<i>Cugnus columbianus</i>	o		u	u
Snow Goose	<i>Chen caerulescens</i>			o	o
Brant	<i>Branta bernicla</i>			r	r
Canada Goose	<i>Branta canadensis</i>	u		u	c
Wood Duck	<i>Aix sponsa</i>	c	c	c	c
Green-winged Teal	<i>Anas crecca</i>	o		o	o
American Black Duck	<i>Anas rubripes</i>	u	u	u	u
Mallard	<i>Anas platyrhynchos</i>	u	u	u	u
Northern Pintail	<i>Anas acuta</i>	r		o	o
Blue-winged Teal	<i>Anas discors</i>	r	r	r	r
Gadwall	<i>Anas strepera</i>			o	o
American Wigeon	<i>Anas americana</i>	o		o	o
Canvasback	<i>Aythya valisineria</i>	r		o	o
Redhead	<i>Aythya americana</i>	o			o
Ring-necked Duck	<i>Aythya collaris</i>	u		u	u

Lesser Scaup	<i>Aythya affinis</i>	u		o	o
Common Goldeneye	<i>Bucephala clangula</i>			o	o
Bufflehead	<i>Bucephala albeo</i>	r		o	o
Hooded Merganser	<i>Lopodytes cuculla</i>	u	o	o	u
Common Merganser	<i>Mergus merganser</i>	o		r	o
Red-breasted Merganser	<i>Mergus serrator</i>	o		r	o
Ruddy Duck	<i>Oxyura jamaicensis</i>	r		o	o
Vultures-Hawks-Falcons					
Black Vulture	<i>Coragyps atratur</i>	u	u	u	u
Turkey Vulture	<i>Cathartes aura</i>	c	c	c	c
Osprey	<i>Pandion haliaetus</i>	o		r	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	r	r	r	r
Northern Harrier	<i>Circus cyaneus</i>	r		r	
Sharp-shinned Hawk	<i>Accipeter striatus</i>	o	r	c	u
Cooper's Hawk	<i>Accipeter cooperii</i>	o	r	o	o
Red-shouldered Hawk	<i>Buteo lineatus</i>	c	c	c	c
Broad-winged Hawk	<i>Buteo platypterus</i>	u		o	
Red-tailed Hawk	<i>Buteo jamicensis</i>	c	c	c	c
American Kestrel	<i>Falco sparverius</i>	u	u	u	u
Merlin	<i>Falco columbarius</i>	o		r	
Quail-Turkey					
Wild Turkey	<i>Meleagris gallopavo</i>	r	r	r	r
Northern Bobwhite	<i>Cotinus virginianus</i>	c	c	c	c
Rails-Cranes					
King Rail	<i>Rallus elegans</i>	r	r	r	r
Sora	<i>Porzana carolina</i>	r	r	r	r
Common Moorhen	<i>Gallinula chloropus</i>	r	r	r	r
American Coot	<i>Fulica americana</i>	o		o	o
Plovers-Sandpipers					
Semipalmated Plover	<i>Charadrius semipalmatus</i>	r		r	r
Killdeer	<i>Charadrius vociferus</i>	u		u	u
Greater Yellowlegs	<i>Tringa melanoleuca</i>			o	o
Lesser Yellowlegs	<i>Tringa flavipes</i>			o	o
Solitary Sandpiper	<i>Tringa solitaria</i>	u		r	
Spotted Sandpiper	<i>Actitis macularia</i>	c	u	u	
Whimbrel	<i>Numerius phaeopus</i>	r			
Sanderling	<i>Calidris alba</i>			o	
Semipalmated Sandpiper	<i>Calidris pusilla</i>	o		o	
Western Sandpiper	<i>Calidris mauri</i>				r
Least Sandpiper	<i>Calidris minutilla</i>			o	o
Short-billed Dowitcher	<i>Limnodromus griseus</i>			r	
Common Snipe	<i>Gallinago gallinago</i>	o		o	o
American Woodcock	<i>Scolopax minor</i>	c	c	c	u
Gulls-Terns-Auks					
Laughing Gull	<i>Larus atricilla</i>	o	o	o	o
Ring-billed Gull	<i>Larus delawarensis</i>	c	u	c	c
Herring Gull	<i>Larus argentatus</i>	u	u	u	u
Great Black-backed Gull	<i>Larus marinus</i>	o		o	o
Caspian Tern	<i>Sterna caspia</i>	o			
Royal Tern	<i>Sterna maxima</i>	o			

Doves-Cuckoos-Owls-Swifts-Hummingbirds

Rock Dove	<i>Columba livia</i>	u	u	u	u
Mourning Dove	<i>Zenaida macroura</i>	c	c	c	c
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	o			
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	c	c	o	
Eastern Screech-Owl	<i>Otus asio</i>	u	u	u	u
Great Horned Owl	<i>Bubo virginianus</i>	u	u	u	u
Barred Owl	<i>Strix varia</i>	c	c	c	c
Common Nighthawk	<i>Chordeiles minor</i>	r	r	r	
Chuck-wills widow		u	u	o	
Whip-poor-will	<i>Caprimulgus vociferus</i>	u	u	o	
Chimney Swift	<i>Caprimulgus carolinensis</i>	c	c	u	
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	c	c	u	
Belted Kingfisher	<i>Ceryle alcyon</i>	c	c	c	c

Woodpeckers-Flycatchers

Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	u	u	u	o
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	c	c	c	c
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	u	o	u	u
Down Woodpecker	<i>Picoides pubescens</i>	c	c	c	c
Hairy Woodpecker	<i>Picoides villosus</i>	u	u	u	u
Northern Flicker	<i>Colaptes auratus</i>	u	u	c	c
Pileated Woodpecker	<i>Dryocopus pileatus</i>	c	c	c	c
Eastern Wood-Pewee	<i>Contopus virens</i>	c	c	u	
Acadian Flycatcher	<i>Empidonax virescens</i>	c	c	u	
Eastern Phoebe	<i>Sayornis phoebe</i>	c	c	u	r
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	c	c	c	
Eastern Kingbird	<i>Tyrannus tyrannus</i>	u	u	u	

Larks-Swallows-Jays-Crows

Purple Martin	<i>Progne subis</i>	u	u		
Tree Swallow	<i>Tachycineta bicolor</i>	u	o	u	
Northern Rough-winged Swallow	<i>Stelgidopteryx</i>	u	u	o	
Riparia Bank Swallow	<i>Riparia serripennis</i>	o			
Cliff Swallow	<i>Hirundo pyrrhonta</i>	r	r		
Barn Swallow	<i>Hirundo rustica</i>	c	c	c	
Blue Jay	<i>Cyanocitta cristata</i>	c	c	c	c
American Crow	<i>Corvus brachyrhynchos</i>	c	c	c	c
Fish Crow	<i>Corvus ossifragus</i>	u	u	u	u

Titmice-Nuthatches-Wrens

Black-capped Chickadee	<i>Parus atricapillus</i>			r	r
Carolina Chickadee	<i>Parus carolinensis</i>	c	c	c	c
Tufted Titmouse	<i>Parus bicolor</i>	c	c	c	c
Red-breasted Nuthatch	<i>Sitta canadensis</i>	r		u	u
White-breasted Nuthatch	<i>Sitta carolinensis</i>	c	c	c	c
Brown-headed Nuthatch	<i>Sitta pusilla</i>	u	u	u	u
Brown Creeper	<i>Certhia americana</i>	r		o	o
Carolina Wren	<i>Thryothorus ludovicianus</i>	c	c	c	c
House Wren	<i>Troglodytes aedon</i>	u	u	o	r
Winter Wren	<i>Troglodytes troglodytes</i>	r		u	u
Marsh Wren	<i>Cistothorus palustris</i>	o			

Kinglets-Thrushes-Thrashers

Golden-crowned Kinglet	<i>Regulus satrapa</i>	o		u	u
Ruby-crowned Kinglet	<i>Regulus calendula</i>	o		u	u
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	c	c	u	
Eastern Bluebird	<i>Sialia sialis</i>	u	u	u	o

Veery	<i>Catharus fuscescens</i>	o		r	
Gray-cheeked Thrush	<i>Catharus minimus</i>	o		r	
Swainson's Thrush	<i>Catharus ustulatus</i>	o		r	
Hermit Thrush	<i>Catharus guttatus</i>	o		u	c
Wood Thrush	<i>Hylocichta mustelina</i>	c	c	u	
American Robin	<i>Turdus migratorius</i>	u	u	c	c
Gray Catbird	<i>Dumetella carolinensis</i>	c	c	c	c
Northern Mockingbird	<i>Mimus polyglottos</i>	u	u	u	u
Brown Thrasher	<i>Toxostoma rufum</i>	u	u	u	u
Waxwings-Shrikes-Starlings					
American Pipit	<i>Anthus rubescens</i>	o		o	o
Cedar Waxwing	<i>Bobyccilla cedrorum</i>	c	r	u	c
Loggerhead Shrike	<i>Lanius ludovicianus</i>	r		r	r
European Starling	<i>Sturnus vulgaris</i>	u	u	u	u
Vireos-Wood Warblers					
White-eyed Vireo	<i>Vireo griseus</i>	c	c	c	
Solitary Vireo	<i>Vireo solitarius</i>	o		o	
Yellow-throated Vireo	<i>Vireo flavifrons</i>	u	u	u	
Warbling Vireo	<i>Vireo gilvus</i>	o		r	
Philadelphia Vireo	<i>Vireo philadelphicus</i>	o		o	
Red-eyed Vireo	<i>Vireo olivaceus</i>	a	a	c	
Blue-winged Warbler	<i>Vermivora pinus</i>	c		u	
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	o			
Tennessee Warbler	<i>Vermivora peregrina</i>	u		u	
Nashville Warbler	<i>Vermivora ruticapilla</i>	o		o	
Northern Parula	<i>Parula americana</i>	u	u	u	
Yellow Warbler	<i>Dendroica petechia</i>	u	u	u	
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	o		u	
Magnolia Warbler	<i>Dendroica magnolia</i>	o		o	
Cape May Warbler	<i>Dendroica tigrina</i>	o		o	
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	u		u	
Yellow-rumped Warbler	<i>Dendroica coronata</i>	c		u	c
Black-throated Green Warbler	<i>Dendroica virens</i>	c	c	u	
Blackburnian Warbler	<i>Dendroica fusca</i>	o		o	
Yellow-throated Warbler	<i>Dendroica dominica</i>	u	u	u	
Pine Warbler	<i>Dendroica pinus</i>	c	c	c	u
Prairie Warbler	<i>Dendroica discolor</i>	c	c	c	o
Palm Warbler	<i>Dendroica palmarum</i>	u		u	
Bay-breasted Warbler	<i>Dendroica castanea</i>	o		o	
Blackpoll Warbler	<i>Dendroica striata</i>	u		o	
Cerulean Warbler	<i>Dendroica cerulea</i>	o			
Black-and-white Warbler	<i>Mniotilta varia</i>	u	c	c	
American Redstart	<i>Setophaga ruticilla</i>	c	c	c	
Prothonotary Warbler	<i>Protonotaria citrea</i>	a	a	c	
Worm-eating Warbler	<i>Helmitheros vermivorus</i>	u	u	u	
Swainson's Warbler	<i>Limnothlypis swainsonii</i>	u	u	u	
Ovenbird	<i>Seiurus aurocapillus</i>	a	a	c	
Northern Waterthrush	<i>Seiurus noveboracensis</i>	c	u	u	
Louisiana Waterthrush	<i>Seiurus motacilla</i>	c	c	c	
Kentucky Warbler	<i>Oporornis formosus</i>	r	r	r	
Common Yellowthroat	<i>Geothlypis trichas</i>	c	c	c	u
Hooded Warbler	<i>Wilsonia citrina</i>	c	c	c	
Wilson's Warbler	<i>Wilsonia pusilla</i>	r		r	
Canada Warbler	<i>Wilsonia canadensis</i>	o	o	o	
Yellow-breasted Chat	<i>Icteria virens</i>	u	u	u	

Tanagers-Sparrows

Summer Tanager	<i>Piranga rubra</i>	u	u	u	
Scarlet Tanager	<i>Pirango olivacea</i>	u	r	r	
Northern Cardinal	<i>Cardinalis cardinalis</i>	c	c	c	c
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	u		u	
Blue Grosbeak	<i>Guiraca caerulea</i>	u	u	o	
Indigo Bunting	<i>Passerina cyanea</i>	c	c	u	
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	c	c	c	c
American Tree Sparrow	<i>Spizella arborea</i>	r		o	o
Chipping Sparrow	<i>Spizella passerina</i>	u	u	o	r
Field Sparrow	<i>Spizella pusilla</i>	u	u	u	u
Fox Sparrow	<i>Passerella iliaca</i>			u	u
Song Sparrow	<i>Melospiza melodia</i>	u	u	u	u
Swamp Sparrow	<i>Melospiza georgiana</i>	u	r	o	u
White-throated Sparrow	<i>Zonotrichia albicollis</i>	u		c	c
White-crowned Sparrow	<i>Zonotrichia leucophrus</i>	r		r	r
Savannah Sparrow	<i>Passerculus sandwichensis</i>	u		o	u
Dark-eyed Junco	<i>Junco hyemalis</i>	o		c	c

Blackbirds-Finches

Bobolink	<i>Dolichonyx oryzivorus</i>	o		r	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	u	u	c	c
Eastern Meadowlark	<i>Sturnella magna</i>	o	o	o	r
Rusty Blackbird	<i>Eyphagus carolinus</i>	o		o	o
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>			r	r
Boat-tailed Grackle	<i>Quiscalus major</i>	o	o	o	o
Common Grackle	<i>Quiscalus quiscula</i>	c	c	c	c
Brown-headed Cowbird	<i>Molothrus ater</i>	c	c	c	c
Orchard Oriole	<i>Icterus spurius</i>	u	u		
Northern Oriole	<i>Icterus galbula</i>	u	u	o	r
Purple Finch	<i>Carpodacus purpureus</i>			o	u
Pine Siskin	<i>Carduelis pinus</i>	o		u	u
American Goldfinch	<i>Carduelis tristis</i>	c	u	u	c
Evening Grosbeak	<i>Hesperiphona vespertina</i>	o		o	u

Butterflies

include the following:

PAPILIONIDAE - Swallowtails

Pipe Vine Swallowtail (*Battus philenor*)
 Zebra Swallowtail (*Eurytides marcellus*)
 Black Swallowtail (*Papilio polyxenes*)
 Eastern Tiger Swallowtail (*Papilio glaucus*)
 Spicebush Swallowtail (*Papilio troilus*)
 Palemedes Swallowtail (*Papilio palamedes*)

Pearl Crescent (*Phyciodes tharos*)
 Question Mark (*Polygonia interrogationis*)
 Eastern Comma (*Polygonia comma*)
 American Painted Lady (*Vanessa virginiensis*)
 Red Admiral (*Vanessa atalanta*)
 Common Buckeye (*Junonia coenia*)
 Red-spotted Purple (*Limenitis arthemis astyanax*)
 Viceroy (*Limenitis archippus*)
 Southern Pearly-eye (*Enodia portlandia*)
 Carolina Satyr (*Hermeuptychia sosybius*)
 Little Wood-Satyr (*Megisto cymela*)
 Common Wood-Nymph (*Cercyonis pegala*)
 Monarch (*Danaus plexippus*)

PIERIDAE - Whites & Sulphurs

Cabbage White (*Pieris rapae*)
Clouded Sulphur (*Colias philodice*)
Orange Sulphur (*Colia eurytheme*)
Cloudless Sulphur (*Phoebis sennae*)
Sleepy Orange (*Eurema nicippe*)

LYCAENIDAE - Hairstreaks & Blues

Great Purple Hairstreak (*Atlides halesus*)
Striped Hairstreak (*Satyrrium liparops*)
White-Cedar Hairstreak (*Callophrys hesseli*)
Gray Hairstreak (*Strymon melinus*)
Red-banded Hairstreak (*Calycopis cecrops*)
Eastern Tailed-Blue (*Everes comyntas*)
Spring Azure (*Celastrina ladon*)

NYMPHALIDAE - Brushfoots, Satyrs & Milkweed Butterflies

Gulf Fritillary (*Agraulis vanillae*)
Variegated Fritillary (*Eutopieta claudia*)
Great Spangled Fritillary (*Speyeria cybele*)

HESPERIIDAE - Spreadwing Skippers & Folded-winged Skippers

Silver-spotted Skipper (*Epargyreus clarus*)
Southern Cloudy Wing (*Thorybes bathyllus*)
Confused Cloudy Wing (*Thorybes confusus*)
Juvenal's Dusky Wing (*Erynnis juvenalis*)
Horace's Dusky Wing (*Erynnis horatius*)
Southern Skipperling (*Copaeodes minimus*)
Clouded Skipper (*Lerema accius*)
Delaware Skipper (*Anatrytone logan*)
Duke's Skipper (*Euphyes dukesi*)
Hobomok Skipper (*Poanes hobomok*)
Zabulon Skipper (*Poanes zabulon*)
Yehl Skipper (*Poanes yehl*)
Dun Skipper (*Euphyes vestris*)
Lace-winged Roadside Skipper (*Amblyscirtes aesculapius*)
Carolina Roadside Skipper (*Amblyscirtes carolina*)
Reversed Roadside Skipper (*Amblyscirtes reversa*)

FISH

Longnose Gar	<i>Lepisosteus osseus</i>
Bowfin	<i>Amia calva</i>
Redfin Pickerel	<i>Esox Americanus</i>
Chain Pickerel	<i>Esox niger</i>
Golden Shiner	<i>Notemigonus crysoleucas</i>
White Catfish	<i>Ameiurus catus</i>
Channel Catfish	<i>Ictalurus punctatus</i>
Yellow Bullhead	<i>Ameiurus natalis</i>
Brown Bullhead	<i>Ameiurus nebulosus</i>
American Eel	<i>Anquilla rostrata</i>
Mosquitofish	<i>Gambusia holbrooki</i>
Swampfish	<i>Chologaster cornuta</i>
Pirate Perch	<i>Aphredoderus sayanus</i>

Mud Sunfish	<i>Acantharchus pomotis</i>
Flier	<i>Centrarchus macropterus</i>
Warmouth	<i>Lepomis gulosus</i>
Bluespotted Sunfish	<i>Enneacanthus gloriosus</i>
Banded Sunfish	<i>Enneacanthus obesus</i>
Redbreast Sunfish	<i>Lepomis auritus</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Bluegill	<i>Lepomis microchirus</i>
Largemouth Bass	<i>Micropterus salmoides</i>
Black Crappie	<i>Pomoxis nigromaculatus</i>
Eastern Swamp Darter	<i>Etheostoma fusiforme</i>
Yellow Perch	<i>Perca flavescens</i>
Eastern Mudminnow	<i>Umbra pygmaea</i>
Creek Chubsucker	<i>Erimyzon oblongus</i>

Mammals

Opposum	<i>Didelphis virginiana</i>
Least Shrew	<i>Cryptotis parva</i>
Dismal Swamp Shrew	<i>Sorex longirostris fisheri</i>
Eastern Mole	<i>Scalopus acmaticus</i>
Starnosed Mole	<i>Condylura cristata</i>
Southeastern long-tailed shrew	<i>Sorex longirostris</i>
Greater Short-tailed Shrew	<i>Blarina brevicauda telmalestes</i>
Eastern Long-eared Myotis	<i>Myotis keenii septentrionalis</i>
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>
Eastern Big-eared Bat	<i>Plecotis rafinesquii</i>
Evening Bat	<i>Nycticeius humeralis</i>
Northern Red Bat	<i>Lasiurus borealis</i>

Little Brown Myotis	<i>Myotis lucifugus</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Eastern Big-eared Bat	<i>Plecotus rafinescruci</i>
Eastern Cottontail	<i>Sylvilagus floridanus</i>
Marsh Rabbit	<i>Sylvilagus valustris</i>
Eastern Chipmunk	<i>Tamias striatus</i>
Gray Squirrel	<i>Sciurus carolinensis</i>
Southern Flying Squirrel	<i>Glaucomys volans</i>
Beaver	<i>Castor canadensis</i>
Marsh Rice Rat	<i>Orzomys palustris</i>
Eastern Harvest Mouse	<i>Reithrodontomys humulis</i>
Cotton Mouse	<i>Peromyscus gossypinus</i>
White-footed Mouse	<i>Peromyscus leucopus</i>
Golden Mouse	<i>Ochrotomys nuttalli</i>
Southern Lemming Vole	<i>Synaptomys cooperi helaletes</i>
Groundhog	<i>Marmota monax</i>
Muskrat	<i>Ondatra zibethicas</i>
Nutria	<i>Myocastor coypus</i>
Meadow Vole	<i>Microtus pennsylvanicus</i>
Gray Fox	<i>Urocyon cinereoargenteus</i>
Red Fox	<i>Vulpes fulva</i>
Black Bear	<i>Ursus americanus</i>
Raccoon	<i>Procyon lotor</i>
Coyote	<i>Canis latrans</i>
Mink	<i>Mustela vison</i>

River Otter	<i>Lutra canadensis</i>
Bobcat	<i>Felis rufus</i>
Long-tailed Weasel	<i>Mustela frenata</i>
White-tailed Deer	<i>Odocoileus virginianus</i>

Reptile and Amphibians

Snakes

Brown water snake	<i>Nerodia taxispilota</i>
Red-bellied water Snake	<i>Nerodia erythrogaster erythrogaster</i>
Northern water snake	<i>Nerodia sipedon sipedon</i>
Northern Brown snake	<i>Storeria dekayi dekayi</i>
Northern Red-bellied snake	<i>Storeria accipitamaculata occipita maculata</i>
Eastern Ribbon snake	<i>Thamnophis sauritus sauritus</i>
Eastern Garter snake	<i>Thamnophis sirtalis sirtalis</i>
Eastern Earth snake	<i>Virginia valeriae valeriae</i>
Eastern Hognose snake	<i>Heterodon platirhinos platirhinos</i>
Southern Ringneck snake	<i>Diadophis punctatus punctatus</i>
Eastern Worm snake	<i>Carphophis amoenus amoenus</i>
Eastern Mud snake	<i>Farancia abacura abacura</i>
Northern Black Racer	<i>Coluber constrictor constrictor</i>
Rough Green snake	<i>Opheodrys aestivus</i>
Black Rat snake	<i>Elaphe obsoleta obsoleta</i>
Eastern King snake	<i>Lampropeltis getula getula</i>
Scarlet King snake	<i>Lampropeltis elapsoides</i>
Southern Copperhead	<i>Aqkistrodon contortrix contortrix</i>
Eastern Cottonmouth	<i>Aqkistrodon Discivorus piscivorus</i>

Canebrake Rattlesnake	<i>Croatalus horridus atricaudatus</i>
Rainbow snake	<i>Farancia erythrogrampa erythrogrampa</i>

Turtles

Common Snapping turtle	<i>Cheldra serpentine serpentine</i>
Stinkpot	<i>Sternotherus odoratus</i>
Eastern Mud turtle	<i>Kinosternon subrubrum subrubrum</i>
Spotted turtle	<i>Clemmys guttata</i>
Eastern Box turtle	<i>Terrepene carolina carolina</i>
Eastern Painted turtle	<i>Chrysemys victa victa</i>
Yellow-bellied turtle	<i>Trachemys scripta scripta</i>
Red-bellied turtle	<i>Psuedemys rubriventris</i>

Lizards

Northern Fence lizard	<i>Sceloporus undulatus hyacinthinus</i>
Ground Skink	<i>Scincella lateralis</i>
Five-Lined Skink	<i>Eumeces fasciatus</i>
Broad-Headed Skink	<i>Eumeces laticeps</i>
Southeastern Five-Lined Skink	<i>Eumeces inexpectatus</i>

Toads & Frogs

Eastern Spadefoot	<i>Scaphiopus holbrooki holbrooki</i>
American Toad	<i>Bufo americanus</i>

Southern Toad	<i>Bufo terrestris</i>
Fowler's Toad	<i>Bufo woodhousii fowleri</i>
Oak Toad	<i>Bufo cruercicus</i>
Spring Peeper	<i>Pseudacris crucifer</i>
Pinewoods Tree frog	<i>Hyla femoralis</i>
Squirrel Tree frog	<i>Hyla squirella</i>
Gray Tree frog	<i>Hyla versicolor</i>
Little Grass frog	<i>Pseudacris ocularis</i>
Upland Chorus frog	<i>Pseudacris triseriata feriarum</i>
Brimley's Chorus frog	<i>Pseudacris brimlevi</i>
Southern Cricket frog	<i>Acris gryllus gryllus</i>
Bullfrog	<i>Rana catesbeiana</i>
Carpenter frog	<i>Rana virgatipes</i>
Green frog	<i>Rana clamitans melanota</i>
Southern Leopard frog	<i>Rana utricularia</i>
Eastern Narrow-mouthed frog	<i>Gastrophyrne caralinensis</i>

Salamanders

Greater Siren	<i>Siren lacertina</i>
Two-toed Amphiuma	<i>Amphiuma means</i>
Marbled salamander	<i>Ambystoma opacum</i>
Red-backed salamander	<i>Plethodon cinereus cinereus</i>
Slimy salamander	<i>Plethodon glutinosus</i>
Many-lined salamander	<i>Stereochilus marginatus</i>
Southern Two-lined salamander	<i>Eurycea bislineata cirrigera</i>

The species listed below have not been observed in the Dismal Swamp. However, due to their range, these species may occur in areas of the swamp.

Florida Cooter	<i>Pseudemys floridana floridana</i>
River Cooter	<i>Pseudemys concinna</i>
Eastern Slender Glass lizard	<i>Ophisaurus attenuatus longicaudus</i>
Green Anole	<i>Anolis carolinensis</i>
Eastern Glass lizard	<i>Ophisaurus ventralis</i>
Southern Dusky Salamander	<i>Desmognathus auriculatus</i>

Plants

Trees

Loblolly Pine	<i>Pinus taeda</i>
Pond Pine	<i>Pinus serotina</i>
Bald Cypress	<i>Taxodium distichum</i>
Atlantic white cedar	<i>Chamaecyparis thyoides</i>
Red Cedar	<i>Juniperus virginiana</i>
Black Willow	<i>Salix nigra</i>
Swamp Cottonwood	<i>Populus-heterophylla</i>
Hop Hornbeam	<i>Ostrya virginiana</i>
Musclewood	<i>Carpinus caroliniana</i>
American Beech	<i>Fagus grandifolia</i>
White Oak	<i>Quercus alba</i>
Overcup Oak	<i>Quercus lyrata</i>
Swamp Chestnut Oak	<i>Quercus michauxii</i>
Southern Red Oak	<i>Quercus falcata</i>
Cherrybark Oak	<i>Quercus pagoda</i>
Water Oak	<i>Quercus nigra</i>

Willow Oak	<i>Quercus phellos</i>
Laurel Oak	<i>Quercus laurifolia</i>
Post Oak	<i>Quercus stellata</i>
Black Oak	<i>Quercus velutina</i>
Yellow Poplar	<i>Liriodendron tulipifera</i>
Southern Magnolia	<i>Magnolia grandifolia</i>
Sweetbay	<i>Magnolia virginiana</i>
Pawpaw	<i>Asimina triloba</i>
Redbay	<i>Persea borbonia</i>
Sassafras	<i>Sassafras albidum</i>
Sweet gum	<i>Liquidambar styraciflua</i>
American sycamore	<i>Platanus occidentalis</i>
Washington Thorn	<i>Crataegus phaenopyrum</i>
Shadbush	<i>Amelanchier canadensis</i>
American Holly	<i>Ilex opaca</i>
Box Elder	<i>Acer negundo</i>
Red Maple	<i>Acer rubrum</i>
Silky Camellia	<i>Stewartia malacodendron</i>
Black Gum	<i>Nyssa sylvatica</i>
Tupelo Gum	<i>Nyssa aquatica</i>
Dogwood	<i>Cornus florida</i>
Sourwood	<i>Oxydendrum arboreum</i>
Persimmon	<i>Diospyros virginiana</i>
Horse Sugar	<i>Symplocos tinctoria</i>
Green Ash	<i>Fraxinus pennsylvanica var. subintegerrima</i>
Pumpkin Ash	<i>Fraxinus tomentosa</i>
Black Cherry	<i>Prunus serotina</i>

Shrubs

Wax Myrtle	<i>Myrica cerifera</i>
Tag Alder	<i>Alnus serrulata</i>
Virginia Willow	<i>Itea virginica</i>
Swamp Rose	<i>Rosa palustris</i>
Red Chokeberry	<i>Pyrus arbutifolia</i>
Wild Azalea	<i>Rhododendron nudiflorum</i>
Swamp Azalea	<i>Rhododendron viscosum</i>
Sheep Laurel	<i>Kalmia augustifolia</i>

Male-Berry	<i>Lyonial ligustrina</i>
Fetter-Bush	<i>Lyonia lucida</i>
Dog-Hobble	<i>Leucothoe axillaris</i>
Fetter Bush	<i>Leucothoe racemosa</i>
Poison Sumac	<i>Rhus vernix</i>
Winged Sumac	<i>Rhus copallina</i>
Winterberry	<i>Ilex verticillata</i>
Inkberry	<i>Ilex glabra</i>
Sweet Gallberry	<i>Ilex coriacea</i>
Strawberry Bush	<i>Euonymus americanus</i>
Devil's Walking Stick	<i>Aralia spinosa</i>
Sweet Pepperbush	<i>Clethra alnifolia</i>
Highbush Blueberry	<i>Vaccinium corymbosum</i>
French Mulberry	<i>Callicarpa americans</i>
Possumhaw Virburnum	<i>Viburnum nudum</i>
Elderberry	<i>Sambucus canadensis</i>
Titi	<i>Cyrilla racemiflora</i>
Groundsel-Tree	<i>Baccharis halimifolia</i>
Silky Camellia	<i>Stewartia malacodendron</i>

Vines

Greenbrier	<i>Smilax hispida</i>
Greenbrier	<i>Smilax rotundifolia</i>
Greenbrier (Sawbrier)	<i>Smilax glauca</i>
Greenbrier (Coral Greenbrier)	<i>Smilax walteri</i>
Greenbrier	<i>Smilax laurifolia</i>
Wild Yam	<i>Dioscorea villosa</i>
Leather-Flower	<i>Clematis crispa</i>
Climbing Hydrangea	<i>Decumaria barbara</i>
Poison Ivy	<i>Rhus radicans</i>
Rattan Vine	<i>Berchemia scandens</i>
Muscadine Grape	<i>Vitis rotundifolia</i>
Fox Grape	<i>Vitis labrusca</i>

Summer Grape	<i>Vitis aestivalis</i>
Maypop	<i>Passiflora incarnate</i>
Yellow Jassamine	<i>Gelsemium sempervirens</i>
Cross Vine	<i>Bignonia capreolata</i>
Trumpet Vine	<i>Campsis radicans</i>
Japenese Honeysuckle	<i>Lonicera japonica</i>
Coral Honeysuckle	<i>Lonicera sempervirens</i>
Climbing Hempweed	<i>Mikania scandens</i>
Virginia Creeper	<i>Parthenocissus quinquefolia</i>

Ferns and Fern Allies

Groundpine	<i>Lycopodium tristachyum</i>
Running Pine	<i>Lycopodium flabelliforme</i>
Royal Fern	<i>Osmunda regalis</i>
Cinnamon Fern	<i>Osmunda cinnamomea</i>
Climbing Fern	<i>Lycopodium palmatum</i>
Hay-scented Fern	<i>Dennstaedtia punctilobula</i>
Bracken Fern	<i>Pteridium aquinum</i>
Southern Lady Fern	<i>Athyrium asplenioides</i>
Log Fern	<i>Dryopteris celsa</i>
Fancy Fern	<i>Dryopteris intermedia</i>
New York Fern	<i>Thelypteris noveboracensis</i>
Marsh Fern	<i>Thelypteris palustris</i>
Sensitive Fern	<i>Onoclea sensibilis</i>
Netted Chain Fern	<i>Woodwardia areolata</i>
Virginia Chain Fern	<i>Woodwardia virginica</i>
Ebony Spleenwort	<i>Asplenium platyneuron</i>
Resurrection Fern	<i>Pleopeltis polypodioides</i>

Herbaceous Plants

Duckweeds	<i>Lemna valdiviana</i>
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Duckweeds	<i>Spirodela gligorrhiza</i>
Dayflower	<i>Commelina virginica</i>
Dwarf Trillium	<i>Trillium pusillum</i>
Indian Cucumber-root	<i>Medeola virginiana</i>
Blue Eyed Grass	<i>Sisyrinchium angustifolium</i>
Pink Lady's Slipper	<i>Cypripedium acaule</i>
Southern Twayblade	<i>Listera australis</i>
Downy Rattlesnake Pantain	<i>Goodyera pubescens</i>
Crane Fly Orchid	<i>Tipularis bicolor</i>
Lizard's Tail	<i>Saururus cernuus</i>
False nettle	<i>Boehmeria cylindrical</i>
Mistletoe	<i>Phoradendron flavescens</i>
Jumpseed	<i>Tovara virginiana</i>
Smartweed	<i>Polygonum hydropiperoides</i>
Knotweed	<i>Polygonum pensylvanicum</i>
Pokeweed	<i>Phytolacca americans</i>
Chickweed	<i>Stellaria media</i>
Yellow Pond-Lilly	<i>Nuphar luteum</i>
Leather Flower	<i>Clematis viorna</i>
Buttercups	<i>Ranunculus-species</i>
Bitter Cress	<i>Eardamine hirsuta</i>
Mock Strawberry	<i>Duchesnea indica</i>
Partridge Pea	<i>Cassia fasciculata</i>
Lespedeza	<i>Lespedeza cuneata</i>
Lady's Sorrel	<i>Oxalis dillenii</i>
Wild Geranium	<i>Geranium carolinianum</i>
Jewel-Weed	<i>Impatiens pallida</i>
St. John's Wort	<i>Hypericum hypericoides</i>
St. John's Wort	<i>Hypericum mutilum</i>
St. John's Wort	<i>Hypericum virginicum</i>
Violet	<i>Viola primulifolia</i>
Water Loosestrife	<i>Decodon verticillatus</i>
Meadow-Beauty	<i>Rhexia marina</i>
Water Primrose	<i>Ludwigia alternifolia</i>
Water Primrose	<i>Ludwigia palustris</i>
Mermaid-Weed	<i>Proserpinaca palustris</i>
Queen Anne's Lace	<i>Daucus carota</i>
Marsh Pennywort	<i>Hydrocotyle umbellate</i>

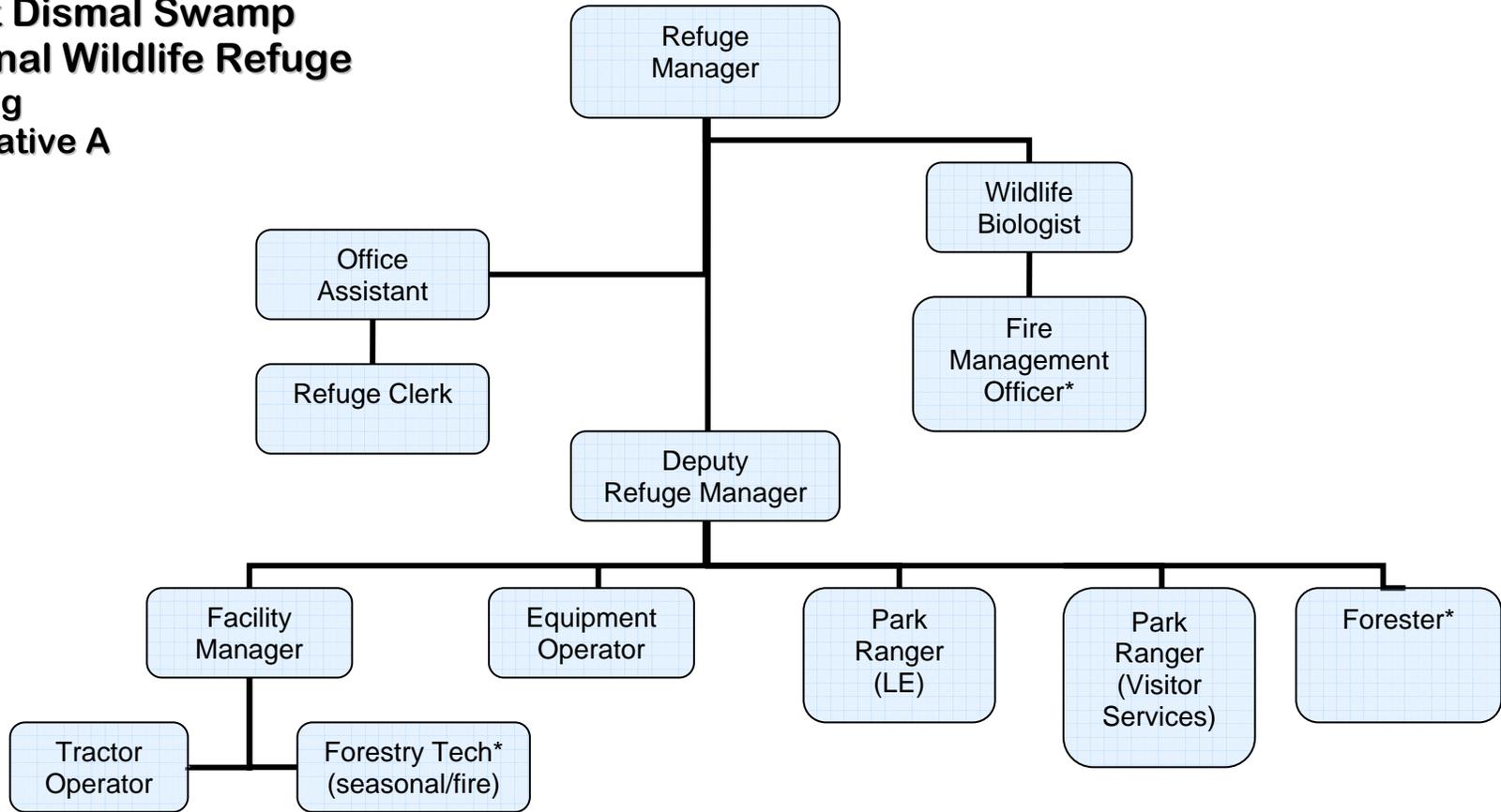
Heal-All	<i>Prunella vulgaris</i>
Skullcap	<i>Scutellaria integrifolia</i>
Nightshade	<i>Solanum carolinense</i>
Gerardia	<i>Agalinis purpurea</i>
Squaw-Root	<i>Conapholis americans</i>
Beech-Drops	<i>Epifagus virginiana</i>
Bladderwort	<i>Utricularia gibba</i>
Purple Bladderwort	<i>Utricularia purpurea</i>
Great Bladderwort	<i>Utricularia inflata</i>
Diodia	<i>Diodia virginiana</i>
Partridge Berry	<i>Mitchella repens</i>
Cardinal Flower	<i>Lobelia cardinalis</i>
Yarrow	<i>Achillea millefolium</i>
Daisey Fleabane	<i>Erigeron annuus</i>
Dog-Fennel	<i>Eupatorium capillifolium</i>
Mistflower	<i>Eupatorium coelestinum</i>
Joe-Pye-Weed	<i>Eupatorium dubium</i>
Goldenrod	<i>Solidago erecta</i>
Coastal Swamp Goldenrod	<i>Solidago latissimifolia</i>
Dandelion	<i>Taraxacum officinale</i>
Ironweed	<i>Vernonia noveboracensis</i>

Grasses-Sedges-Rushes

Cotton Grass	<i>Eriophorum virginicum</i>
Wool Grass	<i>Scripus cyperinus</i>
Foxtail Grasses	<i>Setaria - species</i>
Panic Grasses	<i>Panicum - species</i>
Sedges	<i>Cyperus - species</i>
Sedges	<i>Carex - species</i>
Switch Cane	<i>Arundinaria gigantea</i>
Rushes	<i>Juncus bufonus</i>
Rushes	<i>Juncus repens</i>

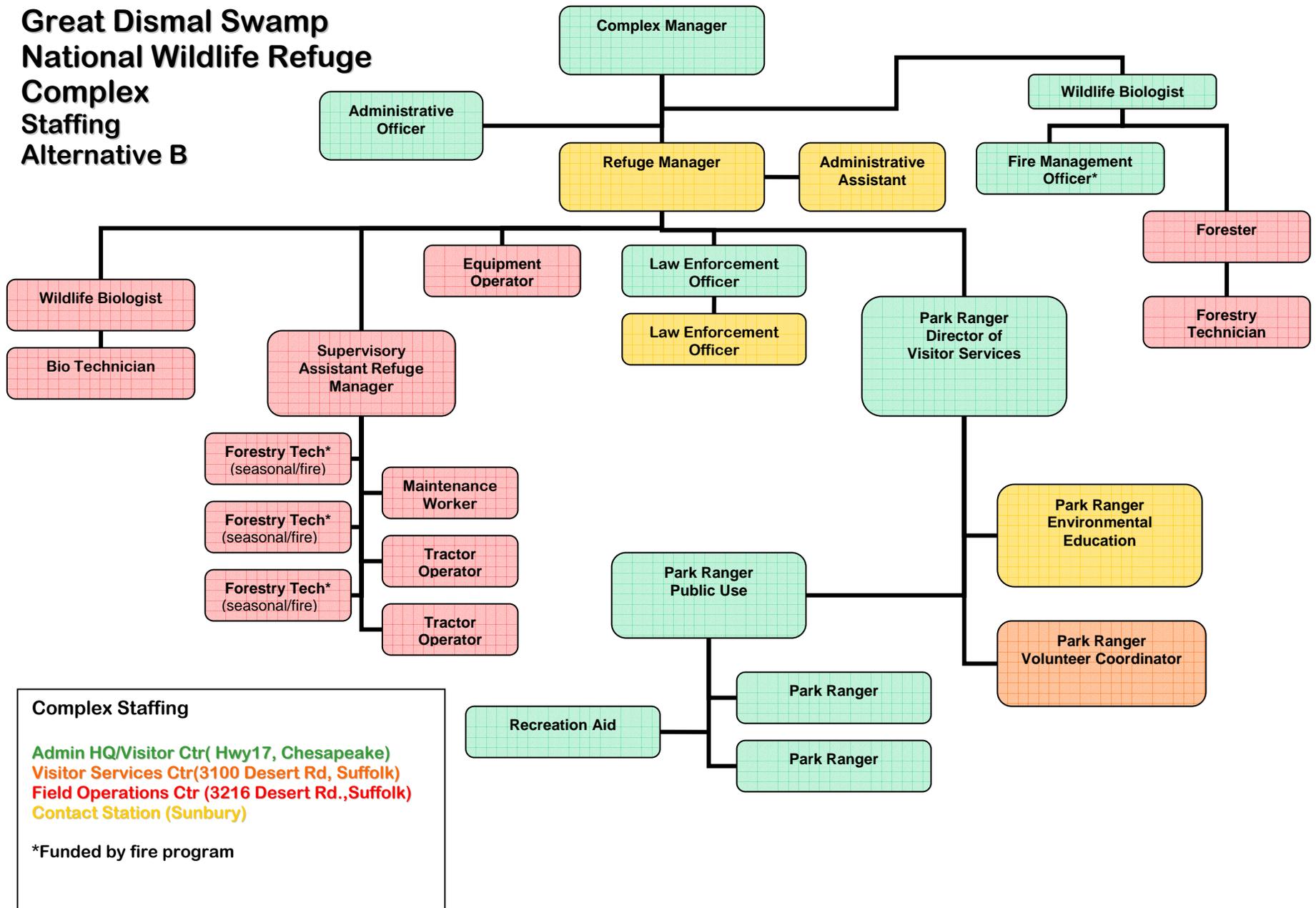
**Appendix D:
Staffing for Alternatives**

Great Dismal Swamp National Wildlife Refuge Staffing Alternative A



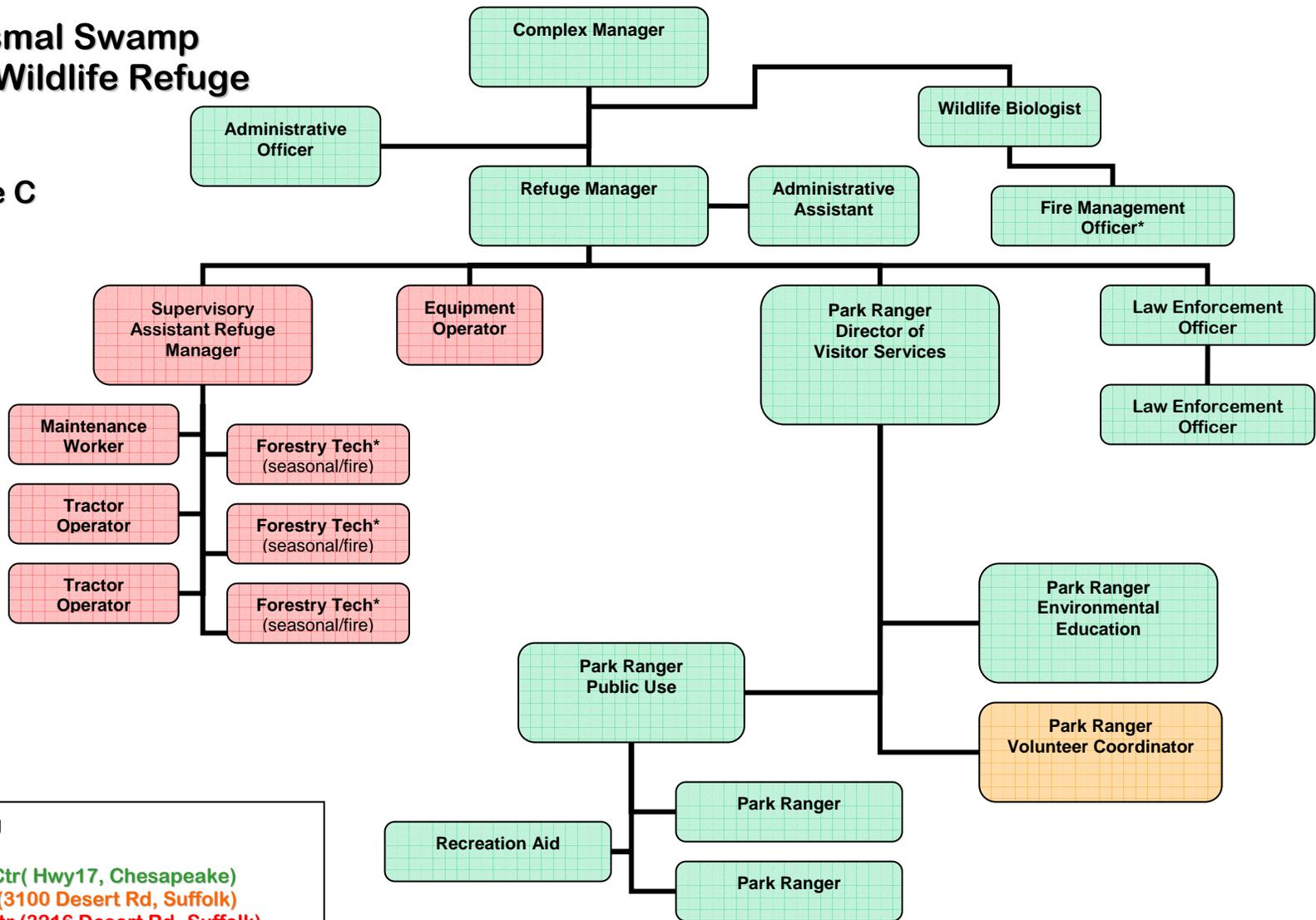
*** Funded by fire program**

Great Dismal Swamp National Wildlife Refuge Complex Staffing Alternative B



Complex Staffing
 Admin HQ/Visitor Ctr(Hwy17, Chesapeake)
 Visitor Services Ctr(3100 Desert Rd, Suffolk)
 Field Operations Ctr (3216 Desert Rd.,Suffolk)
 Contact Station (Sunbury)
 *Funded by fire program

Great Dismal Swamp National Wildlife Refuge Complex Staffing Alternative C



Complex Staffing
 Admin HQ/Visitor Ctr(Hwy17, Chesapeake)
 Visitor Service Ctr(3100 Desert Rd, Suffolk)
 Field Operations Ctr (3216 Desert Rd.,Suffolk)

*Funded by fire program

Appendix E

Appendix E: Compatibility Determinations

Use: Black Bear Hunt

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

A. What is the use? Is the use a priority use?

The use is public hunting of black bears. The entire refuge supports black bears. The refuge contains one of the largest concentrations of black bears on the east coast of the United States. Two studies completed on the bear population within the Great Dismal Swamp, almost 20 years apart, have shown little change in the population density (Hellgren 1988 and Tredick 2005) which indicates a stable population of bears. The population is estimated to be approximately 250-350 bears. Hunters would experience a high quality wildlife-dependent recreational activity which is limited in the surrounding area. Hunting is identified in the National Wildlife Refuge System Act of 1997 as a priority wildlife-dependent public use.

B. Where would the use be conducted?

The hunt will be conducted at up to two entrances within Virginia portion of the refuge. Deer hunting is also allowed in this area but prior to the bear hunts. The first year the hunt areas will be access through the Railroad Ditch and the Jericho Ditch Entrances. The total acreage open to hunting during this first year will be approximately 20,700 acres. Each year the hunt and hunt areas will be evaluated and the specific hunting units may change but more than 25% of the refuge will be open for bear hunting.

C. When would the use be conducted?

Hunts will be conducted on up to two dates in late November or early December in accordance with the established bear hunting seasons in Virginia. The areas are also opened to white-tailed deer hunting on designated dates in October and early November but the hunts will not overlap. Accessibility to much of the hunt area can be significantly impacted by rain events. A combination of rain soaked roads and vehicle traffic can cause damage to the roads as well as make access difficult or impossible. Because of this problem, if a significant rain event occurs or is predicted the scheduled hunt may be postponed to alternate rain delay dates. These rain delay dates will be identified in advance.

D. How would the use be conducted?

Permits will be required by hunters to manage both access and harvest. No more than 100 permits will be issued. This will help to ensure that the hunt does not negatively impact the black bear population and to enhance hunter safety. These permits will be issued through a random drawing. Hunters will be limited to the use of shotguns, 20 gauge or larger, loaded with slugs. The use of dogs to hunt bears will be prohibited. Hunters will be required to check in and out each day. The harvest limit will be approximately 20 bears. The take each day will be monitored and if more than 10 bears are harvested on the first day, various parameters will be evaluated and the second hunt day may be cancelled. The hunt areas will be closed to other public use during the hunt; however, other trails will continue to be open.

E. Why is the hunt being proposed?

The main purpose of the hunt is to add a priority wildlife-dependent recreational opportunity for the public. There are limited public hunting opportunities in southeastern Virginia and northeastern North Carolina. By implementing a bear hunt an additional 200 hunter days will be provided to the area. Additionally, the continued loss of habitat and corridors outside the refuge may eventually create the need to maintain or reduce the black bear population to levels that can be safely supported solely by the refuge. Due to this concern, collaboration with biologists from the Virginia Department of Game and Inland Fisheries and the North Carolina Wildlife Resources Commission began in 1997 to assess the status of bear populations within the refuge watershed and determine the desirability to controlling the refuge bear population. After meeting with bear managers and experts from North Carolina and Virginia, a conservative bear hunt was proposed. This hunt would provide a wildlife-oriented recreational opportunity as well as provide the refuge with information on the physical parameters of the bear population.

Availability of Resources: The refuge will partner with the Virginia Department of Game and Inland Fisheries to obtain and record bear harvest data. Expense to the refuge will be minimal and primarily confined to issuing permits, staffing the entrance, and minor road repairs.

Staff time:	\$5,000
Road maintenance:	\$10,000

A portion of this cost will be recouped through a permit fee.

Anticipated Impacts of the Use: Implementing a limited recreational bear hunt in Virginia would result in negligible adverse, short-term impacts to the black bear population. These impacts would consist of disruption of daily activities such as foraging and resting during the bear hunt. Also, two of the entrances will be closed to other public uses. This impact will be minimal, since the hunts will be conducted during a lower use period, and at least one other entrance will be open for other visitation.

An in-depth evaluation of the potential long-term impacts of the bear hunt was conducted. Two studies completed on the bear population within the Great Dismal Swamp, almost 20 years apart, have shown little change in the population density (Hellgren 1988 and Tredick 2005) which indicates a stable population of bears.

The initial harvest recommendation was set based upon consultation with the Virginia Department of Game and Inland Fisheries, the North Carolina Wildlife Resources Commission, and Dr. Michael Vaughan of Virginia Polytechnic Institute and State University (VPI&SU) (the professor involved with both of the above-cited bear studies).

A harvest target of 20 bears for the hunt was based on the conclusion of the researchers that a hunt would not have an adverse impact on the bear population if no more than 20% of the female bears were taken. Both of the above cited studies assume a population of approximately 250-350, and a 50:50 male:female sex ratio is generally assumed. Twenty percent of the female bear population would then be 25-35 bears. This hunt proposes a cap of 20.

Additionally, the maximum number of hunters was determined by examining hunter success rates. Nearby states have hunter success rates of up to 5.5% on bear hunts. This rate included hunts with dogs and hunts on previously un-hunted populations as well as hunts on denser populations (2004-2005 Maryland DNR Black Bear Report). If 100 hunters each day are allowed to hunt, using a 5.5% hunter success rate, a total of 11 bears might be taken over the two hunt days.

An additional evaluation of the 2005 study by Catherine Tredick concerning the potential of the hunt creating an isolated population was conducted. Tredick’s study states that “Genetic statistics at GDSNWR indicate that this population is isolated to some degree by geography (i.e., the Albemarle Sound) and encroaching urban development (i.e., the towns of Suffolk and Chesapeake). (Tredick 2005, i). Further discussion with both Tredick and Vaughan clarified that the Great Dismal Swamp population is isolated from the other two populations studied on the other side of the Albemarle Sound (Alligator River NWR and Pocosin Lakes NWR). Additionally they agreed that the hunt would not be detrimental to the bear population when held within the described parameters (personal communication, 26 October 2005, Columbia, NC).

Finally, no federal endangered or threatened species would be impacted by the hunt. Nor would there be any major impacts to state listed species. Based upon this review of the proposed bear hunt, impacts to the Great Dismal Swamp NWR bear population would be minimal.

Public Review and Comments: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 45 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: Black bear hunting is compatible with stipulations listed below.

Stipulations Necessary to Ensure Compatibility:

- The hunt program will be managed in accordance with state and federal regulations.
- No more than 100 bear hunt permits will be issued.
- Each hunter will be issued the list of refuge regulations.
- No more than two entrances will be open for hunting.
- Hunting will occur in late November or December to minimize the impacts on female bears.
- The harvest limit will be approximately 20 bears. If 10 or more bears are killed the first day, various parameters will be evaluated and the second hunt day may be cancelled.
- The hunt program will be reviewed annually to ensure the impacts on the population are sustainable.
- Hunt areas will be buffered to protect neighbors and visitors.
- News releases will be issued, the website updated, and signs posted to inform the public about the bear hunt before and during the event.
- Hunters must possess and carry the refuge permit.
- Hunters may use only shotguns, 20 gauge or larger, loaded with only slugs only. Buckshot may not be used.
- Dogs are prohibited.
- Hunters must wear 400 square inches (2600 square centimeters) of solid-colored, hunter orange clothing or material in a visible manner.
- Hunters must sign in and out each day.
- Hunters may not possess loaded firearms within 50ft (15m) of a refuge road, including roads closed to vehicles.
- Hunters may not shoot onto or across refuge roads, including roads closed to vehicles.

Justification: The National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57) identifies six priority wildlife-dependent public uses of national wildlife refuges: environmental education, interpretation, hunting, fishing, wildlife observation and wildlife photography. Where these uses are determined to be compatible, they are to receive enhanced consideration over other uses in planning and management. The bear hunt will provide a compatible wildlife-dependent recreational opportunity. Opening the Great Dismal Swamp NWR to black bear hunting will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: Refuge Manager _____ **Date** _____

Concurrence: Regional Chief _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

References

- Hellgren, Eric Charles. 1988. Ecology and Physiology of a Black Bear (*Ursus americanus*) Population in Great Dismal Swamp and Reproductive Physiology in the Captive Female Black Bear. Dissertation for Doctor of Philosophy. Virginia Polytechnic State and University. Blacksburg, VA. 231 pp..
- Tredick, Catherine Anne, 2005. Population Abundance and Genetic Structure of Black Bears in Coastal North Carolina and Virginia Using Noninvasive Genetic Techniques. Master of Science Thesis. Virginia Polytechnic Institute and State University. Blacksburg, Va.
- Maryland DNR. "2004-2005 Black Bear Project Report." Submitted by Harry Spiker, Black Bear Project Manager, August 22, 2005. Retrieved from website, <http://www.dnr.state.md.us/wildlife/gpar/gpbear.asp> on December 9, 2005.

Use: Collections

Refuge Name: Great Dismal Swamp National Wildlife Refuge

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Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

(a) What is the use? Is the use a priority public use?

Collecting small numbers of invertebrates, plants, water samples, archeological artifacts (which would remain the property of the US Fish and Wildlife Service) and soil samples for use in scientific and educational studies will be permitted. The establishing authorities for the refuge directed that environmental education would be among the priority public uses for the refuge, and the National Wildlife Refuge System Improvement Act identified environmental education as a priority use for the National Wildlife Refuge System. Much of the collection done on the refuge would be for environmental education purposes or research.

(b) Where would the use be conducted?

Most of the collections will be conducted at designated outdoor classroom sites at Jericho Lane, Washington Ditch, and the Railroad Ditch entrances. However, some collections will occur at other locations within the refuge to support biological, ecological, and archeological research. This activity will be limited during designated hunts. The Washington Ditch entrance and access to the boardwalk will be available during the hunts while the other entrances to the refuge will be closed to these activities due to safety concerns.

(c) When would the use be conducted?

Collections will occur throughout the year upon issuance of a special use permit. The permit will outline specific periods for the activity to avoid conflicts with refuge operations or unacceptable wildlife disturbance. The time period for collections may be limited based upon management and/or visitor use priorities.

(d) How would the use be conducted?

Permittees will be required to submit a request in writing documenting why and how the collections will be used for educational or scientific purposes. The requests will be reviewed by the refuge manager and resource management

specialists to develop stipulations for the permit, if necessary, to assure that the collection does not interfere with refuge operations or create unacceptable wildlife disturbance. The permittee must also present appropriate state and federal permits, if applicable. If the collections are part of research study, the permittee will be required to submit reports, to be stipulated within the permit, that allow the refuge manager to provide oversight of the collections and obtain useful information for science-based stewardship.

(e) Why is this use being proposed?

The refuge incorporates globally-rare habitats and some habitats that are rare within Virginia and North Carolina, so the refuge offers opportunities for scientists to study biological, ecological and archeological features that cannot be easily found elsewhere. Moreover, the research is expected to add to the body of knowledge required by refuge resource specialists to accomplish science-based stewardship of the Great Dismal Swamp ecosystem.

Availability of Resources: No special facilities will be required for these collections, so the basic cost to the refuge is the staff time (less than \$2,000 annually) required to review and process collection requests. Therefore, this activity would have no significant affect on refuge funding and staffing.

Anticipated Impacts of the Use:

Collections on the refuge may result in negligible impacts to air and water quality from the emissions of automobiles and automobile runoff from parking lots. These impacts are not expected to be significant.

While the activity of collecting may disturb individual wildlife and plants periodically, and result in the mortality of invertebrates and plants collected, no adverse impact on wildlife or plant populations or conflict with the refuge mission is anticipated.

Moderate, long-term positive impacts to archeological sites and artifacts are expected. Additionally, there will be some negative impacts to the sites as a result of soil disturbance during the investigation. These impacts will be moderate but short term. Some artifacts will be removed from these sites but the site will be restored. All collections will be collected under a research permit. Information collected as a result of these studies will increase cultural and historical knowledge of human use of the refuge and help to identify specific locations that need protection.

Public Review and Comment: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: The collection of natural resources and artifacts is compatible with stipulations listed below.

Stipulations to Ensure Compatibility:

- Collections will be restricted to permittees who have consulted refuge staff concerning special requirements needed to assure that the collections do not disrupt sensitive flora and fauna and to assure that collections do not disrupt refuge operations.
- Permittees must present appropriate state and federal permits that may be required in addition to the refuge permit.
- The collections will be monitored to assure compliance with permit conditions and assess impacts.
- Collections will not be permitted unless a demonstrated need exists to examine flora and fauna specific to the Great Dismal Swamp ecosystem.
- Less than 50 collection permits will be issued annually.
- Most collections will involve insects, aquatic invertebrates, plant cuttings, and soil, water.
- Most collections will occur within designated outdoor classroom areas; thus confining the minimal wildlife disturbance to small specific areas of the refuge.

Justification:

The Great Dismal Swamp National Wildlife Refuge arguably incorporates the best remaining remnant of an expansive wetlands ecosystem. Therefore, the study of flora and fauna specific to the once vast system will often focus within the refuge, and these collections will support and be a part of scientific research and education. Information obtained as a result of many of the collections will be incorporated into environmental education and interpretation programs on the refuge.

The National Wildlife Refuge System Improvement Act of 1997 identified environmental education and interpretation as a priority public use for refuges. Moreover, the establishing legislation for the Great Dismal Swamp National Wildlife Refuge directed that wildlife and wildlands research and environmental education be the top priority public uses for the refuge. The collection of small numbers of invertebrates, plants, water, archeological artifacts and soil samples for use in scientific and educational studies of Great Dismal Swamp NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: **Refuge Manager** _____ **Date** _____

Concurrence: **Regional Chief** _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

Use: Concession operation

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

(a) What is the use? Is the use a priority public use?

A concession operation will be established to support visitor services in Suffolk and Chesapeake. These services will include guided boat tours on Lake Drummond; public transportation to Lake Drummond; canoe, kayak, and bicycle rentals; and the sale of snacks, soft drinks, and educational materials. The concession operation will facilitate wildlife observation, interpretation, wildlife photography, and environmental education, four of the six wildlife-dependent priority public uses identified in the National Wildlife Refuge System Improvement Act.

(b) Where would the use be conducted?

In Suffolk, the existing headquarters facility will be converted to a visitor services center that will support concession operations that provide a tram service to Lake Drummond; boat tour on Lake Drummond; canoe, kayak, and bicycle rentals; and sale of educational materials and snacks. To support these concession activities, the facilities will have to be improved as follows: expansion of existing parking; retrofitting headquarters for bookstore and concession offices; construct a 200 yard road to link the existing parking lot to Railroad Ditch.

In Chesapeake, concession operations will part of a new visitor center complex adjacent the Dismal Swamp Canal and US Highway 17. This operation will support canoe, kayak, and bicycle rental; tour boat transportation to Lake Drummond; and the sale of snacks and educational materials.

(c) When would the use be conducted?

The normal operating hours for the concessions would be daylight hours every day, including weekends and holidays, seven days a week, in both Suffolk and Chesapeake portions of the refuge. These operating hours may be subject to modification due to management or biological demands. Any changes to the normal routine will be advertised in advance when possible. This activity will be limited during designated hunts. The Washington Ditch

entrance and access to the boardwalk will be available during the hunts while the other entrances to the refuge will be closed to this activity due to safety concerns.

(d) How would the use be conducted?

The refuge would solicit concessionaires through a competitive bidding process. The successful bidder would enter into a contract or cooperative agreement with the refuge to provide basic visitor services at the specified locations on the refuge. The concessionaire would compensate the U.S. Fish and Wildlife Service through rendering payments and/or services to the refuge.

(e) Why is this used being proposed?

The concessionaire services will enhance the safety and enjoyment of visitors who are participating in priority wildlife dependent recreational activities that have been identified by the establishing authorities and the National Wildlife Refuge Improvement Act. This will also reduce the need for additional refuge staff.

Availability of Resources: These activities would be part of a proposed major expansion of visitor services that would require additional specific budget allocations to support the construction of new facilities in Chesapeake and restoration of facilities in Suffolk. The estimated cost of implementation is summarized as follows:

Suffolk – Rehab of existing headquarters/parking*	\$2,000,000
one staff (ORP)	\$50,000
Tram*	\$150,000
Tram maintenance	\$10,000

*start-up cost

Anticipated Impacts of Use:

Soil and vegetation disruption will result from expanding the parking area at the refuge headquarters and constructing the 200-yard road to link the parking area directly to Railroad Ditch. This would be mitigated by best management practices during construction. Less than one acre of pine forest habitat would be impacted. This impact will be minor due to the scope but long term.

Some negligible long-term impacts to water quality would occur along the ditches of the Railroad Ditch entrance, since paved surfaces would result in vehicle fluids flowing into ditches rather than absorbed in the dirt roads. Increased vehicle emissions would occur due to increased visitation and the operation of on the refuge. To limit the amount of vehicle emissions that increased visitation would bring, an electric tram will be utilized to conduct tours.

Wildlife disturbance at designated public use corridors will increase minimally due to increased numbers of visitors. This impact will be mitigated by emphasizing the use of low impact transportation (canoes, kayaks, bicycles, hiking, tram). Only 21 acres of 111,201 acres would be impacted by this use (0.019%).

Improved visitor support services will likely result in annual visitation to the western refuge entrances increasing to 100,000 visits. This impact will be limited to designated, trails and waterways. The bulk of the refuge will not be impacted by this visitation.

Public Review and Comment: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for nine months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: A concession operation is compatible with stipulations listed below.

Stipulations Necessary to Ensure Compatibility:

- The concession operations will be conducted in accordance with a contract or cooperative agreement between the concessionaire and the Service.
- The agreement will ensure that impacts to the resources in the refuge are minimal.
- Impacts will be monitored so that any sign of unacceptable damage or disturbance would be ameliorated immediately.
- All activities will be conducted within existing refuge regulations.

Justification: The National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57) identifies six legitimate and appropriate uses of wildlife refuges: environmental education, interpretation, hunting, fishing, wildlife observation and wildlife photography. These priority public uses are dependent upon healthy wildlife populations. Where these uses are determined to be compatible, they are to receive enhanced consideration over other uses in planning and management.

The concession operation will directly support fishing, wildlife observation and photography, and environmental education/interpretation --- priority uses identified by the National Wildlife Refuge System Improvement Act of 1997. The refuge's establishing legislation also directed that concessions operations be used to support access and transportation to Lake Drummond and the Dismal Swamp Canal. A concessionaire will also provide local economic benefits and support priority visitor service operations.

The use of concession operations to facilitate wildlife dependent priority public uses on the Great Dismal Swamp NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: **Refuge Manager** _____ **Date** _____

Concurrence: **Regional Chief** _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

Use: White-tailed deer hunt

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

(a) What is the use? Is this use a priority public use?

White-tailed deer hunting will be conducted on approximately 100,000 acres of the refuge. Hunting is identified as a priority use by the establishing authorities for the refuge as well as the National Wildlife Refuge Improvement Act. This is an historic and traditional use of the Great Dismal Swamp and will provide a quality wildlife-dependent recreational opportunity to the participating hunters. Special youth hunts will be scheduled in various areas of the refuge within state seasons.

(b) Where would the use be conducted?

Deer hunting will take place from up to 80 miles of refuge roads. Usually hunters do not hunt further than 200-300 yards from the road. Hunters will gain access into the refuge at Portsmouth Ditch in Chesapeake; Jericho Lane and Railroad Ditch in Suffolk; and Corapeake Ditch in Gates County, North Carolina. To ensure the safety of people visiting the office and the boardwalk along Washington Ditch buffer areas around these areas are closed to hunting activities. Additionally, areas along the Dismal Swamp Canal, the Feeder Ditch and other publicly used canals have been closed to protect the public. Portions of the hunt area may be closed due to management activities.

(c) When would the use be conducted?

The hunts will be scheduled within the deer hunting seasons established by Virginia and North Carolina. Traditionally, these hunts have been held in October, November, and December. The timing of the hunts on the refuge will continue to be coordinated annually with the states. In Virginia, the refuge is situated on the eastern side of the "Dismal Swamp Line," a geographical boundary that distinguishes between the early season which generally starts in early October, and the late season, which starts in mid-November. The refuge therefore hosts the deer hunt during the early season. In North Carolina, the refuge season begins shortly before the rest of the North Carolina season. State biologists and administrators have approved the refuge season in North Carolina.

(d) How would the use be conducted?

Hunters will purchase hunt permits from the refuge during publicly announced periods in August and September. The permit will allow hunters to gain access into up to four designated locations on the refuge for scouting days and all designated hunt dates. During the designated hunt dates, a maximum hunter capacity will be established for each entrance in order to inhibit overcrowding of the hunt areas. Hunting will occur only during legal hunting hours specified by the states. Bag limits are the same as the states' generally, but the refuge allows either sex to be taken during the entire hunt, which is variably different from the surrounding states. Once again, this has been coordinated with the states and meets with their approval.

(e) Why is this use being proposed?

The primary purpose of the deer hunts is to maintain the deer population within the carrying capacity of the refuge habitat. Harvested deer will be spot-checked to monitor the overall health of the deer population. The hunts also provide a wildlife-dependent priority public use activity identified by the establishing authorities for the refuge and the National Wildlife Refuge Improvement Act. In eastern Virginia especially, there are very few other public hunting lands available.

Availability of Resources: A fee is charged for each hunt permit, and most of the fee is returned to the refuge to support visitor services and partially offset the cost of administering the hunts. The estimated costs are summarized below:

Permit administration:	\$5,000
Road maintenance:	\$20,000
Law Enforcement:	\$2,000
Security/Search and Rescue:	\$2,000

Anticipated Impacts of the Use: Accommodating this wildlife-dependant use is expected to result in minimal impacts. Although hunting causes mortality to wildlife, season dates and bag limits are set with the long-term health of populations in mind. The white-tailed deer population is monitored by state agencies. Survey information indicates that a limited harvest will not adversely affect the overall deer population level. A healthy deer population will be sustained as a result of maintaining the population within an acceptable level that can be supported by the habitat. Minimal disturbance to wildlife and vegetation will occur, most of which occurs within 200-300 yards of the roads. This is typically minimal and short-term in duration. Overall impacts of disturbance are minimized by only hunting 14 days of the deer season. Vehicle impacts to the refuge are usually minimal and short-term. Vehicles are restricted to designated roadways and no off-road access is allowed. Regular refuge operations are disrupted on hunt dates, since the refuge staff must support an extended shift (16 hours) and maintain preparedness for law enforcement and search/rescue operations.

To reduce possible conflicting uses of the refuge other non-hunting uses are severely limited. Washington Ditch and the $\frac{3}{4}$ mile boardwalk trail is open to allow for other wildlife-dependent uses. The impacts to other public uses are substantial for the fourteen days of the deer hunt but mitigated by allowing access as the Washington Ditch area.

Public Review and Comment: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: White-tailed deer hunting is compatible with stipulations listed below.

Stipulations Necessary to Ensure Compatibility:

- Deer harvest data and hunter participation will be evaluated annually to assess the effectiveness of the deer hunt program in supporting refuge resource management objectives and wildlife oriented recreational opportunities.
- All hunters must obtain a refuge hunt permit.
- Only shotguns and archery equipment only.
- All hunters must obtain an appropriate state hunting license and comply with state and refuge regulations.

- All hunters must carry a compass and whistle
- All hunters must sign in and out each day.
- A maximum of 1000 hunters will be issued hunt permits.
- Approximately 200 deer (or less) will be harvested each season.
- Approximately 80 miles of roads will be maintained and mowed before each hunt, and some road repairs will be required during rainy hunt seasons.
- General visitors will be confined to using the Washington Ditch Entrance (Dismal Town Trail) on hunt dates.

Justification:

Natural predation and mortality are not adequate to maintain deer populations at levels consistent with the habitat, so overpopulation would be expected to develop without the deer hunt, resulting in a significant decline in the health and vitality of the deer and habitat degradation. Hunting is also recognized as a wildlife-dependent priority public use within the National Wildlife Refuge System and the establishing legislation for the Great Dismal Swamp National Wildlife Refuge. White-tailed deer hunting on Great Dismal Swamp NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: **Refuge Manager** _____ **Date** _____

Concurrence: **Regional Chief** _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

Use: Hunt dog retrieval

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

(a) What is the use? Is the use a priority public use?

Hunting deer utilizing dogs is a historic and traditional method of hunting in southeastern Virginia and northeastern North Carolina. Although the refuge does not allow this activity on the refuge it is a popular method of hunting on surrounding refuge lands. Due to the proximity of this activity to refuge lands, hunting dogs occasionally stray onto refuge property and their owners seek permission to access the refuge to retrieve these dogs. Access will be permitted to retrieve hunting dogs that have been used for legal hunting on privately owned lands adjacent the refuge. This use is not identified as a priority use but does benefit the refuge by facilitating the removal of these dogs which disturb wildlife on the refuge.

(b) Where would the use be conducted?

Dogs stray across the boundary from the northeast corner to the southeast corner of the refuge. Individuals wishing to retrieve their dogs must obtain a Special Use Permit from the refuge office prior to entering the refuge. Permittees will be allowed vehicle access at the four entrances that are used for the white-tailed deer hunts: Portsmouth Ditch, Jericho Lane, Railroad Ditch, and Corapeake Ditch. Dog retrievers will not be allowed, in general, on Washington Ditch road.

(c) When would the use be conducted?

Vehicle access for dog retrieval will be allowed daily during daylight hours within the period between October 1 and early January (one week after the state deer hunting seasons close) with prior notification of refuge staff by the permittee. Access may be limited due to bad road conditions, other weather related conditions, or habitat management activities.

(d) How would the use be conducted?

Dog retrieval permits will be purchased from the refuge that will document stipulations and procedures to gain access to the refuge. Each permit allows five permittees access. For each day a dog retriever desires access, they will call the refuge office during normal office hours and receive the combination to the gate. Dog retrieval will not be combined with deer hunting. Dog retrievers will not be in possession of guns or bows and arrows. This activity may be limited due to road conditions or management activities.

(e) Why is this use being proposed?

Deer that are being legally tracked by dogs on adjacent lands frequently lead the chase into the refuge. The dogs are often led several miles deep into the refuge, exhausting them to the point that it is difficult for them to return to the point where the chase began. Hunting dogs also chase, harass and disturb wildlife. Therefore, allowing dog owners to retrieve the dogs represents the humane treatment of animals that were engaged in a lawful activity and helps to limit disturbance to wildlife. In addition, retrieving the dogs reduces the probability of developing a population of feral dogs on the refuge. Feral dogs disturb and prey on wildlife.

Availability of Resources: A user fee will be charged for the few permits that are issued for this use. Direct costs are estimated as follows:

Permit Administration:	\$1,000
Law Enforcement:	\$1,000

Anticipated Impacts of the Use:

Hunting dogs left for extended periods of time on the refuge can harass and kill wildlife and be particularly harmful to ground nesting birds during the nesting season. Some dogs can at times become a direct or perceived threat to other persons engaged in recreation on the Refuge. Young children especially can be easily frightened by dogs, and even knocked down and injured by overly friendly dogs. Dogs often leave waste at public use sites which many visitors find objectionable. This waste can also be deposited in wetlands. Hunting dogs will be removed from the refuge before they are injured, die, or become feral and disturb wildlife long-term. Very little disturbance to wildlife, plants, or other resources is expected from allowing permittees access to the refuge to retrieve dogs due to the low numbers of permittees. As with all access to the refuge, vehicles add emissions to the air and potential contaminants to the water, but these are expected to be negligible.

Public Review and Comment: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: Dog retrieval is compatible with stipulations listed below.

Stipulations Necessary to Ensure Compatibility:

- Special permit conditions for this activity will be reviewed and updated to assure that safe and efficient access is provided with minimal wildlife disruption.
- Approximately 30 permits (or fewer) will be issued annually to retrieve dogs.
- Permittees must call during normal office hours to receive authorization for entry into the refuge for permitted activity.
- Access will normally be allowed seven days a week during the designated dog retrieval season.
- Access may be denied or restricted based upon road conditions or management activities.
- Permittees will not possess guns or alcohol.
- Permittees will not be allowed vehicle access on Washington Ditch.

Justification:

These hunting dogs have been released during legal hunting activities off the refuge. However, failure to retrieve these dogs once they enter the refuge could result in their death due to exhaustion and starvation as well as significant disturbance to wildlife. Some of these dogs could become feral, creating more wildlife disturbance and threatening visitors. Therefore, it is in the refuge's best interest to have these dogs retrieved by their owners. Dog retrieval on Great Dismal Swamp NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: **Refuge Manager** _____ **Date** _____

Concurrence: **Regional Chief** _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

Use: Recreational fishing from boats on Lake Drummond.

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

(a) What is the use? Is the use a priority public use?

Fishing from boats will be permitted on Lake Drummond, one of two natural lakes in the state of Virginia. While fishing in Lake Drummond may not be perceived as high quality like you may find in other reservoirs, rivers, bays or sounds due to the lower fish population, it is more of a challenge to find the native fish in the dark water. Also, historically, a strong demand has existed to pursue black crappie during the spring on Lake Drummond, and the lake has produced trophy fish. Fishing has been identified as a wildlife-dependent priority public use by the establishing authorities for the refuge and the National Wildlife Refuge System Improvement Act.

(b) Where would the use be conducted?

Fishing will be restricted to Lake Drummond, and only allowed from a boat. Fishing from the bank causes erosion and compaction of fragile organic soils. Fishing from the boat ramp has been shown to result in increases in litter and fishing tackle left on the site. Ditches contain much debris that would snag fishing tackle creating litter and other debris to be left in the ditches.

(c) When would the use be conducted?

This activity will be permitted throughout the year, from sunrise to sunset, with most of the activity occurring during April-June. April through June is perceived to be the best time to fish Lake Drummond by the people who have traditionally used it. Boat access is allowed year round via the Feeder Ditch but restricted when accessing via Railroad Ditch entrance (April – June). This activity will be limited during designated hunts. Lake Drummond will be closed to these activities due to safety concerns.

(d) How would the use be conducted?

Lake Drummond is open to fishing all year from sunrise to sunset. Boaters entering from the east side of the refuge via the Chesapeake Boat Ramp and the Feeder Ditch do not have to have a permit. However, to access the

lake from that side, they have to transport their boats over a spillway, using a railway trolley to pull them across. That trolley is limited to lower weight boats, and thus the Army Corps of Engineers, who maintains it, has posted a motor size limit of 10 horsepower.

Access to the Lake through the Railroad Ditch entrance requires a permit. The refuge issues permits for boaters to launch their boats directly onto the west side of the lake via the Railroad Ditch entrance from April 1- June 15. These boats are limited to 25 horsepower.

(e) Why is the use being proposed?

The Service has the authority to control all public access to Lake Drummond. The Railroad Ditch Entrance is entirely within the refuge, and the Service can manage public access via the Feeder Ditch from US 17 under the terms of a long-term permit with the Corps of Engineers. Fishing has been identified as a wildlife-dependent priority use by the establishing authorities for the refuge and the National Wildlife Refuge System Improvement Act. Historically, a strong demand has existed to pursue black crappie during the spring on Lake Drummond, and the lake has produced trophy fish. Fishing on Lake Drummond is unique in that the lake is not stocked, and is not home to large populations of typical game fish. Fishing on a natural lake is more of a challenge, and the entire circumference of Lake Drummond is owned by the refuge, so there is very little evidence of human intrusion once the boat ramp is left behind, except for the occasional air traffic.

Availability of Resources: This activity can be support within existing funding levels for the refuge.

Annual Maintenance (roads, ramp, pier): \$5,000
Staff time (permits, inspections, law enforcement): \$5,000

Anticipated Impacts of the Use:

Fishing has shown no assessable environmental impact to the refuge, its habitats, or wildlife species in the past and is not anticipated to so in the future. Disturbance to wildlife is limited to occasional disturbance such as flushing non-target species (waterfowl) and harvesting fish species while recreational fishing. Restrictions on sizes of boats and motors will assure minimal impacts to aesthetics on the Lake Drummond and disturbance to wildlife and other public use activities. Harvests are regulated to take only surplus specimens, thus assuring viable, healthy populations within management and habitat guidelines. Restrictions to the fishing program assure that these activities have no adverse impacts on other wildlife species and little adverse impact on other public use programs. Minimal wildlife disturbance, erosion, automobile emissions, and automobile fluid contamination will occur along the launching routes and in Lake Drummond. This is limited by a restricted access season (April – June), ensuring minimal impact. Negligible oil residue from outboard exhausts may occur in the lake. Less than 5,000 motorized boats of ten horsepower or less will enter the lake from the Feeder Ditch. The activities follow all applicable laws, regulations and policies. These activities are compliant with the purpose of the refuge and the National Wildlife Refuge System Mission. Operating this activity does not alter the refuge's ability to meet habitat goals and it helps support several of the primary objectives of the refuge.

Fishing is a priority public use listed in the National Wildlife Refuge System Improvement Act. By facilitating this use on the refuge, we will increase visitors' knowledge and appreciation of fish and wildlife, which will lead to increased public stewardship of fish and wildlife and their habitats on the refuge and in general. Increased public stewardship will support and complement the Service's actions in achieving the refuge's purposes and the mission of the National Wildlife Refuge System.

Public Review and Comment: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: Fishing on Lake Drummond is compatible with stipulations listed below.

Stipulations to Ensure Compatibility:

- The fishing program will be evaluated periodically to determine impacts. If adverse impacts are detected fishing may be restricted or discontinued.
- Fishing is limited to Lake Drummond only.
- Access can be gained via the Feeder Ditch year round or the Railroad Ditch April through June.

- Boats are limited to a maximum of 25 horsepower engines. If access is gained via the Feeder Ditch then a boat utilizing the railway tram are limited to 10 horsepower engines.
- Must possess a valid state fishing license and comply with all state fishing and boating regulations.

Justification:

Fishing is a wildlife- dependent priority public use for the National Wildlife Refuge System. Moreover, this use was identified as priorities under the terms of the establishing legislation for the refuge. Fishing on the Great Dismal Swamp NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: **Refuge Manager** _____ **Date** _____

Concurrence: **Regional Chief** _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

Use: Research and Studies Conducted by Outside Agencies, Universities, and Organizations

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

(a) What is the use? Is the use a priority public use?

Research and studies by non-Service personnel will be permitted throughout the refuge. The research will focus on the study of the flora, fauna, ecology, and cultural history of the Great Dismal Swamp. This activity is not a priority use, but these studies provide analysis and information about the cultural and natural history of the Great Dismal Swamp. This information is critical to providing sound stewardship and restoration of the Great Dismal Swamp ecosystem. Collections of water, soil, plants and invertebrates will be allowed in conjunction with research when appropriate.

(b) Where would the use be conducted?

These studies will be conducted throughout the refuge, with the exact locations to be determined by the focus of the study. Each proposal will be evaluated by refuge staff and other subject matter experts to determine the value of the study and study site. If needed, recommendations to modify the study site will be provided.

(c) When would the use be conducted?

The timing will depend on the project that is being conducted. Research will be allowed to occur throughout the year. Individual research projects may require one or two visits per year, while other projects may require daily visits. The time allowed for each project will be limited to the minimum required to complete the project. This activity will be limited during designated hunts. The Washington Ditch entrance and access to the boardwalk will be available during the hunts while the other entrances to the refuge will be closed to these activities due to safety concerns.

(d) How would the use be conducted?

The methods will depend upon the research being conducted. Researchers will be required to submit a written proposal that outlines the methods, materials, timing, and justification for proposed project. These proposals will be reviewed by refuge resource management specialists to assess environmental impacts, assure that the project does not interfere with other resource operations, and provide suggested modifications to the project to avoid disruptions to refuge wildlife and operations. Research will be restricted to those projects that will be expected to enhance the body of knowledge about the natural and cultural history of the Great Dismal Swamp ecosystem. Researchers will be expected to obtain and present any additional federal, state, and archaeological permits if applicable.

(e) Why is this use being proposed?

The refuge incorporates wildlife and habitats that are uncommon in Virginia and North Carolina. Some habitats, such as the Atlantic white cedar forests and pine-pocosin woodlands, are considered globally-rare. Therefore, scientists would be hard-pressed to find representative areas outside the refuge on which to conduct studies. Moreover, the information generated by these studies enhances the ability of the Service to provide science-based stewardship of the Great Dismal Swamp ecosystem.

Availability of Resources: This activity can be supported within existing funding levels for the refuge. Refuge staff will be required to review, coordinate, process, and administer permit requests for this activity as summarized below:

Staff time – permits review/coordination: \$5,000
Monitoring/enforcement: \$5,000

Anticipated Impacts of the Use:

Research activities may disturb fish and wildlife and their habitats. For example, the presence of researchers can cause waterfowl or other migratory birds to flush from resting and feeding areas, cause disruption of birds and turtles on nests or breeding territories, or increase predation on nests and individual animals as predators follow human scent or trails. Efforts to capture animals can cause disturbance, injury, or death to groups of wildlife or to individuals. To wildlife, the energy cost of disturbance may be appreciable in terms of disruption of feeding, displacement from preferred habitat, and the added energy expended to avoid disturbance. Sampling activities can cause compaction of soils and the trampling of vegetation, and the establishment of temporary foot trails vegetation beds. Negligible vehicle emissions, contaminants from vehicle fluids and very minor erosion from roads might result from vehicle access to the research sites. Research efforts may also discover methods that result in a reduction in impacts described above.

Public Review and Comment: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: Research is compatible with stipulations listed below.

Stipulations to Ensure Compatibility:

- Collections will be restricted to permittees who have consulted refuge staff concerning special requirements needed to assure that the collections do not disrupt sensitive flora and fauna and to assure that collections do not disrupt refuge operations.
- Permittees must present appropriate state and federal permits that may be required in addition to the refuge permit.
- Field activities will be monitored to assure compliance with permit conditions and assess impacts.
- Cultural and archeological surveys will be coordinated with the Regional Historic Preservation Officer and the appropriate State Historic Preservation Officer to assure compliance with the Archeological Resource Protection Act.
- Approximately 30 research permits (or fewer) would be issued annually.
- Research permits will be issued only for bona-fide natural resource and cultural research purposes to individuals representing agencies, universities or other organizations.

Justification: The Great Dismal Swamp National Wildlife Refuge arguably incorporates the best remaining remnant of an expansive wetlands ecosystem. Few similar opportunities for research occur in the historic Great Dismal Swamp. The study of flora, fauna, and cultural history will directly support refuge habitat management and environmental education. Environmental education and interpretation have been identified as priority uses by the National Wildlife Refuge System Improvement Act of 1997 and in the refuge's establishing legislation. Allowing research and studies by non-service personnel on Great Dismal Swamp NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: **Refuge Manager** _____ **Date** _____

Concurrence: **Regional Chief** _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

Use: Restore forest types and habitat by harvesting and salvaging forest products.

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

(a) What is the use? Is it a priority public use?

Forest products will be harvested and/or salvaged as part of habitat restoration projects on the refuge. Typically, these operations will involve commercial logging that will be implemented to imitate natural forces, such as fires and hurricanes that once influenced and maintained representative habitats within the Great Dismal Swamp ecosystem. In addition, forest areas that have been damaged by fires and hurricanes may be salvaged in order to promote natural regeneration of the forests.

Commercial logging and salvage operations are not recognized as wildlife-dependent priority uses by the National Wildlife Refuge System Improvement Act. However, the establishing authorities for the refuge recognized that “timber management” would be required to maintain some of the forests representative of the Great Dismal Swamp ecosystem. Therefore, this activity is an important use for the Great Dismal Swamp National Wildlife Refuge.

(b) Where would this use be conducted?

These timber harvest operations would occur in pine forests and pine/pocosin habitats as well as the Atlantic white cedar forests on the refuge. Up to 4,000 acres of Atlantic white cedar and up to 10,000 acres of pine and pine/pocosin forest areas would be treated. These stands are in areas throughout the refuge.

(c) When would the use occur?

These operations would occur throughout the year as conditions allow. Due to higher water levels in the winter, much of the timber harvest may take place primarily during the spring, summer and fall to reduce impacts. These activities may be limited during designated hunts. Areas of refuge will be closed to these activities due to safety concerns during the hunts.

(d) Why is this use being proposed?

Reliance upon natural forces to maintain habitats representative of the Great Dismal Swamp ecosystem is no longer feasible due to the human-caused disruptions of fire and hydrologic regimes. The Great Dismal Swamp evolved with wildfire, and its forest and habitat types developed because of the influence of wildfire. However, wildfire has been suppressed for a number of years, and still is. It must continue to be suppressed because of the surrounding development, airports, highways, etc. that would be threatened by fire or disrupted by smoke. Therefore, in order to accomplish the refuge's mission of restoring and maintaining rare forest types, active habitat manipulation is required. Harvesting timber is one way to ensure regeneration of the forest type. Making that timber harvest commercially viable makes it economically feasible for the refuge to maintain these habitats..

Availability of Resources: The annual costs are estimated as follow:

Preparation of Habitat Management Plans/Programs:	\$10,000
Pre/Post Treatment Surveys/Assessments:	\$10,000
Permit Administration:	\$10,000
Road Repairs/Maintenance	\$50,000

Anticipated Impacts of the Use:

The operation of heavy equipment would compact the soil at the treatment sites. Using low ground pressure equipment and aerial forwarding (such as by helicopter) when feasible will help mitigate the compaction. Minor sedimentation would occur in the ditches adjacent to the treatment sites. Heavy equipment and vehicles would add emissions to the air. Visual aesthetics would be impaired temporarily at the treatment sites. Temporary, but significant, wildlife and vegetation disturbance would occur in the immediate vicinity of the treatment sites while harvests were underway. Minor wildlife disturbance would also occur along the roads used to haul timber from the refuge. Natural regeneration of Atlantic white cedar would increase and result in the expansion of viable cedar forests. Habitat conditions within pine/pocosin would improve for potential nesting of red-cockaded woodpeckers. The probability of catastrophic wildfires on the refuge would be reduced in the treated areas.

Impacts to other users of the refuge will be moderate, as areas of logging and log hauling will be closed to other public use, except as unavoidable.

Public Review and Comment: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: The salvage of timber products is compatible with stipulations listed below.

Stipulations Necessary to Ensure Compatibility:

- Timber sales will not be conducted for economic benefits. Instead, the operation will be merely a tool to implement critical habitat restoration programs for the refuge. Therefore, these timber sales will be consistent with approved forest management plans and programs that outline the habitat restoration needs for the refuge.
- A maximum of 4,000 acres of Atlantic white cedar forests would be available for commercial timber sales.
- A maximum of 10,000 acres of pine/pocosin forests would be designated for select commercial cutting.
- Timber sales would be conducted under special use permit or contract or a combination of the two to specify low ground pressure equipment and other details to minimize impacts and maximize benefits.

Justification: The refuge's establishing legislation directed that a timber management program be conducted on the refuge and stated, through the Secretary's report of 1974, that "commercial timbering for the sake of revenue will not be considered as an objective of management". Timber management will be used primarily to imitate natural influences, especially fire that used to shape and maintain the natural biological diversity of the Great Dismal Swamp ecosystem. Moreover, these sales will also provide economic benefits. The harvest of forest products for the restoration of forest habitats on Great Dismal Swamp NWR will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: **Refuge Manager** _____ **Date** _____

Concurrence: **Regional Chief** _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

Use: Wildlife Dependent Recreation

Refuge Name: Great Dismal Swamp National Wildlife Refuge

Establishing and Acquisition Authorities: Dismal Swamp Study Act of 1972 (P.L. 92-478); Dismal Swamp Act of 1974 (P.L. 93-402); Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b; Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a)(4), 16 U.S.C. 742f(b)(1); Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r

Refuge Purposes:

- Subject to such restriction, conditions, and reservations as are specified in deeds [granted to the United States by The Nature Conservancy] ... the Secretary shall administer the lands and waters and interests therein in accordance with the provisions of the National Wildlife Refuge System Administration Act ... the Secretary may utilize such additional statutory authority as may be available to him for the conservation and management of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive education as appropriate to carry out the purposes of this Act ... the Secretary may not acquire any such lands and waters and interests therein by purchase or exchange without first taking into account such recommendations as may result from the study required under Public Law 92-478. (Dismal Swamp Act of 1974, P.L. 93-402)
- ... particular value in carrying out the national migratory bird management program. (Authorizing the Transfer of Certain Real Property for Wildlife, 16 U.S.C. 667b)
- ... for the development, advancement, management, conservation, and protection of fish and wildlife resources. (16 U.S.C. 742f(a)(4);... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition servitude. (16 U.S.C. 742f(b)(1), Fish and Wildlife Act of 1956)
- ...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (16 U.S.C. Migratory Bird Conservation Act)

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

Description of Use:

A. What is the use? Is the use a priority use?

The use is wildlife-dependent recreation: wildlife observation and photography and environmental education and interpretation, often referred to as “non-consumptive recreational use.” The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation and photography, environmental education, and interpretation as four of the six priority wildlife-dependent recreational uses to be facilitated in the Refuge System, and encourages the Service to provide opportunities for the public to enjoy them.

B. Where would the use be conducted?

Wildlife observation and photography, environmental education and interpretation will occur on all existing ditch roads, the Washington Boardwalk Trail, the two lake piers, and at Lake Drummond. The activities will also occur at new trails and facilities such as the Feeder Ditch Trail, the observation platforms at Lake Drummond and at the Railroad/West marsh, the environmental education pavilion, the Refuge contact station in Sunbury, at designated outdoor classroom sites, and at the visitor center complex.

Visitors will be encouraged to focus their wildlife-dependent activities to the five primary entrance areas: Jericho Lane, Washington Ditch, Railroad Ditch, Corapeake Ditch, Feeder Ditch, the Refuge contact station in Sunbury, and at the visitor center complex in Chesapeake.

C. When would the use be conducted?

Wildlife observation and photography will be conducted on the trails daily, year-round from dawn to dusk (i.e., daylight hours only), unless a conflict with a management activity or an extenuating circumstance necessitates deviating from these procedures. Closures for extensive flooding, downed trees, ice storms or other events affecting human safety are examples that would require these uses to be temporarily suspended. Environmental education and interpretation programs will be scheduled based upon staff availability and public request. Activities at the visitor center complex will be year-round, based on sufficient staffing.

D. How would the use be conducted?

Utilization of the ditch roads will be authorized for bicycles and pedestrians who simply want to walk or hike. All users will be expressly restricted to the established roads and trails, outdoor classroom sites, boardwalks, observation platforms and piers. Automobile access will be limited to the Railroad Ditch Entrance, until public transportation is made available, and to the Corapeake Auto Trail once developed. Education groups may request a special use permit allowing automobile access through gated areas to designated outdoor classroom sites when necessary.

Water access for these activities is limited to Lake Drummond with authorized use of canoes, kayaks, and motorized boats of less than 25 hp when accessed from the Interior Ditch boat ramp, and motorized boats of less than 10 hp when accessed from the Feeder Ditch. Access from the Interior Ditch boat ramp is only by special permit and during the season of April 1 to June 15. Permit access is allowed daily, during daylight hours with advance reservation. Access from the Feeder Ditch is allowed daily, year-round, during daylight hours.

E. Why are these activities being proposed?

These activities will be conducted to provide compatible educational and recreational opportunities for visitors to enjoy the resource and to gain understanding and appreciation for fish and wildlife, wildlands ecology and the relationships of plant and animal populations within the ecosystem, and wildlife management. They will enhance the public's understanding of natural resource management programs and ecological concepts to enable the public to better understand the problems facing our wildlife and wildlands resources, to realize what effect the public has on wildlife resources, to learn about the Service's role in conservation, to better understand the biological facts upon which Service management programs are based, and to foster an appreciation as to why wildlife and wildlands are important to them. The authorization of these uses will produce a more informed public, and advocates for Service programs. Likewise, these uses will provide opportunities for visitors to observe and learn about wildlife and wildlands at their own pace in an unstructured environment and to observe wildlife habitats firsthand. Professional and amateur photographers will also be provided opportunities to photograph wildlife in their natural habitats. Photographic opportunities obviously will result in increased publicity and advocacy for Service programs. These uses will also provide wholesome, safe, outdoor recreation in a scenic setting, with the realization that those who come strictly for recreational enjoyment will be enticed to participate in the more educational facets of the public use program, and can then become advocates for the refuge and the Service,

Availability of Resources: At full development additional staff will be stationed at the visitor center in Chesapeake, the Refuge contact station in Sunbury, and the visitor service center in Suffolk. Staff will develop visitor center exhibits, leaflets, signs, video, website, and special events; develop and conduct more environmental education and interpretation events and programs for different age groups, types of groups (including scouts, 4-H, college, adults, etc.) and for larger numbers of groups; hold teacher workshops, recruit and train more volunteers; revise leaflets and develop new ones; update kiosk information, develop needed signs; catalog and store photos, slides, and historical items, develop habitat demonstration areas; work with local Tourism and Park and Recreation Departments, the Virginia Department of Game and Inland Fishers, Back Bay NWR, North Carolina and Virginia State Parks and other organizations to plan events and activities; display off-site exhibits at more local events; prepare and present off-site programs; develop ecotourism with Virginia Tourism; participate in the development of watershed-wide cooperative outreach groups, develop better relationships with the media; and be able to respond immediately to public inquiries.

The development of many of these facilities and activities is dependent upon receiving adequate funding and staffing. The refuge will continue to manage these activities at current levels until this funding is made available.

These activities occur on roads that would have to be maintained for other refuge management purposes.

The direct costs of supporting these activities are summarized as follows:

Annual Cost

Parking Lot Maintenance	\$10,000
Mowing	\$10,000
Trail Restroom Maintenance	\$2,400
Gate Maintenance	\$2,000
Boat ramp maintenance	\$5,000
Facility maintenance	\$20,000
Educational materials	\$10,000
Interpretative materials	\$10,000

Teacher workshops	\$5,000
Law Enforcement	\$41,000
Outdoor Recreation Planner	\$50,000
Maintenance Worker	\$50,000

Facility Cost (Start-up cost)

Feeder Ditch Trail	\$4,200,000
Canal Bridge	\$1,000,000
Observation Tower, Lake Drummond /Observation platform, Railroad/West	\$250,000
Corapeake Auto Tour Route	\$8,200,000
Jericho EE site	357,000
Land acquisition for Rt17 Visitor Center	\$2,000,000
Rt. 17 Visitor Center	\$10,000,000
Interpretative media	\$150,000
West Boardwalk trail construction	\$100,000

Anticipated Impacts of the Use:

The impacts summarized below are further described in the Environmental Assessment prepared for the Great Dismal Swamp NWR Comprehensive Conservation Plan.

In that the refuge is an 111,201 acre dense seasonally-flooded wetland forest and that these wildlife dependant activities, with few exceptions, are confined to the network of ditch roads, minimal wildlife and habitat disturbance will occur. During periods of high visitation (spring, summer, fall), the dense vegetation along the roads and trails provides a physical barrier which limits the impacts to the surrounding habitat and physically restricts the movement of pedestrians. Additionally, movement into the surrounding habitat is hampered by extensive areas of surface water and the instability of peat soils. The restriction of use to designated roads and trails is posted and printed in all visitor information.

Activities on Lake Drummond are restricted to pier or boat use. Again the dense forest vegetation forms a barrier around the lake rim. There is virtually no accessible bank or shore line, providing physical protection to the habitat and wildlife populations. In addition, the remoteness of the lake (3 ½ miles and around a spillway from the public boat ramp to the east) or by special permit only during the brief April 1 to June 15 season, limits the use of the lake to less than 5,000 vessels per year—most of which are canoes and kayaks—thus, negligible oil residual from outboard exhaust is anticipated.

The Service has the authority to control all public access to Lake Drummond. The Railroad Ditch Entrance is entirely within the refuge, and the Service can manage public access under the terms of a long-term permit with the Corps of Engineers. Public access will be managed and curtailed if adverse impacts to wildlife are detected. Construction of the visitor center will occur on prior disturbed habitat. In the parcel, land that is not used for the facility or for parking will be restored to wetland habitat, therein providing a positive impact for the watershed. The parcel is separated from the refuge by the Dismal Swamp Canal, providing another physical barrier of protection for wildlife and habitat from the anticipated large numbers of visitors.

Additional facilities (outdoor classroom sites, observation platforms, and the education pavilion) will result in moderate disturbance to wildlife while under construction. These impacts will be short lived and should not significantly affect wildlife or the habitat. They will be designed to be of minimal impact to a limited area. Best management practices as well as storm water runoff and sedimentation plans will be implemented to minimize erosion or degradation to water quality. The proposed Feeder Ditch trail and observation tower will use an existing dirt road bed and ditch spoils bank where possible and be boardwalked through the more sensitive soil areas.

Best practices and environmentally friendly products will be used in the paving of trail entrances and the auto trail route. Due to the instability of the clay soils in the ditch road beds during wet periods, paving will be necessary to allow uninterrupted visitor access. Any impacts during paving will be localized.

The refuge appears to be in a rural setting, but in fact is surrounded by 1.5 million people in the most rapidly growing communities in Virginia. The nearby populations significantly increase the need for law enforcement on the refuge. Added facilities will require additional patrolling of parking areas and trails to provide visitor security and to inhibit littering, vandalism, and other violations.

Adding a visitor center and an environmental education pavilion on the refuge will increase the number of activities, programs, and needed materials to reach a much greater segment of the public with up-to-date information that promotes the Great Dismal Swamp NWR and the Service mission and goals and can create support for wildlife both on and off the refuge. As more people enjoy quality experiences, visitation will increase. Thus, the communities surround the refuge will benefit through increased use of the facilities, service stations, lodging, and restaurants.

Working with the community, community organizations, tourism, schools, local businesses, news media, congressional entities, constituent groups, and state and local government agencies to develop programs, events, and activities can only increase the good association with the community and help establish a better understanding of the refuge and the Service and their missions and goals.

Public Review and Comments: As part of the Comprehensive Conservation Plan (CCP) process, scoping meetings were held in Elizabeth City and Gates County, North Carolina and in Chesapeake and Suffolk, Virginia, a comment request newsletter was mailed to adjacent landowners and other interested groups and individuals, and open comments were received and recorded for 9 months. Another comment period of 30 days and an additional round of public meetings will take place following the release of the draft CCP/Environmental Assessment.

Determination: Wildlife Dependent Recreation is compatible with stipulations listed below.

Stipulations Necessary to Ensure Compatibility:

- General access will be restricted to daylight hours only.
- Access for these uses will be limited to designated roads, trails, observation decks, and facilities that are listed on refuge brochures and signs.
- Boating access on Lake Drummond will be limited to less than 5000 vessels annually.
- All boat use on Lake Drummond will be monitored to assess wildlife disturbance. Portions of Lake Drummond may be closed, if necessary, to protect sensitive wildlife populations.
- Access beyond gated areas will be by special use permit for organized environmental education groups.
- A special use permit will be required of commercial touring groups.

Justification: The National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57) identifies six priority wildlife-dependent public uses of national wildlife refuges: environmental education, interpretation, hunting, fishing, wildlife observation and wildlife photography. Where these uses are determined to be compatible, they are to receive enhanced consideration over other uses in planning and management. Environmental education, interpretation, wildlife observation and wildlife photography provide compatible wildlife-dependent recreational opportunities. Opening the Great Dismal Swamp NWR to these activities will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Signature: Refuge Manager _____ **Date** _____

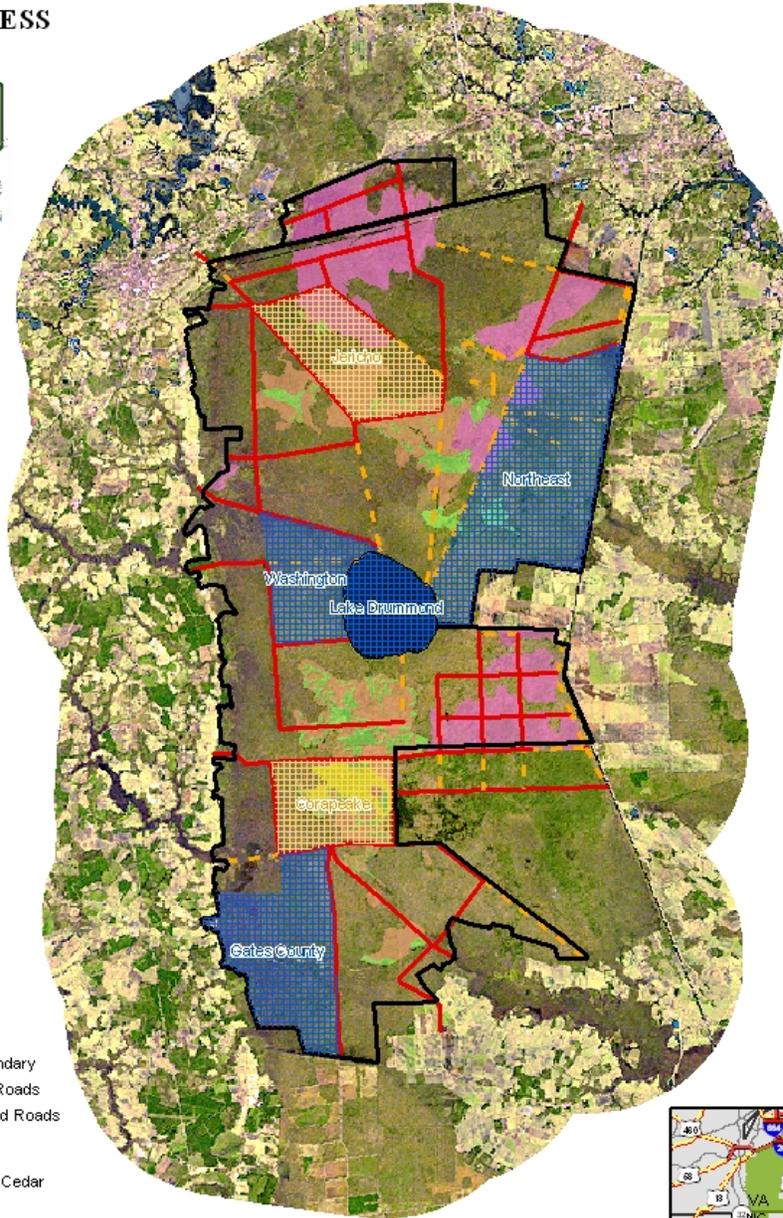
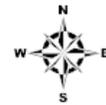
Concurrence: Regional Chief _____ **Date** _____

Mandatory 10 or 15 year Re-evaluation Date: _____

**Appendix F:
Wilderness Review**

Great Dismal Swamp
National Wildlife Refuge

WILDERNESS
REVIEW



Legend

- Refuge Boundary
- Maintained Roads
- Unmaintained Roads
- Pine
- Intermediate Cedar
- Mixed Cedar
- Pure Cedar
- Units proposed as WSA
- Units considered but not proposed as WSA

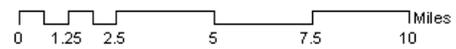


Figure F-1.

Appendix F. Wilderness Review

Introduction

The purpose of a wilderness review is to identify and recommend to Congress lands and waters of the National Wildlife Refuge System (NWRS) that merit inclusion in the National Wilderness Preservation System (NWPS). Wilderness reviews are required elements of comprehensive conservation plans, are conducted in accordance with the refuge planning process outlined in the Fish and Wildlife Service Manual (602 FW 1 and 3), and include compliance with the National Environmental Policy Act (NEPA) and public involvement.

The wilderness review process has three phases: inventory; study; and, recommendation. Lands and waters that meet the minimum criteria for wilderness are identified in the inventory phase (Phase I). These areas are called wilderness study areas (WSAs). In the study phase (Phase II), a range of management alternatives are evaluated to determine if a WSA is suitable for wilderness designation or management under an alternate set of goals and objectives that do not involve wilderness designation.

The recommendation phase (Phase III) consists of forwarding or reporting the suitable recommendations from the Director through the Secretary and the President to Congress in a wilderness study report. The wilderness study report is prepared after the record of decision for the final CCP has been signed. Areas recommended for designation are managed to maintain wilderness character in accordance with management goals, objectives, and strategies outlined in the final CCP until Congress makes a decision or the CCP is amended to modify or remove the wilderness proposal. If the final determination in a CCP is that a WSA is not suitable, the decision is documented in the CCP, ending the study process. The unsuitable areas will then be managed following the management direction outlined in the CCP.

Phase I. Wilderness Inventory

Introduction

The wilderness inventory is a broad look at the planning area to identify WSAs. A WSA is a roadless area of undeveloped Federal land and water that meets the minimum criteria for wilderness as identified in Section 2(c) of the Wilderness Act.

Great Dismal Swamp National Wildlife Refuge personnel, listed at the end of this appendix, gathered information and conducted an inventory of the refuge's lands and waters. That process required combining site knowledge with existing land status maps, photographs, available land use information and road inventory data to determine if the refuge lands and waters met the minimum criteria for wilderness. Aerial photographs were used to document the imprint of human work, road locations, and other surface disturbances.

Minimum Wilderness Criteria

A WSA is required to be a roadless area or island, meet the size criteria, appear natural, and provide for solitude or primitive recreation.

Roadless— Roadless refers to the absence of improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use. A route maintained solely by the passage of vehicles does not constitute a road. Only Federal lands **and waters** are eligible to be considered for wilderness designation and inclusion within the NWPS.

The following factors were the primary considerations in evaluating the roadless criteria.

- A. The area does not contain improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use.
- B. The area is an island, or contains an island that does not have improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use.
- C. The area is in Federal fee title ownership.

Size— The size criteria can be satisfied if an area has at least 5,000 acres of contiguous roadless public land, or is sufficiently large that its preservation and use in an unimpaired condition is practicable.

The following factors were the primary considerations in evaluating the size criteria.

- A. An area of more than 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- B. A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features.
- C. An area of less than 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- D. An area of less than 5,000 contiguous acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Naturalness— The Wilderness Act, Section 2(c), defines wilderness as an area that “generally appears to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable.” The area must appear natural to the average visitor, rather than “pristine.” The presence of historic landscape conditions is not required.

An area may include some human impacts provided they are substantially unnoticeable in the unit as a whole. Significant hazards caused by humans, such as the presence of unexploded ordnance from military activity and the physical impacts of refuge management facilities and activities are also considered in evaluating the naturalness criteria.

An area may not be considered unnatural in appearance solely on the basis of the sights and sounds of human impacts and activities outside the boundary of the unit. The cumulative effects

of these factors in conjunction with land base size, physiographic and vegetative characteristics were considered in the evaluation of naturalness.

The following factors were the primary considerations in evaluating naturalness.

- A. The area appears to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable.
- B. The area may include some human impacts provided they are substantially unnoticeable in the unit as a whole.
- C. Does the area contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity?
- D. The presence of physical impacts of refuge management facilities and activities.

Solitude or Primitive and Unconfined Recreation—A WSA must provide outstanding opportunities for solitude or primitive and unconfined recreation. The area does not have to possess outstanding opportunities for both solitude and primitive and unconfined recreation, and does not need to have outstanding opportunities on every acre. Further, an area does not have to be open to public use and access to qualify under this criteria; Congress has designated a number of wilderness areas in the Refuge System that are closed to public access to protect resource values.

Opportunities for solitude refer to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport. These primitive recreation activities may provide opportunities to experience challenge and risk; self reliance; and adventure. These two elements are not well defined by the Wilderness Act, but can be expected to occur together in most cases. However, an outstanding opportunity for solitude may be present in an area offering only limited primitive recreation potential. Conversely, an area may be so attractive for recreation use that experiencing solitude is not an option.

The following factors were the primary considerations in evaluating outstanding opportunities for solitude or primitive unconfined recreation.

- A. The area offers the opportunity to avoid the sights, sounds and evidence of other people. A visitor to the area should be able to feel alone or isolated.
- B. The area offers non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport.

Supplemental Values— The Wilderness Act states that an area of wilderness may contain ecological, geological, or other features of scientific, educational, scenic or historical value. Supplemental values of the area are optional, but the degree to which their presence enhances the area's suitability for wilderness designation should be considered. The evaluation should be based on an assessment of the estimated abundance or importance of each of the features.

Summary of Wilderness Inventory Findings

Approximately 76,000 acres (Figure F-1) of the Great Dismal Swamp NWR were eliminated from consideration as a WIA, because they consisted of less than 5,000 contiguous acres. In addition, they do not meet the roadless, naturalness, or solitude criteria due to one or more of the following factors: clear evidence exists that these areas have been logged over the past two centuries; they are bisected by logging roads and ditches/canals that drained water from the areas to support logging and agriculture; and the existence of utility rights-of-way. Therefore, the imprint of human work is obvious and prominent throughout the area. Moreover, refuge management activities are ongoing throughout some of these areas involving the restoration of marshes and bogs and restoration of globally-rare habitats such as pine/pocosin and Atlantic white cedar forests. Some areas contained developments including the refuge headquarters; operations compound; and kiosks, trails, and parking areas for visitor services.

The planning team identified six roadless areas that met the first and third size criteria. These six areas were further evaluated to determine whether they met the criteria for a WSA. The wilderness values of each of these areas are described in the following sections and summarized in Figure F-2.

Wilderness Inventory Areas

Unit 1 - Northeast (9,360 acres)

This area is bounded by the Dismal Swamp Canal and adjacent Highway 17 on the east; Fivemile Ditch on the north; Portsmouth Ditch on the west; and the refuge boundary, the Feeder Ditch, and Lake Drummond on the South. This unit lies almost completely on organic soils and historically represented the headwaters of the Northwest River. Today, the Dismal Swamp Canal, constructed in 1805 and part of the Atlantic Intracoastal Waterway, intercepts drainage from this area, so the water from this area reaches the Northwest River only during floods. No access trails or roads enter the interior of the unit. Red maple is the dominant forest type with some scattered pine stands and an Atlantic white cedar stand east of Portsmouth Ditch. The two-mile Southeast Ditch that drains the areas and the remains of railroads and rail equipment are scattered throughout the area are evidence of past logging. The Northeast Unit contained Atlantic white cedar forests that were severely damaged by Hurricane Isabel in September 2003 and will require active restoration that will include commercial harvest. Evidence of past logging and hydrologic disruption adversely affect the “naturalness” of this area. Therefore, this area is not recommended for designation as a WSA.

Unit 2 – Gates County (8,000 acres)

This WIA is located in the southwestern portion of the refuge bounded by the refuge boundary on the west, U.S. Highway 158 on the south, Weyerhaeuser Road on the east and Cross Canal on the north. The eastern portion of this unit is almost entirely maple/gum with the exception of several small mesic islands containing large beech, oak and loblolly pine. The western portion contains one of the largest stands of cypress/tupelo gum on the refuge. This unit is roadless, with no developed access into the interior of the unit. The 50-acre Fringe Marsh, located along the

southern boundary, was created in 1985 utilizing mechanical clearing and prescribed fire. This area once drained into the Pasquotank River and Perquimans River in North Carolina during periods of heavy rainfall. However, the construction of U.S. 158 in 1950 created a dike which forces all drainage into the Pasquotank River, because the highway has no culverts that would preserve natural drainage patterns. Although this area has been logged over the past 200 years, the lack of railway artifacts and developed ditches and canals minimize the evidence of logging. Nevertheless, the clear evidence of refuge habitat manipulation and hydrologic disruption precludes the recommendation of this area as a WSA.

Unit 3 – Jericho (5,850 acres)

This unit is bounded on the north by Hudnell Ditch Road, on the east by Hudnell/East Ditch Roads, on the south by Camp Ditch, and on the west by Jericho Ditch Road. The western portion of this unit once contained extensive stands of Atlantic white cedar, but now only remnant stands of “old growth” cedar remain north of Camp Ditch as a result of the combination of hydrologic disruptions, past logging, and absence of habitat maintenance. Mature cedar is scattered throughout much of the unit in small groups or as single trees. A 120-foot tall fire tower, constructed by the Virginia Department of Forestry in the 1950’s, is located on the unit’s western boundary on Jericho Ditch Road. More recently, firelines were constructed in 2002 to contain wildfires near the unit’s western boundary. Overall, the human influences, particularly logging and hydrologic disruptions, to this area are subtle, but these influences are detectable. Therefore, this area is not recommended as a WSA.

Unit 4 – Washington (2,500 acres)

Although well under the 5,000-acre minimum for a WSA, this unit was considered because of its scenic values. Developed access into the interior of this unit does not exist. The unit is bounded on the north by Railroad Ditch, West Ditch Road on the west, Lake Drummond on the east, and on the south by Interior Ditch. This unit lies on organic soils dominated by maple/black gum or cypress/black gum forests. Public access to this area is limited to the two roadways (West Ditch Road and Interior Ditch Road) where limited vehicle access to the edge of the unit is allowed. Although the area has been logged over the past two centuries, the evidence is likely to be noticed primarily by resource management specialists who have some knowledge about the ecology of the Great Dismal Swamp. Therefore, the area appears to most visitors to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable. However, the current practice of allowing motorized vehicles along the boundaries of this area creates some uncertainty about the wilderness values of the tract. Therefore, the area is not recommended for designation as a WSA.

Unit 5 – Lake Drummond (5,000 acres)

Lying in center of the refuge and one of only two natural lakes in Virginia, Lake Drummond offers significant opportunities for solitude as well as scenic and historical value. A one quarter mile buffer was recommended around the perimeter of the lake to protect the visual quality of the area and to reach the 5,000 acres necessary for consideration as a WSA. Two gravel roads reach the lake from the west side, and the Feeder Ditch provides small boat access from the east. The use of motorized boat access and use of Lake Drummond for fishing and wildlife observation, priority uses of the National Wildlife Refuge System, is permitted. Lake Drummond is unquestionably considered to be one of the most scenic areas within the refuge, and the low level of motorized boat traffic allows the retention of solitude on this large natural lake. Nevertheless,

the existence of man-made structures (piers and observation platforms at the mouth of Washington and Interior Ditches, Feeder Ditch Canal, boat ramp at Interior Ditch) and the use of motorized boats detract from the wilderness values. Therefore, this area is not recommended for designation as a WSA.

Unit 6 – Corapeake (4,575 acres)

The boundary of this unit consists of Corapeake Ditch on the north, Forest Line Ditch on the east, Cross Canal on the south, and Sherrill ditch on the west. This unit lies entirely on deep organic soils. The western portion is primarily maple/sweetgum forest, while the central and eastern portion contains some of the largest stands of mature Atlantic white cedar on the refuge. Commercial logging took place in this unit as late as the early 1970's, and the effects can still be seen. Many of the remaining mature stands require commercial logging and heavy equipment operation for restoration and maintenance. The evidence of past logging and current habitat manipulation detract from the wilderness values of this unit. Therefore, it is not recommended for designation as a WSA.

Conclusion

The refuge has roadless areas of significant size that create the appearance of wilderness to many visitors. However, closer examination of each WIA reveals characteristics that detract from the values and manageability of these areas as wilderness. In a broader context, the area within the Great Dismal Swamp National Wildlife Refuge is only a small remnant of an ecosystem that once extended over as much as 1,000,000 acres. The refuge incorporates the most intact remaining remnant of this vast system, but this remnant has been altered and influenced by humans over the past two centuries.

In 1974, the Secretary of the Interior reported to Congress that the “pristine character of the swamp no longer exists as a result of physical alterations.” This same report stated that the “ability to restore the Great Dismal Swamp as aggressively as it was altered must be maintained”. At some time in the future, habitat restoration and scientific knowledge about the Great Dismal Swamp ecosystem may reach a level where designation of some portions of the refuge as wilderness would be desirable. However, continued restoration, management, and research will be needed before a credible recommendation could be developed.

Wilderness Review Team

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Appendix G:

Glossary

alternative – a reasonable way to fix the identified problem or satisfy the stated need [see also *management alternative*].

appropriate use - a proposed or existing use of a national wildlife refuge that (1) supports the Refuge System Mission, the major purposes, goals or objectives of the refuge; (2) is necessary for the safe and effective conduct of a priority general public use on the refuge; (3) is other wise determined under Service Manual Chapter 605 FW1 (draft), by the Refuge Manager and Refuge Supervisor to be appropriate.

biological or natural diversity – the abundance, variety, and genetic constitution of animals and plants in nature; also referred to as “biodiversity.”

breeding habitat – habitat used by migratory birds or other animals during the breeding season.

buffer zones – protective land borders around critical habitats or water bodies that reduce runoff and nonpoint source pollution loading; areas created or sustained to lessen the negative effects of land development on animals and plants and their habitats.

candidate species – those species for which the Service has on file sufficient information on biological vulnerability and threats to propose them for listing.

carrying capacity – the size of the population that can be sustained by a given environment.

Categorical Exclusion (CE, CX, CATEX, CATX) – a category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

CFR – Code of Federal Regulations.

community – the area or locality in which a group of people resides and shares the same government.

community type – a particular assemblage of plants and animals named for the characteristic plants.

compatible use – an allowed use that will not materially interfere with, or detract from, the purposes for which the unit was established (Service Manual 602 FW 1.4).

compatibility determination – a compatibility determination is required for a wildlife-dependant recreational use or any other public use of a refuge. A compatible use is one which, in the sound professional judgment of the Refuge Manager, will not materially interfere with or detract from fulfillment of the Refuge System Mission or refuge purpose(s).

Comprehensive Conservation Plan (CCP) – a document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge, help fulfill the mission of the System, maintain and where appropriate, restore the biological integrity, diversity, and environmental health of each refuge and the System, and meet other mandates.

concern – see *issue*.

conservation – the management of natural resources to prevent loss or waste. Management actions may include preservation, restoration, and enhancement.

conservation agreements – written agreements reached among two or more parties for the purpose of ensuring the survival and welfare of unlisted species of fish and wildlife and/or their habitats, or to achieve other specified conservation goals. Participants voluntarily commit to implementing specific actions that will remove or reduce the threats to these species.

conservation easement – a legal agreement between a landowner and a land trust (a private, nonprofit conservation organization) or government agency that permanently limits a property’s uses in order to protect its conservation values.

cooperative agreement – the legal instrument used when the principle purpose of the transaction is the transfer of money, property, services or anything of value to a recipient in order to accomplish a public purpose authorized by Federal statute and substantial involvement between the Service and the recipient is anticipated.

cultural resources – evidence of historic or prehistoric human activity, such as buildings, artifacts, archaeological sites, documents, or oral or written history. *Public Law 100-588* (1988) lowered the threshold value of artifacts triggering the felony provision of the Act from \$5,000 to \$500, made attempting to commit an action prohibited by the Act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the Nation.

database – a collection of data arranged for ease and speed of analysis and retrieval, usually computerized.

designated wilderness area – an area designated by the United States Congress to be managed as part of the National Wilderness Preservation System (Draft Service Manual 610 FW 1.5).

digitizing – the process of converting information from paper maps into geographically referenced electronic files for a geographic information system (GIS).

early successional stage – a vegetated area that is in the primary stages of ecological succession.

easement – an agreement by which a landowner gives up or sells one of the rights on his/her property. For example, a landowner may donate a right of way across his/her property to allow community members access.

ecological succession – the orderly progression of an area through time from one vegetative community to another in the absence of disturbance. For example, an

area may proceed from a grass-forb, through a shrub-scrub, to a mixed hardwood forest.

ecosystem – a biological community together with its environment, functioning as a unit. For administrative purposes, the Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and vary in their sizes and ecological complexity.

ecotourism – a type of tourism that maintains and preserves natural resources as a basis for promoting economic growth and development resulting from visitation to an area.

ecosystem approach – a way of looking at socio-economic and environmental information based on ecosystem boundaries, rather than town, city, or county boundaries.

emergent wetland – wetlands dominated by erect, rooted, herbaceous plants.

endangered species – a federally protected species which is in danger of extinction throughout all or a significant portion of its range.

environmental education – education aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems and motivated to work toward their solution.

environmental health – a biotic composition, structure, and functioning of the environment consistent with natural conditions, including the natural biotic processes that shape environment.

evapotranspiration – the combined effects of evaporation and transpiration resulting from high temperatures and seasonal vegetation growth.

exotic species – see *invasive species*

extirpated – no longer occurring in a given geographic area.

federal land – public land owned by the Federal government, including lands such as National Forests, National Parks, and National Wildlife Refuges.

federally listed species – a species listed under the federal Endangered Species Act of 1973, as amended, either as endangered, threatened or species at risk (formerly candidate species).

forested land – land dominated by trees.

forested wetlands – wetlands dominated by trees.

Geographic Information System (GIS) – a computerized system used to compile, store, analyze and display geographically referenced information. Can be used to overlay information layers containing the distributions of a variety of biological and physical features.

goal – descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units.

habitat fragmentation – breaking up of a specific habitat into smaller unconnected areas. A habitat area that is too small may not provide enough space to maintain a breeding population of the species in question.

habitat conservation – the protection of an animal or plant's habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced.

habitat – the place where a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be free of harmful contaminants.

hummock – a slightly elevated mounding of soil and/or organic material occurring in the forest floor naturally or by mechanical disturbance.

interpretive facilities – structures that provides information about an event, place or thing by a variety of means including

printed materials, audiovisuals or multimedia materials. Examples of these would be kiosks which offer printed materials and audiovisuals, signs and trailheads.

interpretive materials – any tool used to provide or clarify information, explain events or things, or serve to increase awareness and understanding of the events or things. Examples of these would be; (1) printed materials such as brochures, maps or curriculum materials; (2) audio/visual materials such as videotapes, films, slides, or audio tapes; and (3) interactive multimedia materials, such as cd-rom and other computer technology.

invasive species – non-native species which have been introduced into an ecosystem, and because of their aggressive growth habits and lack of natural predators, displace native species.

issue – any unsettled matter that requires a management decision; e.g. a Service initiative, an opportunity, a management problem, a threat to the resources of the unit, a conflict in uses, a public concern, or the presence of an undesirable resource condition. Issues should be documented, described, and analyzed in the CCP even if resolution cannot be accomplished during the planning process.

key issue – an issue meeting the following three criteria: (1) falls within the jurisdiction of the Service; (2) can be addressed by a reasonable range of alternatives; (3) influences the outcome of the project.

land trust – organizations dedicated to conserving land by purchasing land, receiving donations of lands, or accepting conservation easements from landowners.

limiting factor – an environmental limitation that prevents further population growth.

local agencies – generally referring to municipal governments, regional planning commissions or conservation groups.

long term protection – mechanisms such as fee title acquisition, conservation easements

or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintenance of the species population at the site.

Maintenance Management System Projects (MMS) - the Maintenance Management System is a national database which contains the unfunded maintenance needs of each refuge.

[management] alternative – a set of objectives and the strategies needed to accomplish each objective.

[management] concern – see *issue*.

management plan – a plan that guides future land management practices on a tract of land.

[management] strategy – a general approach to meet unit objectives. A strategy may be broad, or it may be detailed enough to guide implementation through specific actions, tasks, and projects.

migratory game birds – birds regulated under the Migratory Bird Treaty Act and state laws, that are legally hunted, includes ducks, geese, woodcock, rails.

migratory nongame birds of management concern - those species of nongame birds that (a) are believed to have undergone significant population declines; (b) have small or restricted populations; or (c) are dependent upon restricted or vulnerable habitats.

mission statement – succinct statement of the unit's purpose and reason for being.

mitigation – actions taken to compensate for the negative effects of a particular project. Wetland mitigation usually takes the form of restoration or enhancement of a previously damaged wetland or creation of a new wetland.

National Environmental Policy Act of 1969 (NEPA) – requires all agencies, including the Service, to examine the environmental

impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making.

National Wildlife Refuge (Refuge) – A “designated area of land, water, or an interest in land or water within the System but does not include Coordination Areas.” Find a complete listing of all units of the System in the current *Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service*.

National Wildlife Refuge System (Refuge System)– all lands and waters and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish and wildlife, including those that are threatened with extinction.

native plant – a plant that has grown in the region since the last glaciation and occurred before European settlement.

natural conditions – conditions thought to exist from the end of the Medieval Warm Period to the advent of the industrial era (approximately 950 AD to 1800 AD), based upon scientific study and sound professional judgment.

non-attainment – air quality measures that have pollution level above the National Ambient Air Standards.

non-consumptive, wildlife-oriented recreation - photographing or observing plants, fish and other wildlife.

non-point source pollution – nutrients or toxic substances that enter water from dispersed and uncontrolled sites.

nonforested wetlands – wetlands dominated by shrubs or emergent vegetation.

objective – a concise statement of what we want to achieve, how much we want to

achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies.

partnership – a contract or agreement entered into by two or more individuals, groups of individuals, organizations or agencies in which each agrees to furnish a part of the capital or some in-kind service, i.e., labor, for a mutually beneficial enterprise.

population monitoring – assessments of the characteristics of populations to ascertain their status and establish trends related to their abundance, condition, distribution, or other characteristics.

prescribed fire – controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions which allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

priority public uses – see *wildlife-dependant recreational uses*.

private land – land that is owned by a private individual, group of individuals, or non-governmental organization.

private landowner – any individual, group of individuals or non-governmental organization that owns land.

private organization – any non-governmental organization.

Proposed Action (or Alternative) – activities for which an Environmental Impact Statement is being written; the alternative containing the actions and strategies recommended by the planning team. The proposed action is, for all practical purposes, the draft CCP for the refuge.

protection – mechanisms such as fee title acquisition, conservation easements or

binding agreements with landowners that ensure land use and land management practices will remain compatible with maintenance of the species population at the site.

public – individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in the Service issues and those who do or do not realize that Service decisions may affect them.

public involvement – a process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

public involvement plan – broad long term guidance for involving the public in the comprehensive planning process.

public land – land that is owned by the local, state, or Federal government.

Record of Decision (ROD) – a concise public record of decision prepared by the Federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigate.

refuge goals – descriptive, open-ended and often broad statements of desired future conditions that convey a purpose but do not define measurable units.

refuge purposes - the purpose specified in or derived from the law, proclamation,

executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, a refuge unit, or refuge subunit, and any subsequent modification of the original establishing authority for additional conservation purposes.

refuge lands – those lands in which the Service holds full interest in fee title, or partial interest such as easements.

Refuge Operating Needs System (RONS) – the Refuge Operating Needs System is a national database which contains the unfunded operational needs of each refuge. We include projects required to implement approved plans and meet goals, objectives, and legal mandates.

restoration – the artificial manipulation of a habitat to restore it to something close to its natural state. Restoration usually involves the planting of native grasses and forbs, and may include shrub removal and prescribed burning.

runoff – water from rain, melted snow, or agricultural or landscape irrigation that flows over the land surface into a water body.

Safe Harbor Agreements/Program— Voluntary arrangements between the U.S. Fish and Wildlife Service and cooperating non-Federal landowners. The Agreements benefit endangered and threatened species while giving the landowners assurances from additional restrictions. Following development of an agreement, the Service will issue an “enhancement of survival” permit to authorize any necessary future incidental take to provide participating landowners with assurances that no additional restrictions will be imposed as a result of their conservation actions.

service presence – Species present in the watershed for whom the refuge has a special management interest.

state agencies – generally referring to natural resource arms of the state governments of Virginia or North Carolina.

state land– public land owned by a state such as state parks or state wildlife management areas.

step-down management plans – step-down management plans describe management strategies and implementation schedules. Step-down management plans are a series of plans dealing with specific management subjects (wilderness, fire, public use).

strategy – a specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives.

succession – an orderly sequence of changes in plant species and community structure over time, leading to a hypothesized stable climax community.

threatened species – a federally protected species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

trust resource – one that through law or administrative act is held in trust for the people by the government. A federal trust resource is one for which trust responsibility is given in part to the federal government through federal legislation or administrative act. Generally, federal trust resources are those considered to be of national or international importance no matter where they occur, such as endangered species and species such as migratory birds and fish that regularly move across state lines. In addition to species trust resources include cultural resources protected through federal historic preservation laws, nationally important and threatened habitats, notably wetlands, navigable waters, and public lands such as state parks and National Wildlife Refuges.

upland– dry ground; other than wetlands.

vision statement – concise statement of what the unit could be in the next 10 to 15 years.

visitor center – a permanently staffed building offering exhibits and interpretive information to the visiting public. Some visitor centers are co-located with refuge

offices, others include additional facilities such as classrooms or wildlife viewing areas.

visitor contact station- compared to a visitor center, a contact station is a smaller facility which may not be permanently staffed.

visitor facility – a visitor center, visitor contact station, or concessionaire station, permanently or partially staffed by service employees and/or volunteers.

watershed – the geographic area within which water drains into a particular river, stream or body of water. A watershed includes both the land and the body of water into which the land drains.

wetlands – The U.S. Fish and Wildlife Service’s definition of wetlands states that “Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.”

wildlife-dependent recreational use – “A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation.” These are the six priority public uses of the System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs, however, the six priority public uses always will take precedence.

wildlife management – the practice of manipulating wildlife populations, either directly through regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors.

Appendix H:
RONs & MMS

Alternative A: Projects that will require significant funding

*RONS – Refuge Operating Needs System – a database that reflects what refuges need to accomplish projects. Projects are ranked by Region and Washington, and funded as funds are available.

**K means thousands of dollars, M means Millions of dollars.

Project/Strategy	Goal/Program/ Objective	First year cost	Cyclic cost and Interval	Duration	Additional Staff Needed	Funding Source
Maintain 2000 acres of Pine-Pocoson with fire every 3-5 years	Habitat/Forest Mgmt/ Pine Pocosin	N/A	\$90K** every 3-5 years.	15	N/A	Fire
Reintroduce Red-cockaded Woodpeckers (RCW) to the refuge and monitor (2,000 ac)	Trust Resources/ RCW/ Reintroduce RCW's		5K every 3 years	15		Endangered species
Monitor black bear population in cooperation with state wildlife agencies and universities (already in RONS* database)	Trust Resources/ Black Bear/Maintain healthy population	\$100K	\$100K annually	5		RONS and challenge cost share
Acquire remaining properties within acquisition boundary as they become available (4,000 acres) Survey and post boundary	Land Protection/ Habitat protection/ Protect and restore	N/A	\$6 M over the 15 years + 54K for survey	15		Migratory Bird Conservation Fund, LWCF

Alternative B: Projects that will require significant funding and/or additional staff

Project/ Strategy	Goal/ Program/ Objective	First Year Cost (not including recurring cost) Including staff hires (not salary)	Cyclic Cost and Interval	Duration	Additional Staff Needed (not cumulative)	Funding Source
Utilize approved herbicides on 6,000 acres on stands that are not easily accessible by harvesting equipment	Habitat/ Forest Mgmt/ Atlantic white cedar (AWC)	\$75K for GS-11 Forester and GS-7 Forestry Tech hire	400 ac/year @ \$100/acre + monitoring = 15K to 40K per year	15	Refuge funded Forester and Forestry Tech	RONS, Fire
Implement hardwood removal and prescribed burning on 10,000 acres to improve habitat for RCW	Habitat/ Forest Mgmt/ Pine-Pocosin	Forester hires covered above	Year 1-3 – Treat 2000 ac Year 4 Burn 2000 ac (90K) Year 4-6 – Treat 2000 ac Year 7 – Burn 4000 ac (180K) etc.	15	Refuge funded Forester and Forestry Tech	RONS, Fire
Restore additional 220 acres of Remnant Marsh habitat by mechanical clearing and prescribed burning	Habitat/ Forest Mgmt/ Remnant Marsh	Forester hires covered above	Year 1-4 150 acres cleared x \$1.8K/ac = \$270K, burn every 3-5 years at \$70/ac = 6-20K	15	Refuge funded Forester and Forestry Tech	RONS, Fire
Develop GIS surface flooding models to provide continuous assessment of water mgmt. strategies on wildlife and habitat	Habitat/ Water Mgmt	\$75 K for GS-9 Biologist and GS-7 Biotech hire	\$200K for study	5	Biologist and Biotech	RONS, partners
Reintroduce RCW's to Refuge and State Park and monitor (10,000 ac)	Trust Resources/ RCW/ Reintroduce RCW's on 10K acres	Biologist hires covered above	10K every 3 years	15	Biologist and Biotech	RONS, partners

Develop Clearings of 5-10 ac using tree girdling or small clearcuts for neotropical mig. Birds	Trust Resources/ Neotropical Migratory Birds/ Establish focus area	Biologist/Forester hires covered above	10K per year for Smithsonian Institute monitoring and interns or temps to treat the sites	15	Biologist, Biotech, Forester, Forestry Tech	RONS, Challenge Cost Share, partners
Monitor black bear population in cooperation with state wildlife agencies and universities (same as Alt. A, except there would be staff available to assist in Alt. B)	Trust Resources/ Black Bear/ Maintain healthy population	Biologist hires covered above	\$100K per year	5	Biologist, Biotech	RONS
Acquire remaining properties within acquisition boundary as they become available (4,000 acres) Survey and post boundary	Land Protection/ Habitat Protection and Restoration/ Protect and Restore	N/A	\$6 M over the 15 years + 54K for survey	15		Migratory Bird Conservation Fund
Resolve boundary disputes, post the refuge boundary, patrol and inspect – approx. 100 miles need surveyed and posted	Land Protection/ Habitat Protection and Restoration/ Protect and Restore	50K to hire Supervisory Refuge Operations Specialist (SROS)	Survey and Post 20 miles/year for 5 years = 108K/year Maintain it annually	15	Supervisory Refuge Operations Specialist	RONS
Purchase land at Jericho Lane for an environmental education site	Public Use/ Environmental Education (EE)/ Provide quality EE programs	357K for land purchase	Cyclic cost will depend upon available funds and willing sellers	5-15		Migratory Bird Conservation Fund, TEA 21 or LWCF, partners
Purchase and replenish field study equipment and teacher training equipment, set up teacher library, present at conferences	Public Use/ Environmental Education/ Provide quality EE programs	150K for initial equipment purchase 50K for Outdoor Recreation Planner-EE	30K/ year to maintain and replenish	15	Outdoor Recreation Planner - EE	RONS
Host annual events – four per year	Public Use/ Interpretation/ Provide	50K for tents, blue goose suit, displays, activities materials etc.	15K/ year to update, hire first person	15	Outdoor Recreation Planner	RONS, partners, grants

	quality interpretive experiences		interpreters, etc.			
Develop new panels, kiosks for Suffolk, Chesapeake, Sunbury, Dismal Swamp Canal Welcome Center	Public Use/ Interpretation/ Provide quality interpretive experiences	150 K for new kiosks, etc	5K/ year for maintenance	15	Outdoor Recreation Planner	RONS, MMS, partners
Pave major vehicle access roads and Parking Lots	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	SROS hire covered above ; Washington Ditch = 1,019K; Jericho Lane = 1,894K; Railroad/West/ Interior = 4,474K	Costs would likely be spread over several years. Annual maintenance would be reduced.	15	Supervisory Refuge Operations Specialist	RONS, TEA-21
Purchase and operate visitor tram on Railroad/West/Interior (Alternative fuel)	Public Use/Wildlife Observation/ Provide opportunities for visitors to view wildlife	150K	5-10K/ year maintenance	15	Already include/ concessionaire operated	RONS, Challenge cost share
Construct observation tower at Lake Drummond and platform at Railroad/West Marsh	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	250K		1	Supervisory Refuge Operations Specialist	RONS, TEA -21
Develop foot-bridge system across Dismal Swamp Canal and boardwalk trail along the Feeder Ditch to Lake Drummond	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	SROS hire covered above. Bridge 1M, 4.4 miles of Boardwalk trail = 4.2M	Costs would likely be spread over several years. Annual maintenance = 30-50K	15	Supervisory Refuge Operations Specialist	RONS, TEA-21
Acquire Corapeake Road ROW and pave Auto tour route	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	SROS hire covered above. ROW = 0.9 miles, 50' wide @ 2K/ac = 5.14 ac x 2K = 10.28K; Pave 12 miles at 1.5 lanes = 685K/mile = 8.2M; Road prep @ 50K/mile x 12 miles = 600K	Costs would be spread over several years. Annual maintenance would be reduced.	15	Supervisory Refuge Operations Specialist	RONS, TEA-21
Expand Volunteer Program	Public Use/ Volunteers/ Provide opportunities for people to donate their	50K to purchase materials 50K to hire Outdoor Recreation Planner - Volunteers	50K/year to send volunteers to training, purchase materials,	15	Outdoor Recreation Planner - Volunteers	RONS, grants, partners

	time		hold annual recognition event			
Convert existing refuge headquarters on Desert Road to Visitor Service Center. Construct road to link parking lot to Railroad Ditch Road	Public Use/ Facilities for Visitor Services/ Visitor Facilities	50K to hire Outdoor Recreation Planner. 500K to construct ¼ mile paved road; 200K to retrofit building including new paint, carpet, etc.		1	Supervisory Refuge Operations Specialist, Outdoor Recreation Planner	RONS, MMS
Establish Administrative HQ and Visitor Center on US Highway 17 in Chesapeake, VA	Public Use/ Facilities for Visitor Services/ Visitor Facilities	100K to hire Outdoor Recreation Planner (ORP) – Director of Visitor Services, one additional ORP and a Recreation Aid. 10,000 sq ft for Visitor Facility and exhibits @ \$264/sqft and 150/sqft for exhibits = 2.6M +1.5M = 4.1M. HQ = 5000 sq ft @ \$260/sqft + 15% for furniture = 1.3M + 195K.	Operations and Maintenance would be 40K/ year	15	Outdoor Recreation Planner and a Recreation Aid	Construction, RONS, partners, Corporate
Establish a visitor contact station with exhibits at the Refuge Operations Center in Sunbury, NC	Public Use/ Facilities for Visitor Services/ Visitor Facilities	50K to hire Outdoor Recreation Planner; 150K for exhibits, 200K to move staff from Desert Rd. HQ to Sunbury building	Operations and Maintenance would be 20K/year; lease would be 60K/ year	15	Outdoor Recreation Planner	RONS, partners

Alternative C: Projects that will require significant funding and/or additional staff

Project/Strategy	Goal/Program /Objective	First Year Cost Including Staff Hires, but not salary	Cyclic Cost and Interval	Duration	Additional Staff Needed (not cumulative)	Funding Source
Reintroduce Red-cockaded Woodpeckers (RCW) to the refuge and monitor (2,000 ac) SAME AS A	Trust Resources/ RCW/ Reintroduce RCW's		5K every 3 years	15		Endangered Species
Monitor black bear population in cooperation with	Trust Resources/ Black	\$100K	\$100K annually	5		RONS and Challeng

state wildlife agencies and universities (already in RONS database, SAME AS A)	Bear/Maintain healthy population					e Cost Share
Acquire remaining properties within acquisition boundary as they become available (4,000 acres) Survey and post boundary; SAME AS A	Land Protection/ Habitat protection/ Protect and restore		\$6 M over the 15 years + 54K for survey	15		Migratory Bird Conservation Fund
Resolve boundary disputes, post the refuge boundary, patrol and inspect – approx. 100 miles need surveyed and posted	Land Protection/ Habitat Protection and Restoration/ Protect and Restore	50K to hire Supervisory Refuge Operations Specialist (SROS)	Survey and Post 20 miles/year for 5 years = 108K/year Maintain it annually	15	Supervisory Refuge Operations Specialist	RONS
Develop environmental education site at Jericho Lane	Public Use/ Environmental Education (EE)/ Provide quality EE programs	357K for land purchase	10K	5-15		Migratory Bird Conservation Fund, TEA 21 or LWCF, partners
Purchase and replenish field study equipment and teacher training equipment, set up teacher library, present at conferences	Public Use/ Environmental Education/ Provide quality EE programs	150K for initial equipment purchase 50K for Outdoor Recreation Planner-EE	30K/ year to maintain and replenish	15	Outdoor Recreation Planner - EE	RONS
Host annual events – four per year	Public Use/ Interpretation/ Provide quality interpretive experiences	50K for tents, blue goose suit, displays, activities materials etc.	15K/ year to update, hire first person interpreters, etc.	15	Supervisory Refuge Operations Specialist	RONS
Develop new panels, kiosks for Suffolk, Chesapeake, Sunbury, Dismal Swamp Canal Welcome Center	Public Use/ Interpretation/ Provide quality interpretive experiences	150 K for new kiosks, etc	5K/ year for maintenance	15	Outdoor Recreation Planner	RONS, Annual Maintenance
Pave major vehicle access roads and Parking	Public Use/ Wildlife Observation/	SROS hire covered above ; Washington Ditch = 1,019K;	Costs would likely be spread over	15	Supervisory Refuge Operation	RONS, TEA-21

Lots	Provide opportunities for refuge visitors to view wildlife	Jericho Lane = 1,894K; Railroad/West/ Interior = 4,474K	several years. Annual maintenance would be reduced.		s Specialist	
Purchase and operate visitor tram on Railroad/West/Interior	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	150K	5-10K/ year maintenance	15	Already included/ concessio naire operated	RONS, Challeng e cost share
Construct observation tower at Lake Drummond and platform at Railroad/West Marsh	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	250K		1	Superviso ry Refuge Operatio ns Specialist	RONS, TEA-21
Develop foot-bridge system across Dismal Swamp Canal and boardwalk trail along the Feeder Ditch to Lake Drummond	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	SROS hire covered above. Bridge 1M, 4.4 miles of Boardwalk trail = 4.2M	Costs would likely be spread over several years. Annual maintenance = 30-50K	15	Superviso ry Refuge Operatio ns Specialist	RONS, TEA-21
Acquire Corapeake Road ROW and pave Auto tour route	Public Use/ Wildlife Observation/ Provide opportunities for refuge visitors to view wildlife	SROS hire covered above. ROW = 0.9 miles, 50' wide @ 2K/ac = 5.14 ac x 2K = 10.28K; Pave 12 miles at 1.5 lanes = 685K/mile = 8.2M; Road prep @ 50K/mile x 12 miles = 600K	Costs would be spread over several years. Annual maintenance would be reduced.	15	Superviso ry Refuge Operatio ns Specialist	RONS, TEA-21
Expand Volunteer Program	Public Use/ Volunteers/ Provide opportunities for people to donate their time	50K to purchase materials 50K to hire Outdoor Recreation Planner - Volunteers	50K/year to send volunteers to training, purchase materials, hold annual recognition event	15	Outdoor Recreatio n Planner - Volunteer s	RONS, grants, partners
Convert existing refuge headquarters on Desert Road to Visitor Service Center. Construct road to link parking lot to	Public Use/ Facilities for Visitor Services/ Visitor Facilities	50K to hire Outdoor Recreation Planner. 500K to construct ¼ mile paved road; 200K to retrofit building including new paint, carpet, etc.		1	Superviso ry Refuge Operatio ns Specialist, Outdoor Recreatio n Planner	RONS, MMS

Railroad Ditch Road						
Establish Administrative HQ and Visitor Center on US Highway 17 in Chesapeake, VA	Public Use/ Facilities for Visitor Services/ Visitor Facilities	100K to hire Outdoor Recreation Planner (ORP) – Director of Visitor Services, one additional ORP and a Recreation Aid. 10,000 sq ft for Visitor Facility and exhibits @ \$264/sqft and 150/sqft for exhibits = 2.6M +1.5M = 4.1M. HQ = 5000 sq ft @ \$260/sqft + 15% for furniture = 1.3M + 195K.	Operations and Maintenance would be 40K/ year	15	Outdoor Recreation Planner and a Recreation Aid	Construction, RONs, partners, Corporate

Maintenance Management System Projects
Great Dismal Swamp National Wildlife Refuge

*First two numbers designate fiscal year that project was first entered. 93 means 1993. 00 means 2000.

Project No.	Project Name	Cost Estimate (\$1000's)
93031*	Replace five unsafe foot bridges	\$104
01019	Replace Terrain King Boom Mower and John Deere 1418 deck mower	\$30
00005	Replace old Chevy S-10 pickup	\$26
01023	Replace 16' Boat	\$25
00001	Replace Radios for Compliance	\$172
02002	Replace 1992 Dodge Dakota	\$25
98523	Replace Material Storage Bldg.	\$27
98008	Rehabilitate South Ditch	\$500
98514	Replace 1972 bus	\$73
96001	Rehabilitate Corapeake/Myrtle Bridge	\$27
98511	Replace unreliable 1981 GMC dump truck	\$140
98519	Rehabilitate Shop Roof and Office space	\$105
99003	Education/Heritage Tourism Center – Chesapeake, VA And Pasquotank Co., NC	\$10216
99008	Facility for Administration in Sunbury, NC	\$3700
99003	Education/Heritage Tourism Center – Suffolk, VA And Gates, NC	\$9708
01017	Replace Feller-Buncher Shears	\$30
97205	Rehabilitate Portsmouth Ditch Road and Big Entry Bridge	\$335
01009	Replace Dodge Caravan	\$30
01005	Replace 1992 Dodge Ram 4x4, ¾ ton	\$25
01007	Replace 1998 Dodge Ram 4x4 extended cab	\$30
01006	Replace 1998 Dodge Dakota 4x4	\$25
02008	Replace Eager Beaver Trailer	\$40
02004	Replace FMO's 2000 Dodge Dakota	\$30
89092	Replace four concrete culverts and regravell parking lot at Washington Ditch	\$409
02003	Replace 2000 Chevy Blazer	\$30
98516	Replace 1977 Case bulldozer	\$140
98510	Replace 1976 International Truck and Portable Bridge	\$152
98515	Replace 1979 Caterpillar bulldozer	\$175
01012	Replace JD 4055 Farm Tractor	\$61
01001	Replace Ford dump truck	\$76
01011	Replace JD 6410 Farm Tractor	\$51
02001	Replace tiltbed truck	\$80
01018	Replace road grader	\$91
01010	Replace John Deere Excavator	\$172
01013	Replace John Deere 7610 Farm Tractor	\$76
99006	Replace Lake Drummond/East Ditch WCS	\$798
99007	Replace Weyerhaeuser North WCS	\$169
99005	Replace Jericho/Middle WCS	\$226
89093	Replace East and Williamson culverts	\$49
99103A	Repair leaking Jericho North WCS	\$74
99103B	Replace Williamson WCS and repair road	\$115
00002	Rehabilitate Hudnell, Jericho North, Camp and Cross Canal Roads (16 miles)	\$1357
01014	Replace Hale trailer pump (fire fighting)	\$30
00003	Rehabilitate County Line Ditch Road (4 miles)	\$1357
99004	Replace Washington Ditch Structure	\$0

01002	Replace Fire Engine	\$0
01004	Replace Jeep Cherokee	\$45
01015	Replace Full Track	\$60
01016	Replace fire plow	\$0
01020	Replace slip-on pumper	\$0
01022	Replace Rhino Deck Mower	\$9
01024	Replace Humpback Trailer pump	\$10
01025	Replace slip-on pumper 2	\$15
02005	Replace tracked personnel carrier 2	\$60
02006	Replace ATV	\$8
00001	Construct Restroom, trails, signs and canoe landing	\$385

Refuge Operating Needs System
Great Dismal Swamp NWR
July 3, 2003

Project	Staffing (FTE's)	Cost: Year 1 (1000's)	Cost: Annually Recurring (1000's)	Project Duration (years)
Determine Refuge Capacity for Black Bear Population	0	113	100	?
Develop Hydrologic Model to Manage Rare Forest Habitat Types	0	157	0	1
Develop and Distribute Refuge Brochures	0	23	6	?
Provide Attractive, Safe Access and Services to Refuge Visitors	3	300	175	15
Restore Rare Forest Habitat Types	1	147	82	15
Improve Visitor Facilities at the Lake Drummond Reservation	1	188	59	15
Improve Efficiency of Refuge Operations	1	192	113	15
Facility in Sunbury, NC	0	150	50	15
Develop Hydrologic Model to Manage Unique Forest Habitat Types	1	177	79	15
Partnership Operation of Natural Science Center in Chesapeake, VA	1	292	172	15
Educational/Heritage Tourism Center for Suffolk, VA and Gates, NC	1	168	82	15

Appendix I:
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