U.S. Fish & Wildlife Service

Lewis and Clark National Wildlife Refuge and Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Final Comprehensive Conservation Plan and Environmental Impact Statement

Our Vision for the Future

Lewis and Clark National Wildlife Refuge

Named for the famed explorers, the landscape and rich wildlife of this Refuge have changed very little in the past 200 years. Modern-day explorers visit this Refuge to experience its wilderness qualities and enjoy the abundant wildlife resources. Native species of migratory birds, wild salmon, and other native plants and animals thrive where natural processes take precedence within the varied habitats of Sitka spruce swamps, riparian forest, tidal marshes, mudflats, and sand bars typical of the Columbia River estuary today and 200 years ago.

Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Julia Butler Hansen Refuge for the Columbian White-tailed Deer is a stronghold for the conservation of this once nearly extinct population. Columbian White-tailed deer and other wildlife thrive here in a mosaic of meadows, wetlands, and riparian forests characteristic of the lower Columbia River watershed. Natural processes and management activities support a broad range of native plants and wildlife from Sitka spruce swamps to wild salmon. The Refuge staff works closely with a variety of partners, both on and off the Refuge, to accomplish Refuge purposes and conservation goals.

Lewis and Clark National Wildlife Refuge and
Julia Butler Hansen Refuge for the Columbian White-tailed Deer
Comprehensive Conservation Plan and Environmental Impact Statement
Wahkiakum County, Washington, and Clatsop and Columbia Counties, Oregon

Type of Action:	Administrative
Lead Agency:	U.S. Department of the Interior, Fish and Wildlife Service
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Abstract: We developed alternatives, including preferred and no action alternatives, as required by National Environmental Policy Act regulations, for each of the following refuges. Two alternatives were developed for the Lewis and Clark National Wildlife Refuge and three alternatives were developed for the Julia Butler Hansen Refuge for the Columbian White-tailed Deer (refuges). We compared and assessed issues, opportunities, and options for managing the refuges in the alternatives. Summaries of the alternatives follow:

Lewis and Clark Refuge

Alternative 1 (No Action). Under Alternative 1 no changes to current management would occur, and we would: Monitor refuge islands and treat invasive plant infestations as funded; protect wintering and foraging habitat for migratory waterfowl and bald eagles; and provide hunting, fishing, wildlife observation and photography.

Alternative 2 (Preferred Alternative). Under Alternative 2 current management would continue, and we would: Expand partnerships for managing invasive species; recruit graduate students to conduct wildlife and habitat research; explore options for managing State-owned lands within the refuge's acquisition boundary; expand wildlife observation and photography opportunities; initiate a wilderness study for eligible refuge lands; and develop partnerships to ensure dredge spoil islands provide benefits for wildlife.

Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Alternative 1 (No Action). Under Alternative 1 no changes to current management would occur, we would: Maintain and protect habitats; establish early successional riparian forest habitat; manage predators January through April; and provide wildlife-dependent public use programs.

Alternative 2 (Preferred Alternative). Under Alternative 2 current management would continue, and we would: Close a section of Steamboat Slough to waterfowl hunting to improve public safety; manage predators year-round as needed to achieve Columbian white-tailed (CWT) deer recovery goals; establish an experimental CWT deer population upriver; develop two trails; open Crims and Price islands to waterfowl hunting; improve interpretive media; and initiate a wilderness study for eligible refuge lands;.

Alternative 3. Under Alternative 3 current management would continue, and we would: Conduct predator management January through August to achieve recovery goals for the CWT deer; develop a bicycle and hiking trail; open Crims and Price islands to waterfowl hunting; close a small section of Steamboat Slough to waterfowl hunting to improve public safety; install new interpretive exhibit panels; develop curriculum for the refuge's study sites; and initiate a wilderness study for eligible refuge lands.

Lewis and Clark National Wildlife Refuge and Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Comprehensive Conservation Plan and Environmental Impact Statement

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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 U.S. Fish and Wildlife Service's best estimates of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations, and as such, are primarily used for 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.

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The Lewis and Clark National Wildlife Refuge was established to preserve the vital fish and wildlife habitat of the Columbia River estuary.
Photo: Coho salmon stilly / USFWS

The Julia Butler Hansen Refuge for the Columbian White-tailed Deer was established to protect and manage the endangered Columbian white-tailed deer.
Photo: Columbian white-tailed deer buck / USFWS

Chapter 1. Introduction and Background

1.1 Introduction

From its origin in the Canadian Rockies, the Columbia River flows 1,200 miles through forests, fields, and mountains until meeting the Pacific Ocean near Astoria, Oregon. The river's significance to this country is far-reaching. Native Americans have fished its waters and lived near its shores for thousands of years. In 1805, the Lewis and Clark expedition journeyed down the river, seeking a route to the Pacific Ocean. This exploration opened the vast, uncharted territory of the Columbia River Basin to a westward migration that continues even today. The grandeur and abundance of the Columbia River are revealed in many ways. Its natural beauty defines much of who we are in the Pacific Northwest and we are drawn to it for recreation and renewal. Millions of people depend on the river for employment in water-related industries, for commerce, and for transportation. Wildlife species also depend upon the river. Thousands of species swim in its waters, dwell along its banks, and fly and nest in the surrounding heights (LCREP 1999).

The lower Columbia River estuary is formed where the Columbia River meets the Pacific Ocean. An estuary is the area where the fresh water of a river meets the salt water of an ocean. In the Columbia River system, this occurs in the lower 35 river miles. In an estuary, the river has a direct, natural connection with the open sea. This transition from fresh water to salt water creates a special environment that supports unique communities of plants and animals, specially adapted for life at the margin of the sea. Estuarine environments are considered among the most productive ecosystems on earth (LCREP 1999).

It is within the lower Columbia River estuary that the Julia Butler Hansen Refuge for the Columbian White-tailed Deer (refuge) and the Lewis and Clark National Wildlife Refuge (refuge or collectively refuges), become intertwined with the Columbia River. Both refuges are located in the lower reach of the Columbia River with lands and waters in southwest Washington (Wahkiakum County) and northwest Oregon (Clatsop and Columbia counties) (Map 1). Since the early 1970s, both refuges have played important roles in the protection, conservation, and management of natural resources in an ecologically significant area.

The U.S. Fish and Wildlife Service (Service), an agency of the Department of the Interior (DOI), is the principal Federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. The Service manages the refuges as part of the National Wildlife Refuge System (Refuge System), which comprises 150 million acres managed on 550 national wildlife refuges and other units of the Refuge System, plus 37 wetland management districts.

The Lewis and Clark Refuge's approved acquisition boundary encompasses approximately 33,000 acres of the Columbia River estuary, including 18 named islands and numerous sand bars, mud flats, unnamed intertidal marshes, and areas of open water in northern Clatsop County, Oregon (Map 2). The refuge also includes three small parcels in Oregon on the mainland at Tongue Point, Emerald Heights, and Brownsmead. The Service has acquired 12,167 acres of land within the refuge's approved boundary; the State of Oregon also owns land within the refuge boundary.

Julia Butler Hansen Refuge was established in 1971 and contains more than 6,000 acres of pastures, Sitka spruce swamps, brushy woodlots, marshes, and sloughs, in both Washington and Oregon (Map 3). As the refuge's name implies, this refuge was set aside specifically to protect the endangered Columbian white-tailed deer (CWT deer) and its habitat.

1.2 Proposed Action

The Service proposes to develop and implement comprehensive conservation plans for both refuges. As part of a single planning process, this Comprehensive Conservation Plan and Environmental Impact Statement (CCP/EIS) covers both refuges. The final documentation will be separated into individual CCPs for each refuge at the conclusion of this planning process. The CCPs will set forth management guidance for the refuges for a period of 15 years, as required by the National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S. Code [U.S.C.] 688dd-688ee), which mandates the Service to address "…significant problems that may adversely affect the populations and habitats of fish, wildlife and plants and the actions necessary to correct or mitigate such problems."

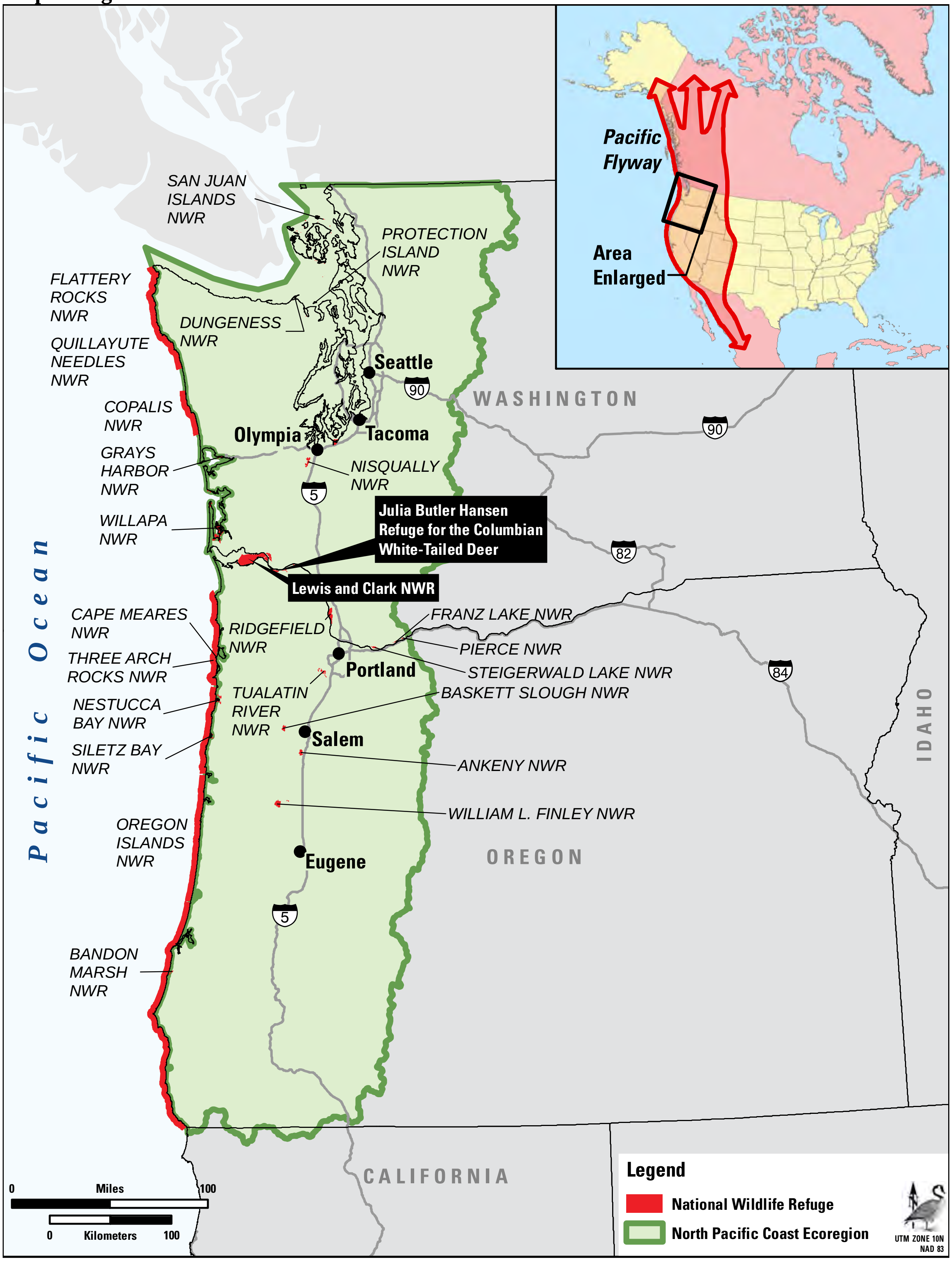
We have developed and analyzed alternatives for managing the refuges. The alternatives address the major issues and relevant mandates identified in the CCP process and are consistent with principles of sound fish and wildlife management. The Service evaluated two alternatives for the Lewis and Clark Refuge and has identified Alternative 2 as the preferred alternative. The Service evaluated three alternatives for Julia Butler Hansen Refuge and identified Alternative 2 as the preferred alternative.

The preferred alternatives represent the best balanced approach for achieving the refuges' purposes, visions, and goals; contributing to the Refuge System mission; and addressing relevant issues and mandates consistent with sound principles of fish and wildlife management. The preferred alternatives were modified between the draft and final documents based upon comments received from the public or other agencies and organizations. The Service's Pacific Region Regional Director will decide which alternatives will be adopted for implementation. For details on the specific components and actions making up the range of alternatives, see Chapter 2.

1.3 Purpose and Need for the CCP

The purpose of the CCP is to provide the Service, the Refuge System, our partners, and the public with a management plan for improving fish and wildlife habitat conditions and refuge infrastructure, for wildlife and public use on the Lewis and Clark and Julia Butler Hansen Refuges over a period of 15 years. An approved CCP will ensure that the Service manages these refuges to achieve the individual refuges' purposes, visions, goals, and objectives to help fulfill the mission of the Refuge System.

Map 1. Regional Context



Data Sources: Highways, State and Country Boundaries from ESRI; Cities from USGS; USFWS Ecoregions and Refuge Boundaries from USFWS/R1

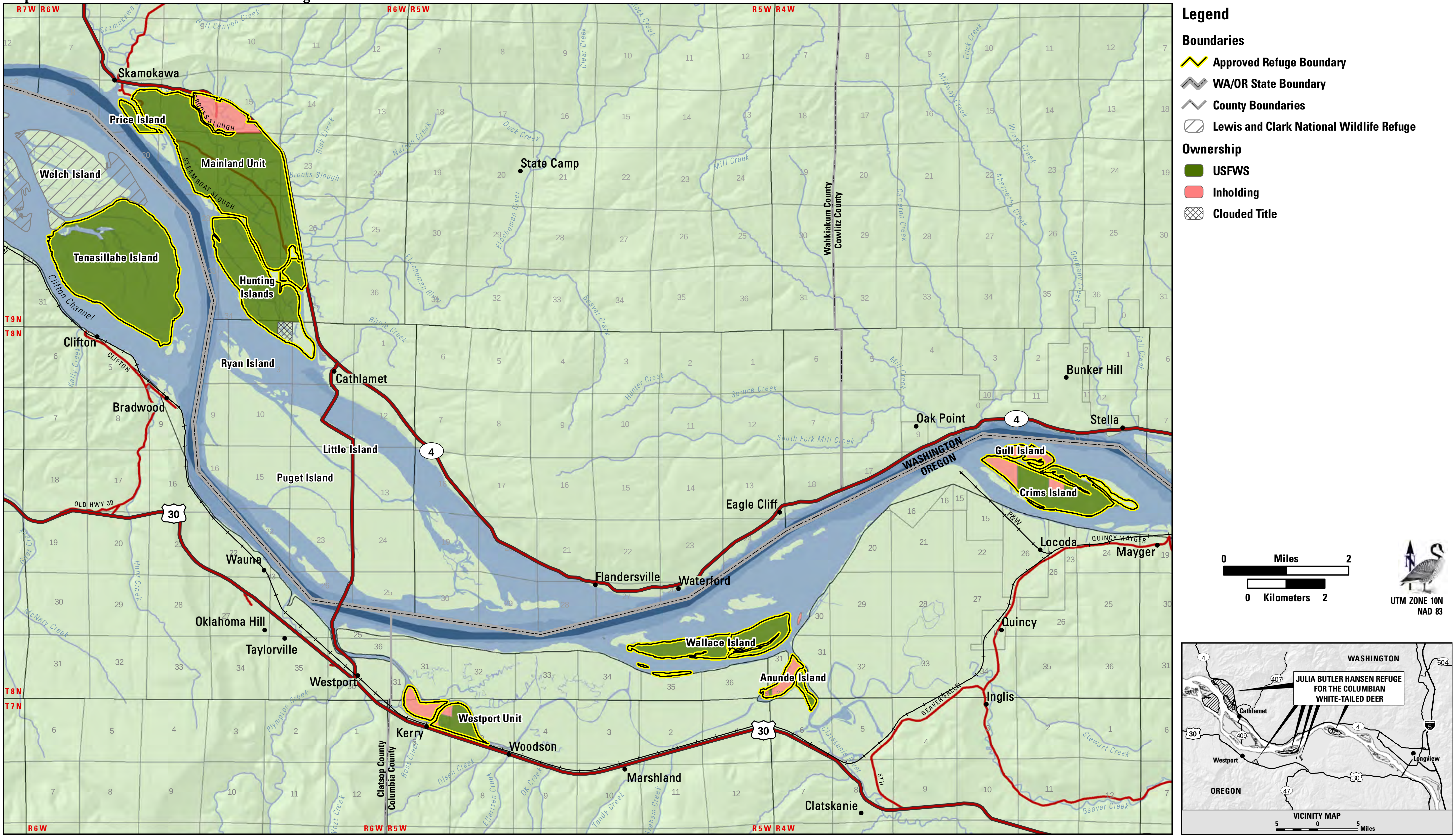
The back sides of map pages are blank to facilitate map readability.

Map 2. Land Status – Lewis and Clark National Wildlife Refuge

Data Sources: Refuge Boundaries from USFWS/R1; Railroads from University of Oregon; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; PLSS from WDNR and OR SSCGIS; Elevation from USGS

The back sides of map pages are blank to facilitate map readability.

Map 3. Land Status – Julia Butler Hansen Refuge for the Columbian White-tailed Deer



Data Sources: Refuge Boundaries from USFWS/R1; Railroads from University of Oregon; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; PLSS from WDNR and OR SSCGIS; Elevation from USGS

The back sides of map pages are blank to facilitate map readability.

This CCP/EIS was developed to provide reasonable, scientifically grounded guidance for improving the refuges' riparian, wetland, Sitka spruce swamp, and grassland habitats, for the long-term conservation of CWT deer, native plants, and migratory birds. The CCP/EIS identifies appropriate actions for protecting and sustaining the cultural and biological features of the estuary islands, the refuges' wintering waterfowl populations and habitats, the migratory shorebird populations that use the refuges, and threatened, endangered, or rare species. A final purpose of the CCP is to provide guidance and evaluate the priority public use programs on the refuges. which may include hunting, fishing, wildlife observation, photography, environmental education, and interpretation.

The CCP is needed for a variety of reasons. Primary among these is the need to improve the refuges' riparian, wetland, and Sitka spruce swamp habitats, some of which are degraded by invasive plants and animals. The CCP/EIS also recognizes and identifies threats to the endangered CWT deer, including predation of fawns, competition for food resources with elk, and impacts to habitat from invasive species. There is a need to address the refuges' contributions to conservation efforts for listed salmon species that migrate through the water and use certain refuge habitats for rearing. The refuges' wildlife-dependent priority public uses were analyzed, to determine what improvements or alterations could be made in the pursuit of higher quality programs (see Chapter 5). We determined whether and how the refuge should consider other nonwildlife-dependent uses, including commercial guiding activities and camping. We also described our strategies for better protecting the refuges' habitats and wildlife and the steps that should be taken to accomplish our goals.

1.4 Content and Scope of the CCP

This CCP/EIS provides guidance for management of the refuges' habitats and wildlife and administration of public uses on refuge lands and waters. Information provided in this CCP/EIS includes the following topics.

- An overall vision for the refuges and their role in the local ecosystem (Chapter 1).
- Goals and objectives for specific conservation targets and public use programs, as well as strategies for achieving the objectives (Chapter 2).
- A description of the refuges' physical environment (Chapter 3).
- A description of the conservation targets, their condition and trends on the refuges and within the local ecosystem, a presentation of the key desired ecological conditions for sustaining the conservation targets, and a short analysis of the threats to each one of the conservation targets (Chapter 4).
- An overview of the refuges' public use programs and facilities, a list of desired future conditions for each refuge program, and other management considerations (Chapter 5).
- An evaluation of the environmental consequences of implementing the alternatives (Chapter 6).
- Evaluations of existing and proposed public and economic uses for compatibility with each refuge's purposes (Appendix B).
- An outline of the projects, staff, and facilities needed to support the alternatives considered.
- Information regarding current state and Federal wildlife species listing status, and identification under relevant ecosystem plans.

This CCP/EIS is intended to comply with both the National Wildlife Refuge Administration Act and the National Environmental Policy Act (NEPA), as amended (42 U.S.C. 4321-4347).

1.5 National Wildlife Refuge System Laws and Directives

1.5.1 Planning and Management Guidance

Refuges are guided by various Federal laws, executive orders, Service policies, and international treaties. Fundamental to the management of every refuge are the mission and goals of the Refuge System, and the designated purposes of the refuge unit as described in establishing legislation, executive orders, or other documents establishing, authorizing, or expanding a refuge.

Key concepts and guidance of the Refuge System are derived from the National Wildlife Refuge System Administration Act of 1966 as amended (16 U.S.C. 668dd-668ee), the Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended, Title 50 of the Code of Federal Regulations (CFR), and the Service Manual. The National Wildlife Refuge System Administration Act is implemented through regulations covering the Refuge System, published in Title 50, subchapter C of the CFR. These regulations govern general administration of units of the Refuge System.

1.5.2 U.S. Fish and Wildlife Service Mission

The mission of the Service is “working with others, to conserve, protect and enhance fish and wildlife and their habitats for the continuing benefit of the American people.” National natural resources entrusted to the Service for conservation and protection include migratory birds, endangered and threatened species, interjurisdictional fish, wetlands, and certain marine mammals. The Service also manages national fish hatcheries, enforces Federal wildlife laws and international treaties regarding importing and exporting wildlife, assists with state fish and wildlife programs, and helps other countries develop wildlife conservation programs.

1.5.3 National Wildlife Refuge System

The Refuge System is the world’s largest network of public lands and waters set aside specifically for conserving wildlife and protecting ecosystems. From its inception in 1903, the Refuge System has grown to encompass 150 million acres managed on 550 national wildlife refuges located in all 50 states and waterfowl production areas in 10 states. More than 40 million visitors annually fish, hunt, observe, and photograph wildlife, or participate in environmental education and interpretive activities on national wildlife refuges.

1.5.4 National Wildlife Refuge System Mission and Goals

The mission of the Refuge System is:
"to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."
(National Wildlife Refuge System Administration Act of 1966, as amended).

Wildlife conservation is the fundamental mission of the Refuge System. The goals of the Refuge System, as articulated in our Mission, Goals and Purposes Policy (601 FW1) follow.

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

1.5.5 National Wildlife Refuge System Administration Act

Of all the laws governing activities on National Wildlife Refuges, the Refuge Administration Act undoubtedly exerts the greatest influence. In 1997, the Refuge System Administration Act was amended by the National Wildlife Refuge System Improvement Act; it included a unifying mission for all national wildlife refuges to be managed as a system, a new process for determining compatible uses on refuges, and a requirement for each refuge to be managed under a comprehensive conservation plan, developed in an open public process.

The Refuge Administration Act states that the Secretary shall provide for the conservation of fish, wildlife and plants, and their habitats within the System as well as ensure that the biological integrity, diversity, and environmental health of the System are maintained. House Report 105–106 accompanying the Improvement Act states "…the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first." Biological integrity, diversity, and environmental health (BIDEH) are critical components of wildlife conservation. As later made clear in the Biological Integrity, Diversity, and Environmental Health Policy section, "the highest measure of biological integrity, diversity, and environmental health is viewed as those intact and self-sustaining habitats and wildlife populations that existed during historic conditions."

Under the Refuge Administration Act, each refuge must be managed to fulfill the Refuge System mission as well as the specific purposes for which it was established. The Refuge Administration Act requires the Service to monitor the status and trends of fish, wildlife, and plants on each refuge.

Additionally, the Refuge Administration Act identifies six priority wildlife-dependent recreational uses. These uses are hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Under the Refuge Administration Act, the Service is to grant these six wildlife-dependent public uses special consideration during planning, managing, establishing, and expanding units of the Refuge System. The overarching goal is to enhance wildlife-dependent recreation opportunities and provide access to quality visitor experiences on refuges, while managing the refuges to conserve fish, wildlife, plants, and their habitats.

New and ongoing recreational uses should help visitors focus on wildlife and other natural resources. These uses should provide an opportunity to make visitors aware of resource issues, management plans, and how the refuge contributes to the Refuge System and Service's mission. When determined compatible on a refuge-specific basis, the six priority uses assume priority status among all uses of the refuge in question. The Service is to make extra efforts to facilitate priority wildlife-dependent public use opportunities.

When preparing a CCP, refuge managers must re-evaluate all general public, recreational, and economic uses (even those occurring to further refuge habitat management goals) proposed or occurring on a refuge for appropriateness and compatibility. No refuge use may be allowed or continued unless it is determined to be appropriate and compatible.

Generally, an appropriate use is one that contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan (see Appropriate Uses policy found at 603 FW 1). A compatible use is a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge. Updated appropriate use and compatibility determinations for existing and proposed uses for the Lewis and Clark and Julia Butler Hansen Refuges are in Appendix B of this CCP/EIS.

A CCP must be developed with the participation of the public, as required by the Refuge Administration Act and other formally established guidance. Issues and concerns articulated by the public play a role in guiding alternatives considered during the development of the CCP, and together with the formal guidance, can play a role in selection of the preferred alternative. It is Service policy to develop CCPs in an open public process. The Service is committed to securing public input throughout the CCP planning process.

1.5.6 Relationship to Previous and Future Refuge Plans

Planning has been part of the refuges' operations since they were established. A considerable number of plans have been completed over the years to guide refuge managers. In recent history, additional smaller "step-down" plans and or management agreements (plans addressing one program or resource) have been developed for one and or both refuges. A list of current management plans for the Julia Butler Hansen and Lewis and Clark refuges and the year they were completed follows.

- Highly Pathogenic Avian Influenza Disease Contingency Plan (2006)
- Fire Management Plan (2004)
- Station Safety Plan (2004; with annual updates current to 2008)
- Elk Management Plan (1986; updated 2004)
- Julia Butler Hansen Habitat Management Plan (1987)
- Julia Butler Hansen Public Use Management/Development Plan (1983)
- Columbian White-tailed Deer Recovery Plan, (1976; updated 1983)
- Julia Butler Hansen Migratory Bird Hunting Plan (1985)
- Julia Butler Hansen Animal Control Plan (1989)
- Habitat Management Summary (annually)
- Julia Butler Hansen Sport Fishing Plan (1985)
- Lewis and Clark Refuge Hunting Plan (1985)
- Lewis and Clark Refuge Management Plan (1986)
- Lewis and Clark Refuge Public Use Management/Development Plan (1984)

1.5.7 Future Planning

The final CCP will be revised every 15 years or sooner if monitoring and evaluation findings determine that changes are needed to achieve the refuges' purposes, visions, goals, or objectives. The CCP provides guidance in the form of goals, objectives, and strategies for refuge programs areas but may lack some of the specifics needed for implementation. Step-down management plans will, therefore, be developed for individual program areas as needed, following completion of the CCP. Step-down plans may require appropriate NEPA and other compliance.

1.6 Refuge Establishment and Refuge Purposes

The purpose or purposes for which a refuge was established or acquired are of key importance in refuge planning. Refuge purposes form the foundation for planning and management decisions. The purposes of a refuge are 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, refuge unit, or refuge subunit.

Unless the establishing law, order, or other document indicates otherwise, purposes dealing with the conservation, management, and restoration of fish, wildlife, and plants, and the habitats on which they depend, take precedence over other purposes in the management and administration of any Refuge System unit. Where a refuge has multiple purposes related to fish, wildlife, and plant conservation, the more specific purpose will take precedence in instances of conflict. When an additional unit is acquired under an authority different from the establishing authority, the addition takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the newer addition.

By law, refuges are to be managed to achieve their purposes. When a conflict exists between the Refuge System's mission and the purpose of an individual refuge, the refuge's purpose may supersede the Refuge System's mission.

Refuge purposes are also the driving force in the development of a refuge's vision statements, goals, objectives, and strategies in a CCP, and are critical to determining the compatibility of all existing and proposed refuge uses. The purposes for the Lewis and Clark and Julia Butler Hansen Refuges follow.

1.6.1 Lewis and Clark National Wildlife Refuge Purposes and Acquisition History

On January 5, 1971, the Service identified a 33,000-acre acquisition boundary for what was called at the time the Columbia River Islands Refuge. Initially, this refuge included some 15,000 acres of county lands, 14,000 acres of state lands, and 3,168 acres of private lands.

On September 21, 1971, the Migratory Bird Conservation Commission (MBCC), under the authority of the Migratory Bird Treaty Act of 1929, approved the purchase price for 3,110 acres of private property, including an agreement with Clatsop County to manage 4,990 acres for a total of 8,100 acres to be included in the Lewis and Clark Refuge. This acreage was identified as important habitat "To preserve an important wintering and feeding area for migratory waterfowl in the Pacific Flyway" in MBCC Memorandum #2. The memorandum also specified numbers for migratory bird populations, including 3,000 whistling swans, 2,000 dusky Canada geese, and 50,000 ducks. It also specifically mentioned the protection of "other water and shore birds, band tailed pigeons, bald eagles, Columbian white-tailed deer, and various kinds of small fur-bearing animals." The importance of this rich estuarine habitat was recognized as "irreplaceable" not only for its importance to waterfowl, but also as a transition area for migrating and juvenile salmon.

On April 19, 1972, the Service signed a 25-year agreement with Clatsop County, Oregon, entitled "Refuge Use and Cooperative Agreement Lewis and Clark National Wildlife Refuge Astoria, Oregon." The agreement, which established the refuge, was authorized under the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), it stated the following:

- "WHEREAS it is the desire of the parties to this agreement to cooperate in the preservation and enhancement of a portion of the Columbia River's islands, estuaries and tidelands constituting a broad ecological unit located in Clatsop County, Oregon, supporting fish and wildlife in Natural habitat for the benefit of the public."
- Section 1 of the agreement specified "For the purpose of establishing the Lewis and Clark National Wildlife Refuge as authorized to be operated and administered under the applicable statutes and regulations for migratory birds, fish and other wildlife…"
- In Section 9 the agreement stated "The commercial fishery is one of the public rights to be continued and preserved within the refuge…" It further stated that it "includes but is not limited to the actual harvesting of fish, the control of seal and sea lions in accordance with State and Federal rules and regulations and the clearing, preservation and maintenance of the fishing grounds."

- Section 7 of the agreement was later amended in July 1975, to give the Service management authority to regulate hunting and to close County lands to hunting with the County's concurrence. The amended section reaffirmed that "Public and commercial fishing shall continue in accordance with established custom and usage…" and that "other recreational uses shall be as prescribed by the U.S. Fish and Wildlife Service." In May 2004, Clatsop County donated these lands to the Service. The deed states the lands to be subject to "Public Waterfowl hunting, recreational fishing, and commercial fishing, in accordance with established custom and usage in accordance with State and Federal rules and regulations."

The MBCC's meeting notes and Memorandum #7 (dated May 1974) re-approved the purchase price for 1,595 acres. The justification for this acquisition was "Wintering area for migratory waterfowl." It further identified the refuge as "extremely important estuarine environment for marine animals, and a transition zone for hundreds of thousands of migrating salmon."

During December 1974, Oregon Department of State Lands (ODSL) entered into a 50-year agreement with the Service entitled "Refuge Use and Cooperative Agreement Lewis and Clark National Wildlife Refuge." This agreement specified the management of state lands inside the refuge acquisition boundary as "...to cooperate in the preservation, enhancement and management of a portion of the Columbia River's island and submerged and submersible lands, located in Clatsop County, Oregon, which constitute a broad and irreplaceable ecological unit supporting fish and wildlife in natural habitat for the benefit of the public."

The Service recognized an opportunity to acquire habitat near the Lewis and Clark Refuge's boundary, which was available through the government excess process from the U.S. Department of Labor (DOL). Formerly, these units were part of the Tongue Point Naval Station; a portion of the area is now part of the Tongue Point Job Corps Center. The first parcel was transferred during March 1979; the DOL under the authority of Section 1 of Public Law (P.L.) 537, 80th Congress (Federal Property and Administrative Service Act 1949) transferred 41.76 acres of the east shore at Tongue Point to the Service for "…wildlife conservation purposes."

In 1989 the Service received a 47.83-acre parcel of land from the Farmers Home Administration. In a letter dated May 26, 1989, it states that the land is "for conservation purposes." This parcel is called the Brownsmead Unit; the refuge has an agreement with the local Volunteer Fire Department, which operates a fire station on a small portion of the property.

In May of 1990, the DOL transferred an additional 89.38 acres (Emerald Heights) to the refuge in order to "...maintain existing habitat for the threatened bald eagle, as well as support its eventual recovery." In the Categorical Exclusion for the property transfer, the Service specifically stated its objectives for acquiring the property "The lower Columbia River estuary is important resident bald eagle habitat. Acquisition of this parcel would secure three of the four nest sites which constitute the Mill Creek bald eagle nesting territory." It also described how the "….mature forest supports cavity nesters and other wildlife species that depend on the presence of large trees and snags."

During April 1992, 83 acres were also transferred from the DOL and added to the refuge at Tongue Point, including 9 acres of tidelands around the base of Tongue Point. Habitat descriptions include "...patchy stand of mature western hemlock up to 36 inches in diameter. Younger stands of hemlock predominate interspersed with Douglas fir. The understory is primarily sword fern with salmonberry and devil's club. Red alder, western red cedar, willow species, mosses, sedges, yellow monkey flower and celery-leaved buttercup are associated with many small drainages."

In 1993, the State of Oregon terminated a 50-year agreement with the Service entitled "Refuge Use and Cooperative Agreement Lewis and Clark National Wildlife Refuge." This agreement was cancelled due to a conflict with State laws, and subsequently the State issued a one-year license based upon existing law. A decision was made to allow the license agreement to expire in 1994 as a result of decreasing land values.

The South Tongue Point Land Exchange and the Marine Industrial Park Development Project Record of Decision were approved on June 20, 1994. The decision stated that the excess lands were set up to enhance habitat and wildlife protection on the refuge. The development component of the land exchange created real property assets for the State of Oregon's Common School Fund; it also encouraged new industrial employment within the area. Initially, the Job Corps conveyed 130 acres to ODSL for the development of a marine industrial site. In exchange, the ODSL conveyed 3,930 acres of State land within the approved Lewis and Clark Refuge boundary to the Service to become part of the refuge.

On May 20, 2004, Clatsop County donated 4,535 acres in fee title to the Service. As it was noted in the earlier agreement from April 19, 1972 (the Service's 25-year management agreement with Clatsop County), these deeded lands are "Subject to; Public waterfowl hunting, recreational fishing, and commercial fishing, in accordance with established custom and usage in accordance with State and Federal rules and regulations." Map 2 shows the approved refuge boundary and ownerships within it.

1.6.2 Summary of Purposes and Management Direction for the Lewis and Clark Refuge

The purposes for the Lewis and Clark Refuge have been identified in legal documentation establishing and adding refuge lands. Because the refuge was originally established to preserve important wintering and foraging habitat for migratory waterfowl in the Pacific Flyway, this purpose represents a priority for refuge management. Protecting nesting and roosting habitat for the bald eagles is also a management priority.

Refuge authority and management is primarily limited to the islands; the State maintains jurisdiction over the open waters of the Columbia River. In accordance with the National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 688dd-688ee), all lands acquired since the original establishment of the refuge retain this purpose. Along with managing for migratory waterfowl to achieve refuge purposes, legal documentation for the inclusion of additional refuge lands identified the following habitats as management priorities, to support a diverse assemblage of native fish, wildlife, and plants, and their habitats.

- Columbia River bottomlands.
- Island, estuaries, and tidelands.
- Forested habitats.
- Recreational and commercial fishing.
- Public waterfowl hunting.
- American bald eagle.

1.6.3 Julia Butler Hansen Refuge for the Columbian White-tailed Deer Purposes and Acquisition History

The Julia Butler Hansen Refuge contains over 6,000 acres of pastures, forested tidal swamps, brushy woodlots, marshes, and sloughs in both Washington and Oregon (Map 3). The refuge is located along the Columbia River from river mile 33 to river mile 56. Virtually all refuge lands were originally intertidal wetlands; some areas were diked, drained, and converted to uplands early in the twentieth century.

The early planning history for protection of the CWT deer began in January 1940, with a report and a plan for the protection of CWT deer habitat by J. Burton Lauckhart, a Service game biologist. The brief report included purchasing lands for the protection of deer habitat. Nearly 25 years later, a formal discussion to preserve these lands within the Refuge System began in a letter (October 28, 1966) from the Service's Acting Regional Director, John Findlay, to John Biggs, Director of Washington's Department of Game, in it he stated "On October 15, 1966, the President signed the endangered species bill (P.L. 89-669) which authorizes the purchase of land for various endangered species of fish and wildlife." Public Law 89-669 was the Endangered Species Preservation Act, the precursor to the Endangered Species Act of 1973. Findlay's letter also stated "Our Region is being programmed $350,000 in fiscal year 1968 for acquisition of the proposed Columbia white-tailed deer area." This letter set the stage for cooperation in establishing protection for CWT deer habitat.

During the following year, the Service completed an Estimated Land Acquisition report under the funding authority of P.L. 88-578 (Land and Water Conservation Fund). The report proposed the purchase of 1,970 acres to create the "Columbia White Tailed Deer Sanctuary" and stated "The lands proposed for acquisition are essential to the preservation of the endangered Columbia white-tailed deer, Odocoileus virginianus leucurus (Douglas)." The report also describes past estimates of suitable habitat from the 1940s of "9,000 acres in Washington and 14,000 in Oregon." At the time of the report (1967), the total estimated acreage of "quality white-tail habitat remaining is less than 2,000 acres." A short description on needed habitat was identified as "A varied pattern of timber, brush and cropland seems to provide optimum habitat."

The first parcel (totaling 845 acres) was purchased during December 1971, establishing the "Columbia White Tailed Deer Sanctuary." By July 1972, the sanctuary had gained over 1,900 acres and was renamed the Columbian White-tailed Deer National Wildlife Refuge.

During May 1973, a Final Environmental Statement entitled "Proposed Additions to and Operation of the Columbian White-Tailed Deer National Wildlife Refuge, Oregon and Washington" was completed. The Environmental Statement described the need for acquisition of 5,230 acres in Clatsop County, Oregon, and Wahkiakum County, Washington, as a national wildlife refuge with the following statements:

- "The objective for acquiring and managing this area is to preserve the Columbian white-tailed deer in its natural habitat for future generations to see and enjoy."
- It identified a secondary purpose as "…providing viewing opportunities for the public to see this animal."
- This report also identified other wildlife values: "…waterfowl, band-tailed pigeons, and numerous other wildlife species associated with a river environment."
- Wintering waterfowl estimates for the refuge and proposed acquisition included "1,000 whistling swans and 200 dusky Canada geese along with several thousand mallards, American widgeon and pintails." The report stated its significance as "…a waterfowl use area, this refuge will be a part of the overall Columbia River wintering area, which plays a major role in winter for the Pacific Flyway."
- A description of the wildlife benefits to preserving the river bottom habitat was specified as "…mammals such as mink and beaver, and birds ranging from grebes to numerous hawks and owls and passerine species. Bald eagles and red-tailed hawks are among the most abundant species."
- The report also mentioned muskrats, nutria, river otter, coyotes, raccoons, and red fox.
- It also described historic, current and proposed management practices for the refuge. General descriptions included "Vegetation on the islands consists of thick stands of willow, black cottonwood, Sitka spruce, red alder, red osier dogwood, elderberry, salmonberry, and other species."
- A description of the fishery identified "Cold water species taken include Chinook and coho salmon and steelhead."
- The sloughs within the acquisition area were characterized by "…populations of warm water game fish including bass, black and white crappies, bluegill, yellow perch, etc., and various catfishes…"

The lands proposed for purchase were located on the Mainland Unit, Price Island, and Hunting Island. These lands were later purchased under the authority of the Fish and Wildlife Act of 1956 and the Endangered Species Act of 1973.

During 1988, the refuge was renamed the Julia Butler Hansen Refuge for the Columbia White Tail Deer (P.L. 100-446, September 27, 1988) to recognize a prominent local legislator who was instrumental in establishing the refuge.

An environmental assessment (EA) was completed during June 1993, entitled "Proposed Additions to Julia Butler Hansen Refuge for the Columbia White-tailed Deer, Clatsop and Columbia Counties, Oregon." This EA stated that the Service "…proposes to ensure the preservation of essential habitat for the Westport, Oregon subpopulation of the endangered Columbia White-tailed Deer." The EA also stated "The proposal would also serve to protect a portion of the dwindling wetland and riparian habitats along the lower Columbia River." This Columbia River addition approved under the authority of the Endangered Species Act of 1973, included 4,484 acres within the approved boundary. All of the units are located in Columbia County, Oregon. Some of these lands were later purchased under the authorities of the Fish and

Wildlife Act of 1956, and the Endangered Species Act of 1973, using the Land and Water Conservation Fund's funding authority.

During 1998, the addition of the Willamette Industries property to the refuge was approved under the authority of the Fish and Wildlife Act of 1956. The purpose for this addition was specified as "…to preserve native spruce swamp habitat for the Endangered Columbian white-tailed deer."

In 2001, the Service modified the approved refuge boundary to include the addition of the Moores-Wright Tracts which included an estimated 264 acres. These lands were not purchased, yet are included in the refuge acquisition boundary for future consideration if they are made available for purchase. The purpose for this addition to the refuge boundary was specified to complement and facilitate ongoing refuge management activities for endangered species, anadromous fish, and migratory birds.

A memorandum of agreement was signed in August of 2003 between the Bonneville Power Administration (BPA), Columbia Land Trust, and the Service for the "Acquisition and Management of a Portion of Crims Island." This document stated that the purpose of the agreement is to "permanently protect, mitigate, and enhance fish and wildlife and their habitats, and to manage these resources in a manner consistent with the council's program in accordance with the goals and objectives established by the refuge to help fulfill BPA's obligations, particularly those under the Northwest Power Act and the Endangered Species Act, and other laws as appropriate. The desired future condition of the property is one of naturally self-sustaining native habitat that minimizes the need for future human intervention to achieve the purpose of the project." Ultimately, the Service will assume all management responsibilities of this land. In May 2004, the Service received a large portion of Crims Island in fee title; approximately one-third of the island is held in private ownership. Map 3 shows the approved refuge boundary and ownerships within it.

1.6.4 Summary of Purposes and Management Direction for the Julia Butler Hansen Refuge

In summary, purposes for the refuge have been identified in legal documentation establishing and adding lands. Because the refuge was originally established for the preservation and management of the endangered CWT deer, this purpose represents the highest priority for refuge management. In accordance with the National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 688dd-688ee), all lands acquired since the establishment of the refuge retain this purpose for preservation of the deer and its habitat. Along with the CWT deer, legal documentation for inclusion of additional lands to the refuge identified the importance of the following resources, also essential to achieving refuge purposes:

- Wetlands – aquatic migratory birds.
- Deepwater channels and slough – native fish including steelhead and Chinook.
- Columbia River bottomlands – diversity of native fish, wildlife, plants and their habitats.
- Native spruce swamp habitat.
- Wintering waterfowl habitat.
- Public viewing opportunities for CWT deer.

1.7 Relationship to Ecosystem Management Goals

One of the major purposes of this CCP is to ensure that refuge management is focused on achieving not only the refuge's purposes, but also national, regional, state, and watershed goals for the preservation and enhancement of wildlife and habitats. These goals are stated in various plans that pertain to the Pacific Northwest and especially the Columbia River Basin. A brief summary of the major plans considered during development of this CCP/EIS follows.

1.7.1 Lower Columbia River Estuary Partnership Comprehensive Conservation and Management Plan

The Lower Columbia River Estuary Partnership (LCREP) is part of the National Estuary Program (NEP). The NEP was established to coordinate the protection of estuaries of national significance that are threatened with ecological degradation resulting from human activities. The estuary partnership focuses its efforts on the tidally influenced portion of the Columbia River, which reaches from the river's mouth to Bonneville Dam.

In response to an agreement between the governors of Oregon and Washington, and the U.S. Environmental Protection Agency, the estuary partnership prepared the Comprehensive Conservation and Management Plan for the estuary (LCREP 1999). The plan embodies the efforts of many committed citizens who represent environmental groups, local governments, state and Federal agencies, ports, tribal governments, industry, labor, agriculture, recreational users, commercial fishing, the Northwest Power Planning Council (now known as the Northwest Power and Conservation Council, or NPCC), and citizens-at-large. The goals of the plan include the following:

- Increase habitat and habitat functions.
- Prevent toxic and conventional pollution.
- Improve land use practices to protect ecosystems.
- Monitor the river for long term impacts and evaluate impact of actions.
- Strengthen coordination between the states in water quality and species issues.
- Enhance education opportunities regarding the lower river and estuary to build stewardship among all citizens: individual, municipal, corporate.

For each of the plan's goals, there are specific actions that may be taken to accomplish the goal. The refuges play an important role in achieving many of the plan's recommended actions, including the following:

- Protect, conserve and enhance identified habitats, particularly wetlands, on the mainstem of the lower Columbia River.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and the mainstem to a condition that is adequate to maintain a healthy, functioning riparian zone for the lower river and estuary.
- Restore 3,000 acres of tidal wetlands along the lower 46 river miles to return tidal wetlands to 50 percent of the level present in 1948.
- Identify and increase points of public access to the river. Ensure that access does not cause further loss of habitat, increased erosion, loss of riparian vegetation, or degradation

of water quality.
- Maintain public information and education efforts regarding the lower river and estuary that focus on endangered species, habitat loss and restoration, biological diversity, and lifestyle practices and connections to the river.

1.7.2 Oregon Natural Heritage Plan

The Oregon Natural Heritage Plan (2003) is a product of the Oregon Natural Heritage Program, whose mission is to conserve the full range of Oregon's native plants, animals, and ecosystems through voluntary and cooperative action. The program uses science to identify high quality and representative examples of native Oregon habitats and species and works to protect these natural treasures through voluntary and cooperative habitat conservation agreements. The Oregon Natural Heritage Plan has three roles:
- Describe the components of Oregon's natural heritage;
- Identify natural areas of exceptional value for conservation; and
- Provide opportunities for voluntary conservation on both public and private lands.

Areas of Critical Environmental Concern, Wilderness Areas, National Monuments, local preserves and other public lands with management plans that adequately protect Oregon's natural heritage are now included with Research Natural Areas and preserves as providing complete or partial protection for some ecosystems and species. For national wildlife refuges, the plan recommends that Research Natural Areas be established to protect natural areas of exceptional value (particularly those areas that are unique, and have no similar examples protected elsewhere). Freshwater tidal marsh at Russian Island (Lewis and Clark Refuge) and cottonwood/willow-creek dogwood tidal swamp at Tenasillahe Island (Julia Butler Hansen Refuge) are identified in the plan as desirable sites for Research Natural Area designation.

1.7.3 Oregon and Washington Comprehensive Wildlife Conservation Strategy

The Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW) prepared Comprehensive Wildlife Conservation Strategies (CWCSs) (ODFW 2006; WDFW 2005) in response to two Federal programs—the Wildlife Conservation and Restoration Program and the State Wildlife Grant Program. The CWCSs included information on the distribution and abundance of priority wildlife and habitats; provide strategies for conserving and monitoring wildlife and habitat; and provide for coordination with Federal, state, tribal, and local agencies, and the public. The CWCSs emphasized proactive measures to conserve declining species and habitats, and to maintain the status of common species. At least 24 species that were identified as priority species in the CWCSs occur on the refuges, including CWT deer; bald eagle; band-tailed pigeon; Chinook, chum, and coho salmon; and steelhead.

1.7.4 Mainstem Lower Columbia River and Columbia Estuary Subbasin Plan

The NPCC was formed by the states of Washington, Oregon, Idaho, and Montana to protect and mitigate fish and wildlife that are affected by development and operation of the Columbia River hydropower system while ensuring an adequate power supply. The NPCC established the Columbia River Fish and Wildlife Program to guide efforts to protect, mitigate, and enhance fish and wildlife resources. Through the Fish and Wildlife Program, the Columbia Basin was divided into 62 subbasins for planning purposes. A subbasin plan was then developed for each subbasin. These plans contain the strategies that drive the implementation of the Council's fish and wildlife program.

The Julia Butler Hansen Refuge's Mainland and Hunting Island units are within the Elochoman Subbasin of the Lower Columbia Province. The Elochoman Subbasin Plan is part of the Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan. Thus, there are three plans that apply to the refuges. It is the Mainstem and Estuary Subbasin Plan (NPCC 2004) that pertains most directly to the refuges.

The Mainstem Lower Columbia River and Columbia Estuary Subbasin Plan identities the following focal species: CWT deer; bald eagle; chum, Chinook, and coho salmon; steelhead; Pacific lamprey; green sturgeon; and white sturgeon. The refuges provide important habitats for these species. Enhancing and preserving these habitats are key elements of the CCP/EIS.

1.7.5 Columbian White-tailed Deer Recovery Plan

Recovery Plans are prepared by the Service for most endangered species. These plans specify actions that are necessary to protect and recover the species. The CWT deer Recovery Plan, as revised in 1983 (USFWS 1983), states that the lower Columbia River population of the deer may be considered recovered if a minimum of 400 individuals can be maintained in at least three viable subpopulations distributed in suitable secure habitat. General guidelines for accomplishing this goal are (1) maintain overall viability of 400 deer; (2) increase the subpopulation on Tenasillahe Island to a minimum viable herd of 50; and (3) secure the habitat of one additional subpopulation. Listed stepwise under the general guidelines are specific actions that are recommended to accomplish the deer's recovery. Actions that are applicable to management of the refuges include the following:

- Census the population annually for numbers, sex ratios, and doe to fawn ratios.
- Maintain closed areas on the Julia Butler Hansen Refuge.
- Manage Julia Butler Hansen Refuge habitat to benefit the deer.
- Prepare a long-range management plan for the Julia Butler Hansen Refuge that is based on existing knowledge of CWT deer habitat relationships.
- Monitor the incidence of hybridization between CWT deer and black-tailed deer and take action if hybridization frequency increases.
- Transplant CWT deer to establish new subpopulations within their historical range.

1.7.6 North American Waterfowl Management Plan, Pacific Coast Joint Venture

The North American Waterfowl Management Plan (NAWMP) is an international action plan to conserve migratory birds throughout the continent. The goal of the NAWMP is to return waterfowl populations to their levels in the 1970s by conserving wetland and upland habitat. Canada and the United States signed the NAWMP in 1986, in reaction to critically low numbers of waterfowl. Mexico joined in 1994, making it a truly continental effort. The NAWMP is a partnership of Federal, provincial, state and municipal governments, non-governmental organizations, private companies, and many individuals, all working toward achieving better wetland habitat for the benefit of migratory birds, other wetland-associated species, and people.

Transforming the goals of the NAWMP into on-the-ground actions is accomplished through partnerships called joint ventures. Joint ventures are made up of individuals, corporations, conservation organizations, and local, state, provincial, and Federal agencies. There are currently 11 habitat joint ventures in the United States and four in Canada endorsed by the NAWMP committee. One of the habitat joint ventures has international status (Canada/United States). Partners from Canada and the United States also jointly support three species joint ventures. Habitat joint ventures restore and enhance wetlands and associated upland habitats. The species joint ventures address monitoring and research needs of black ducks, Arctic nesting geese, and seaducks.

The Oregon Habitat Joint Venture's partners work within a planning framework that links local habitat conservation priorities to the regional goals of the Pacific Coast and Intermountain West Joint Ventures. A series of Oregon "focus area" plans, developed in the 1990s, provide a broad overview of wetland and wildlife resources and describe conservation needs and opportunities in general areas identified as "target areas" for Joint Venture action. A focus area plan was developed for the lower Columbia River, the objectives of the plan follow.

1.7.6.1 Habitat Objectives

Within the Lower Columbia River Focus Area the Joint Venture is dedicated to ensuring the following habitat objectives are met and sustained. These objectives are based on the recommended actions for individual target areas contained in the plan. The figures represent estimates of what the Joint Venture hopes to accomplish, given the resource needs and opportunities identified through the planning process and the financial, political and logistical constraints that exist.

- Ensure that at least 4,600 hectares (11,500 acres) of low-lying pastureland in private ownership will remain in agricultural production with farm management practices that are compatible with providing needed waterfowl feeding areas.
- Permanently protect, through easements or fee title acquisition, an additional 1,600 hectares (4,000 acres) of tidal wetlands, 1,280 hectares (3,200 acres) of freshwater wetlands, and approximately 500 hectares (1,200 acres) of uplands that are important to maintaining the habitat values of the wetlands they are associated with.
- Restore or create at least 500 hectares (1,250 acres) of tidal wetlands, and 100 hectares (250 acres) of freshwater wetlands.
- Enhance wildlife habitat values on 270 hectares (680 acres) of tidal wetlands, 1,450 hectares (3,600 acres) of freshwater wetlands, and 700 hectares (1,750 acres) of uplands.

1.7.6.2 Actions Specific to the Refuges

In addition to the overall objectives, the NAWMP contains the following recommended actions specific to the refuges:

Lewis and Clark Refuge

- Maintain existing habitat values.
- Support land exchanges to acquire the State of Oregon's inholdings as an addition to Lewis and Clark Refuge.

Julia Butler Hansen Refuge

- Enhance open field habitat to support expanded wintering goose populations.
- Support securing additional habitat necessary to carry out the recommendations of the Revised Columbian White-tailed Deer Recovery Plan.

1.7.7 Pacific Flyway Management Plans

The Pacific Flyway Council is an administrative body that forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory game birds in western North America. The Council is generally composed of one member from the public wildlife agency in each state and province in the western United States, Canada, and Mexico.

Biologists from state, Federal, and provincial wildlife and land management agencies, university students and faculty, and others develop management plans for the cooperative management of migratory game bird populations in the Pacific Flyway. Biologists from the Central Flyway, Canada, Mexico, and Russia contribute to these plans. The following management plans pertain to refuge habitats and associated waterfowl species.

1.7.7.1 Canada Goose Agricultural Depredation Control in Oregon and Washington

The Service, ODFW, WDFW, Animal and Plant Health Inspection Service–Wildlife Services (WS), and the Oregon and Washington Farm Bureaus participated in the development of a comprehensive nine point plan (Pacific Flyway Council 1998) to address the agricultural depredation problems associated with Canada geese in the Willamette Valley–Lower Columbia River (WV–LCR). The primary goal for the depredation control plan is to establish a systematic and comprehensive approach for minimizing depredation losses caused by Canada geese in the WV–LCR.

The habitat management and public use objective of the plan is to increase the amount of Canada goose use on public lands, while subsequently decreasing the amount of Canada goose use on private lands. The approach will be to review habitat management programs on Federal refuges and state wildlife areas to ensure that everything possible is being done to provide abundant, high quality goose forage on public lands. Additionally, management agencies will implement public use restrictions on public lands to decrease harassment of wintering Canada geese and increase their use of these lands. Finally, management agencies will recognize private landowners for their role in providing Canada goose foraging areas on selected private lands and consider developing voluntary agreement, conservation easement, or coordinated hunting programs to address adverse agricultural impacts.

The depredation control plan contains a habitat management strategy for the lower Columbia River refuges (including Julia Butler Hansen and Lewis and Clark) for evaluating existing lands for additional goose foraging and wetland restoration opportunities. The strategy includes grazing cattle in pasture areas, which can greatly benefit wintering Canada geese by stimulating growth of young succulent shoots. Grazing can be beneficial or detrimental depending upon the intensity, timing, and duration of grazing in green forage areas. To maximize green forage production, alternative grazing strategies should be investigated to determine their effects on green forage production and subsequent use by wintering Canada geese. Creating and/or improving wetland areas could also increase the use of these public lands by Canada geese.

1.7.7.2 Cackling Canada Geese

The goal of the cackling Canada Geese management plan is to identify needs and responsibilities necessary to cooperatively manage the number and distribution of cackling Canada geese, to provide for optimal aesthetic, educational, scientific, and hunting uses throughout their range (Pacific Flyway Council 1999).

The refuges lie within the primary wintering area of cackling geese in northwestern Oregon and southwestern Washington. They typically support several thousand wintering cackling geese. Refuge management practices discussed in the CCP, including mowing, grazing, and enhancing wetlands, provide considerable goose foraging habitat. The refuges also provide sanctuary from disturbance.

1.7.7.3 Pacific Population of Western Canada Geese

The goal of the Pacific population of Western Canada Geese management plan is to maintain the Pacific population of western Canada geese at a level and distribution that will optimize recreational opportunity and minimize depredation and/or nuisance problems in agricultural and urban areas (Subcommittee on Pacific Population of Western Canada Geese 2000). Objectives of the plan are to:

- Monitor breeding population trends to assess levels relative to objectives;
- Maintain the currently known distribution of the Pacific population of western Canada geese;
- Maintain optimum sport harvest and provide for viewing, educational, and scientific pursuits; and
- Assist in management of agricultural depredation and nuisance problems as outlined in the Pacific Flyway Depredation Policy and the Northwest Oregon/Southwest Washington Canada Goose Depredation Plan.

The refuges provide nesting and wintering habitat for western Canada geese, as well as public viewing and hunting opportunities.

1.7.7.4 Western Population of Tundra Swans

The goal of the western population of tundra swans management plan is to ensure the maintenance of the western population of tundra swans at a size and distribution that will provide for all their benefits to society (Pacific Flyway Council 2001). This plan’s objectives include maintaining a population of at least 60,000 swans in their current geographic distribution to provide suitable public benefits. For the most part, swans use lands where wildlife is already recognized as being an important resource being managed. Therefore, these lands should continue to be managed for waterfowl in general with consideration being given to swans and other waterfowl species that are more dependent upon natural wetlands than agricultural areas. The refuge marshes, especially on the Lewis and Clark Refuge, provide wintering habitat for several hundred swans and the management practices contained in this CCP/EIS will ensure the continuation of that habitat.

1.7.7.5 Dusky Canada Geese

The goal of this management plan is to maintain and enhance the dusky Canada goose population for all of its values to society (Subcommittee on Dusky Canada Geese 1992). The objectives of the plan include: achieving and maintaining a wintering population of 20,000 dusky Canada geese; maintaining wintering habitats in sufficient quantity and quality; and managing wintering habitat to provide optimum food, water, and sanctuary conditions, and to provide optimum geographical distribution.

A minimum of 250 to 300 dusky Canada geese are typically present on the refuges during the fall, winter, and early spring, and more make migrational stopovers. While not a large number, it is significant considering the small size of the population.

1.7.8 Partners in Flight Landbird Conservation Plans

Partners in Flight (PIF) is an international coalition of government agencies, conservation groups, academic institutions, private organizations, and citizens dedicated to the long-term maintenance of healthy populations of native landbirds. The goal of PIF's landbird conservation plans is to focus resources on the improvement of monitoring and inventory, research, management, and education programs involving birds and their habitats. Their strategy is to stimulate cooperative public and private sector efforts in North America and the Neotropics to meet these goals.

Specific strategies for accomplishing the goals are contained in regional landbird conservation plans. These plans describe priority habitats and species, and provide recommended management actions to conserve the habitats and species. The regional plans applicable to the refuges entitled Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington (Altman 2000), and Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington (Altman 1999). The lowlands and valleys plan identifies four priority habitats: grassland/savannah, oak woodland, riparian and chaparral. Two of these habitats—grassland/savanna and riparian—are found within the refuges. In addition, nearly 30 focal species identified in the two plans occur on the refuges.

1.7.9 U.S. Shorebird Conservation Plan, Northern Pacific Coast Regional Shorebird Management Plan

Manomet Center for Conservation Sciences, under contract with the Service, is developing the United States Shorebird Conservation Plan. This national plan includes 11 regional plans reflecting major shorebird flyways and habitats within the United States. The Northern Pacific

Regional Working Group was formed under the auspices of the national plan to formulate shorebird management goals for the Northern Pacific Region (NPR), which represents western Washington and Oregon. The purpose of this management plan is to address shorebird management needs on a regional basis while considering Pacific Flyway and national levels of need (Drut and Buchanan 2000).

Regional goals were established during the development of this plan. The primary goals are to (1) measurably increase populations of species impacted by current or recent declines, at population or flyway levels, over the next 10 years, and (2) stabilize and maintain current levels of breeding, wintering, and migrating populations of other shorebird species within the region/flyway. In support of these broad population goals, specific goals were also developed for research and monitoring, management, habitat protection, and outreach. Specific strategies to meet each of these goals were developed. The plan nominates the Columbia River estuary as a site of international significance.

The habitat management practices outlined in this CCP/EIS will result in the preservation of tidal shorelines and mudflats that provide foraging and resting habitat for shorebirds. Also, shallow managed wetlands will provide foraging habitat for yellow legs, dowitchers, and other species, and intertidal wetlands at Crims Island will provide foraging habitat for shorebirds.

1.8 Planning and Issue Identification

Public scoping for this CCP/EIS began in fall 2006. In September, public meetings were held in Astoria and Clatskanie, Oregon, and in Cathlamet and Longview, Washington. Public commentary was also solicited through distribution of a planning update to the refuges' mailing lists. Public comments on the Draft CCP/EIS and the Service's responses are presented in Appendix I. The Final CCP/EIS incorporates these responses as noted in Appendix I.

Issues and concerns articulated by the public played a role in guiding alternatives considered during the development of the CCP/EIS, and together, with the formal guidance, they can play a role in selection of the preferred alternative.

1.9 Issues Addressed in the CCP/EIS

The core planning team evaluated the issues and the topics documented during the scoping meetings. Issues are defined as matters of controversy, dispute, or general concern over resource management activities, the environment, land uses or public use activities. Issues are important to the planning process because they identify topics to be addressed in the CCP, pinpoint the types of information to gather, and help define alternatives for the CCP. Numerous issues, concerns, and opportunities were raised, and all are addressed in some manner in the CCP/EIS. It is the Service's responsibility to focus CCP planning and EIS analysis on the major issues. Major issues typically suggest different actions or alternative solutions and are typically those within the refuge's jurisdiction which have a positive or negative effect on the resource. Major issues will influence the decisions proposed in the plan. The major issues, concerns, and opportunities are presented in the sections that follow.

1.9.1 Lewis and Clark National Wildlife Refuge

1.9.1.1 Issue 1: Wilderness Study

Should specific areas of the refuge, if appropriate and eligible, be designated as wilderness?

Lewis and Clark Refuge is part of the largest natural marsh in western Oregon. Due to the relative remoteness and lack of influences by humans, some of the islands within the refuge's approved 33,000-acre acquisition boundary may meet the criteria for a wilderness designation. It should be noted that while a wilderness designation can be recommended, only Congress has the authority to grant this designation. This CCP/EIS includes a wilderness inventory and subsequent Wilderness Study Area (WSA) identification which will be the focus of a future Wilderness Study.

1.9.1.2 Issue 2: Dredged Materials Management

What actions should be taken to improve and maximize wildlife benefits in dredge-spoil areas of the refuge?

Columbia River channel maintenance and deepening activities continue to generate dredge spoil accumulations within the refuge's acquisition boundary. Dredge spoil provides habitat for colonial nesting birds and streaked horned larks. This CCP/EIS discusses the areas of dredge spoil placement and what, if any, refuge actions are needed to maximize wildlife benefits.

1.9.1.3 Issue 3: Oregon Department of State Lands Management Agreement

Should the refuge seek to modify the management agreement for State-owned lands within the refuge boundary?

In 1974 the refuge signed an agreement with the ODSL to allow the refuge to manage State-owned lands within the boundary of the Lewis and Clark Refuge as part of the refuge. This agreement was nullified in 1994, as part of a land exchange between the Service and the State of Oregon. After the land exchange, the agreement was not reinstated. As part of the CCP/EIS, the Service considered whether the refuge should again look at managing the State's lands within the boundaries of the Lewis and Clark Refuge, what management activities an agreement with the State should cover, and what future opportunities may be available to acquire or trade lands to better meet the goals of both agencies.

1.9.2 Julia Butler Hansen Refuge for the Columbian White-tailed Deer

1.9.2.1 Issue 1: Population Management of Predators to protect CWT Deer Fawns

Coyotes prey upon CWT deer fawns. Are the methods for coyote removal appropriate to maintain recovery of this endangered deer?

Predation of CWT deer, primarily by coyotes, continues to be a major factor in meeting CWT deer population recovery goals. In order to maintain a healthy and viable CWT deer population, as specified by the CWT deer Recovery Plan, predation needs to be managed. This CCP/EIS explores the best way to reduce predation on CWT deer.

1.9.2.2 Issue 2: Wildlife and Habitat Management

What actions should the Service take to sustain and restore priority species and habitats?

The refuge is actively managing habitat on the Mainland and Tenasillahe Island units for the benefit of the CWT deer. Invasive species such as purple loosestrife and reed canary-grass degrade natural habitat resulting in the need for intensive habitat management activities. This CCP/EIS examines current management practices and potential new actions for meeting Julia Butler Hansen Refuge's purposes, trust resource responsibilities, and maintaining/restoring biological integrity, diversity, and environmental health.

1.9.2.3 Issue 3: Management of Public Access and Use

What type and level of recreational opportunities should be provided? Are existing public use opportunities adequate and appropriate?

Interest in public recreation on the refuge continues to increase. This issue covers wildlife-dependent public uses that have priority over other public uses as mandated by the National Wildlife Refuge System Administration Act of 1966, as amended. The priority public uses include hunting, fishing, wildlife observation, photography, and environmental education and interpretation. Specifically, how the refuge can best meet priority public use needs while also protecting habitat and wildlife is considered in this CCP/EIS.

1.9.2.4 Issue 4: Tidal Wetland and Stream Restoration for Native Fish Enhancement

How will the refuge enhance native fish populations?

Over the last century, major losses of historic, intertidal marsh and riparian forest habitats have occurred within the lower Columbia River estuary. This loss of habitat has had a profound effect on the native fish, wildlife, plants, and habitats of the region. The CCP/EIS looks at the potential for restoring native estuarine habitat to portions of the refuge in concert with protecting habitat for the endangered CWT deer.

1.9.2.5 Issue 5: Wilderness Study

Should specific areas of the refuge, if appropriate and eligible, be designated as wilderness?

Due to the relative remoteness and lack of influences by humans, two of the islands—Hunting and Wallace—in this 6,000-acre refuge may meet the criteria for a wilderness designation. It should be noted that while a wilderness designation can be recommended, only Congress has the authority to grant this designation. This CCP/EIS includes a wilderness inventory and subsequent WSA identification which will be the focus of a future Wilderness Study.

1.9.2.6 Issue 6: Education and Outreach

Should existing programs be expanded to better engage and educate the public on refuge wildlife and habitat management activities?

The refuge is actively managing habitat and wildlife on the Mainland, Crims Island, and Tenasillahe Island units. In many cases, the public does not understand the reason or need for an active management program. In the CCP/EIS we explored how to better engage and educate the public on refuge management activities.

1.10 Issues Outside the Scope of the CCP

While CCPs are very comprehensive, no single plan can cover all issues. The planning team has made a list of some of the issues currently outside the scope of this CCP/EIS.

1.10.1 Lewis and Clark Refuge

1.10.1.1 Floathouses

Thirty-one floathouses are currently located in the channels in and adjacent to refuge lands. They are within the designated boundaries of the refuge, but are technically on Oregon State tidelands. A joint memorandum of understanding between the Service, Clatsop County, ODSL, and floathouse owners was developed to allow the existing floathouses to remain while prohibiting the placement of new structures. This topic is not addressed in the CCP/EIS because it is now in the final stages of implementation.

1.10.1.2 East Sand Island Management

In 1999, the U.S. Army Corps of Engineers (Corps) initiated a pilot project to relocate a colony of 9,000 pairs of Caspian terns from Rice Island to East Sand Island. In addition to the terns, East Sand Island supports numerous colonial nesting birds including double-crested cormorants, brown pelicans, western/glaucous-winged gulls, and Brandt’s cormorants, as well as migrating shorebirds. East Sand Island is located outside the boundaries of the refuge. Because this island is not owned by the refuge and is located outside refuge boundaries, it is outside the scope of this CCP/EIS.

1.10.2 Julia Butler Hansen Refuge for the Columbian White-tailed Deer

1.10.2.1 Deer Depredation

A number of CWT deer have been relocated off of the refuge as part of the recovery effort described within the recovery plan. During the early 1990s, there were some complaints regarding CWT deer depredation on private property on Puget Island. If deer depredation occurs, complaints may again be directed at the refuge staff. However, this issue was not included in this CCP because local depredation complaints have not occurred during the past 10 years associated with relocations.

1.10.2.2 Liquefied Natural Gas Facility

A proposal developed by Northern Star Natural Gas to construct a liquefied natural gas (LNG) facility on private land adjacent to the Julia Butler Hansen Refuge is currently under consideration and review by a number of public and private entities. This plan is extremely controversial in the local community. While the proposed facility would not be on refuge lands, the public is questioning the safety/aesthetic/resource concerns of developing and operating the LNG facility adjacent to refuge lands. In addition, LNG security concerns may impact the refuge's ability to access its docking site and buildings on Tenasillahe Island. This issue is outside the scope of the CCP/EIS and can be better addressed as part of the planning process Northern Star Natural Gas is conducting for that facility.

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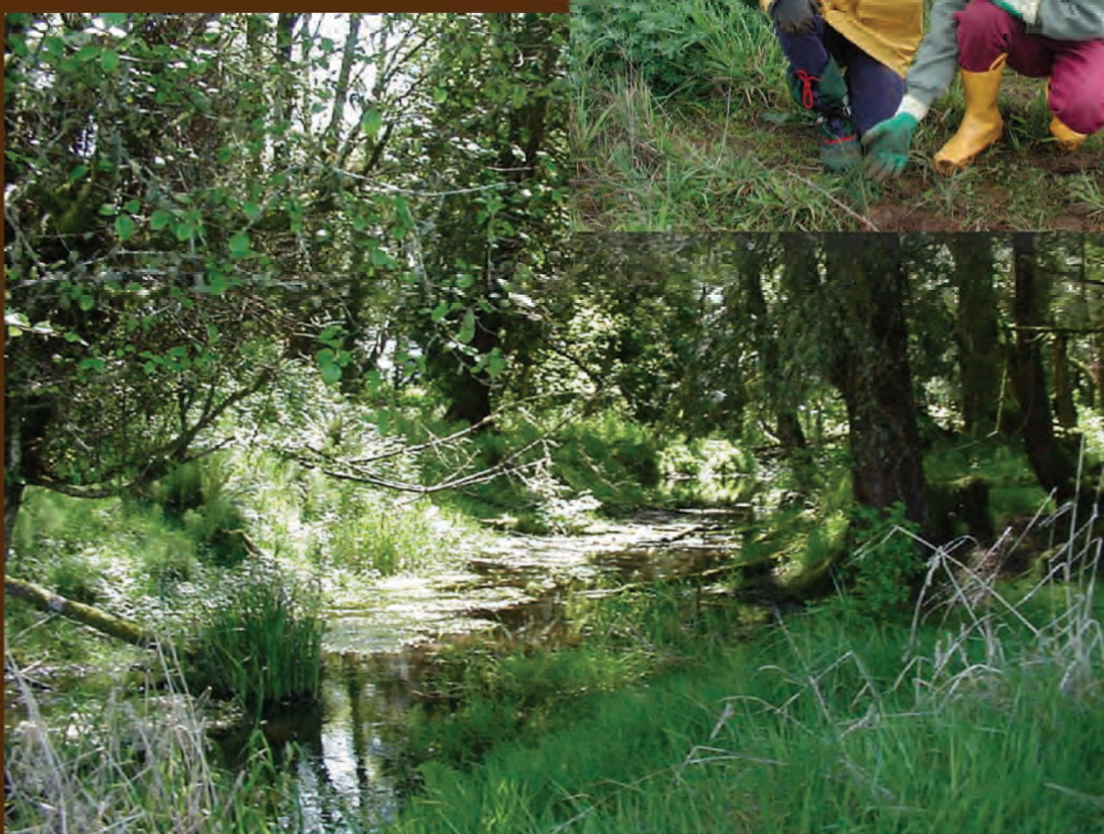
The Columbia River estuary supports populations of resident and wintering bald eagles.
Photo: Bald eagle chicks / Dave Menke USFWS

Chapter 2. Alternatives, Goals, Objectives, and Strategies



Photos:White-tailed deer fawn, children planting native plants, and refuge habitat / USFWS

Chapter 2. Alternatives, Goals, Objectives, and Strategies

2.1 Considerations in Alternative Design

During development of the CCP/EIS alternatives presented in this chapter, the Service reviewed and considered a variety of resource, social, economic, and organizational aspects important for managing the refuges. As is appropriate for a national wildlife refuge, resource considerations were fundamental in designing alternatives. House Report 105-106 accompanying the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) states "…the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first."

The Service planning team reviewed and utilized available scientific information (reports and studies) to better understand ecosystem trends and the latest scientific recommendations for species and habitats. The team also met with staff from local, state, and Federal agencies, and elected officials to ascertain priorities and problems as perceived by others. Refuge staff also met with refuge users, nonprofit groups, and community organizations to ensure their comments and ideas were considered during CCP/EIS development.

The details of public participation can be found in the Draft CCP/EIS (Appendix I, Scoping Report). During development of the alternatives, the planning team considered the actions detailed below. All of these actions were ultimately eliminated for the reasons provided.

2.2 Actions Considered but Not Developed for the CCP/EIS

2.2.1 Commercial Waterfowl Guiding

The planning team considered commercial waterfowl guiding activities occurring within the refuges' boundaries. Guided waterfowl hunting is not an activity that is permitted on the refuges although it does occur off of refuge lands elsewhere in the lower Columbia River. There has been one request in the past 10 years by a waterfowl guide to conduct business on Lewis and Clark Refuge. No other communication has been received expressing interest in a waterfowl guide service. During the scoping process, the issue of commercially guided waterfowl hunting was identified as an issue to be discussed; however, no interest was expressed by commercial waterfowl guides and comments from the general public indicated that not opening the refuge to commercially guided waterfowl hunting is preferred.

Commercial waterfowl hunts differ from other forms of commercial guiding activities (e.g., fishing, kayaking) that occur within a refuge boundary. Generally, these guided activities travel through and around the refuge islands on State-owned navigable waters and do not use the refuges' land base as a destination. In addition, unlike commercially guided fishing or kayaking tours, commercially guided waterfowl hunts occupy a wide area for a period of time, at the exclusion of all other activities. By contrast, fishing and kayaking generally do not exclude others from being in the vicinity, nor does a commercially guided fishing or kayaking trip preclude the general public from being present in the area that kayaking and fishing are taking place. If commercially guided waterfowl hunting were to occur on either refuge, competition for island shoreline hunting sites would likely occur between the waterfowl hunters with guide services and those without guide services.

Commercially guided waterfowl hunting was considered and dismissed from further consideration in this CCP/EIS because minimal demand exists for the service and it would likely conflict with refuge visitors participating in compatible, noncommercial waterfowl hunting.

2.2.2 Camping

The planning team considered providing camping opportunities as some interest was expressed by a few members of the public during the scoping process. Refuge policy states that "camping on refuge lands is allowed only when required to implement or sustain an approved wildlife/wildlands oriented recreational activity or when no other alternative is practical" which means that if hunting, fishing, wildlife observation, interpretation, environmental education, and wildlife photography could not occur on Lewis and Clark or Julia Butler Hansen Refuges without camping, then we would need to consider allowing camping. While camping could make it easier to engage in wildlife-dependent recreation, or add to the refuge recreational experience, camping is not required for the public to partake in the refuges' approved public use opportunities. Therefore, establishing camping on refuge lands is not included in the CCP/EIS alternatives.

Camping does occur within the overall refuge acquisition boundary on State-owned dredge-spoil islands and outside refuge boundaries on the Oregon and Washington mainland. Instead of providing camping on a refuge, a refuge goal for all alternatives considered is to identify existing and additional camping areas with State and local landowners that could be developed and would eliminate potential wildlife impacts. By helping to identify existing camp sites and working with partners to establish additional off-refuge camp sites, the demand by the camping public can be met without conflicting with refuge policy.

2.3 Alternative Descriptions

Tables 2-1 and 2-2 summarize the key differences between the alternatives for each refuge.

2.4 Features Common to all Alternatives

All the alternatives contain some common features. To reduce the length and redundancy of the individual alternative descriptions, common features are presented below. Refuge names have been listed within the text as appropriate when the highlighted item is applicable only to that specific refuge.

2.4.1 Implementation Subject to Funding Availability

Under each alternative, actions will be implemented over a period of 15 years as funding becomes available. It is the intent of the planning team that annual priorities will follow the final CCP guidelines; however, funding initiatives, unforeseeable management issues, and budgets, may vary from year to year. The CCP will be reviewed every five years and updated as necessary throughout its life.

2.4.2 Columbian White-tailed Deer Recovery Plan

The Columbian White-tailed Deer Recovery Plan (USFWS 1983) and the Additions to the Julia Butler Hansen Refuge for the Columbian White-tailed Deer (Oregon and Washington) Environmental Assessment (USFWS 1993) are the driving forces behind refuge purposes, management activities, land acquisition, and partnerships for the recovery of the CWT deer. These documents identify CWT deer life history needs, secure habitat requirements, population size, and distribution, necessary to meet the recovery goals for removing the CWT deer from the endangered species list. The minimum population goals and secure habitat objectives outlined in these documents were directly incorporated into the CCP/EIS without changes.

2.4.3 Elk Hunt Plan

The Julia Butler Hansen Refuge for the Columbian White-tailed Deer Hunt Plan and associated Environmental Assessment for the Control of Elk on the Julia Butler Hansen Refuge for the Columbian White-tailed Deer (2004a) are incorporated in all alternatives and are an important part of managing and maintaining a healthy CWT deer population. The elk hunt plan outlines population objectives for elk on the refuge's Mainland Unit, and describes how an elk hunting program is administered. The management of elk on the Mainland Unit will remain consistent with these documents and no changes are proposed in the CCP/EIS.

2.4.4 Fire Management Plan

The 2004 Wildland Fire Management Plan for the Julia Butler Hansen Refuge for the Columbian White-tailed Deer and the Lewis and Clark National Wildlife Refuge details how the refuges respond to the threat of wildfire, and under what circumstances the refuges are to use fire as a tool on refuge lands. This plan will remain as is and no changes to fire management capabilities or opportunities are proposed in the CCP/EIS.

2.4.5 Wallace Island Hunt Plan

The 2007 Wallace Island Waterfowl Hunt Plan and associated Environmental Assessment were completed to open the Wallace Island shoreline for waterfowl hunting. This hunting management plan was initiated due to a lawsuit from the Humane Society of the United States. No changes to this plan are proposed in the CCP/EIS.

2.4.6 Wilderness Review

The Service's CCP policy requires that a wilderness review be completed for all CCPs. If it is determined that the potential for wilderness designation is found, the process moves on to the wilderness study phase. As part of the process for this CCP/EIS the planning team completed wilderness inventories, which can be found in Appendices E and F. These appendices describe potential wilderness qualities of the islands on both refuges. Based on the public review and comment on the Draft CCP/EIS the Service has identified in the Final CCP/EIS several WSAs which will be the subject of a subsequent wilderness study. The wilderness study, which will be completed within five years of publication of the CCP/EIS, will be available for public review and will, if warranted, make suitable wilderness recommendations to the Secretary of the Interior, the President, and Congress.

2.4.7 Integrated Pest Management (IPM)

In accordance with 517 DM 1 and 7 RM 14, an integrated pest management (IPM) approach would be utilized, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on refuge lands. The IPM approach would involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to nontarget species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. If a pesticide would be needed on refuge lands, the most specific (selective) chemical available for the target species would be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage would be further restricted because only pesticides registered with the U.S. Environmental Protection Agency (EPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by EPA may be applied on lands and waters under refuge jurisdiction.

Environmental harm by pest species causes a biologically substantial decrease in environmental quality as indicated by a variety of potential factors, including declines in native species populations or communities, degraded habitat quality or long-term habitat loss, and/or altered ecological processes. Environmental harm may be the result of direct effects of pests interacting with native species, including preying and feeding on them; causing or vectoring diseases; preventing reproduction or killing their young; out-competing them for food, nutrients, light, nest sites or other vital resources; or hybridizing with them so frequently that within a few generations few if any truly native individuals remain. Environmental harm can also be the result of an indirect effect of pest species. For example, decreased waterfowl use may result from invasive plant infestations that reduce the availability and/or abundance of native wetland plants that provide forage during the winter.

Environmental harm may involve detrimental changes in ecological processes. For example, cheatgrass infestations in shrub steppe can alter fire return intervals displacing native species and communities of bunch grasses, forbs, and shrubs. Environmental harm may also cause or be associated with economic losses and damage to human, plant, and animal health. For example, invasions by fire-promoting grasses that alter entire plant and animal communities, eliminating or sharply reducing populations of many native plant and animal species, can also greatly increase firefighting costs.

See Appendix D for the IPM program documentation to manage pests on the refuge. Along with a more detailed discussion of IPM techniques, this documentation describes the selective use of pesticides for pest management on refuge lands, where necessary. Throughout the life of the

CCP, most proposed pesticide uses on refuge lands would be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects would be documented in Appendix D, under Chemical Profiles. Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as cropland/facilities maintenance would be approved for use on refuge lands where there likely would be only minor, temporary, and localized effects to species and environmental quality based upon non-exceedance of threshold values in Chemical Profiles. However, pesticides may be used on refuge lands where substantial effects to species and the environment are possible (i.e., they may exceed threshold values) in order to protect human health and safety (e.g., mosquito-borne disease).

2.4.8 Monitor Effects of Public Use Programs on Wildlife

Monitoring to assess the effects of public use on wildlife will be conducted. Areas and/or timing of public use will be modified, if necessary, to provide secure and adequately sized sanctuary areas for CWT deer, dusky Canada geese, and other sensitive species.

2.4.9 Regulatory Compliance

All activities in all alternatives requiring review, permits and clearances (Section 106 of the National Historic Preservation Act [NHPA], Section 7 endangered species consultation, Section 401 water quality permit, etc.) will undergo appropriate review and obtain necessary permits and/or clearances as needed.

2.4.10 Maintaining/Upgrading Existing Facilities

Periodic maintenance and upgrading of the refuges' buildings and facilities will be necessary regardless of the alternative selected. Periodic maintenance and upgrading of facilities is necessary for safety and accessibility and to support staff and management needs.

2.4.11 Tribal Coordination

Coordination with Native American Tribes that have an interest in the refuges is common to all alternatives. We will coordinate and consult with the Cowlitz Tribe and the Shoalwater Bay Tribe regarding issues of shared interest. The Service may expand and seek assistance from other Tribes for future issues related to cultural resources education and interpretation, special programs, the NHPA, and the Native American Graves Protection and Repatriation Act.

2.4.12 State Coordination

Under all alternatives, the Service will continue to maintain regular discussions and partnerships with the ODFW and WDFW. Key topics for discussion continue to be the CWT Deer Recovery Plan and its continued implementation on Julia Butler Hansen Refuge and the surrounding private and public lands; the Pacific Flyway Management Plan for the Dusky Canada Goose (Pacific Flyway Council 2008) (Julia Butler Hansen Refuge); wildlife monitoring, hunting and fishing seasons, and regulations; and endangered species management.

2.4.13 Volunteer Opportunities

Volunteer opportunities occur in all alternatives. These are recognized as components of the successful management of public lands and may become vital to the implementation of refuge programs, plans, and projects, especially during periods of declining budgets. Currently, neither refuge has a formal volunteer program due to the refuges' small staff size, rural nature and remoteness, and large land base.

2.4.14 Participation in Planning and Review of Regional Development Activities

The Service will actively participate in planning and studies for ongoing and future industrial and urban development, water pollution, and other potential concerns that may adversely affect refuge wildlife resources, habitats, and/or environmental quality. The Service will cultivate working relationships with pertinent county, State, and Federal agencies to stay abreast of current and potential developments; and will utilize outreach and education as needed to raise awareness of each of the refuges resources and dependence on the local environment.

2.4.15 U.S. Army Corps of Engineers Section 536 Habitat Restoration

The Corps has funded a habitat restoration project to improve tidal flow and fisheries access to 87 acres of slough habitat and restore 210 acres of native riparian forest on the Mainland Unit. The project is intended to benefit a multitude of fish and wildlife species including federally endangered salmonids and CWT deer as well as bald eagles, waterfowl and neotropical migratory bird species. Restoration and reconnection of tidal sloughs and riparian forest habitat to the Columbia River would mimic the more natural riparian forest/tidal channel habitats that were historically abundant in the Columbia River estuary. This restoration will take place under all alternatives, and it has been covered in an environmental assessment (U.S. Army Corps of Engineers 2008). .

2.4.16 Adaptive Management

Based upon 522 DM 1 (Adaptive Management Implementation policy), refuge staffs shall utilize adaptive management (AM) for conserving, protecting, and, where appropriate, restoring lands and resources. Within 43 CFR 46.30, AM is defined as a system of management practices based upon clearly identified outcomes, where monitoring evaluates whether management actions are achieving desired results (objectives). In the recently published *DOI Adaptive Management Technical Guide*, AM is defined as a decision process that "promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood". Adaptive management accounts for the fact that complete knowledge about fish, wildlife, plants, habitats, and the ecological processes supporting them may be lacking. The role of natural variability contributing to ecological resilience also is recognized as an important principle for AM. It is not a "trial and error" process, but rather AM emphasizes learning while doing based upon available scientific information and best professional judgment considering site-specific biotic and abiotic factors on refuge lands.

2.4.17 Participation in Planning and Review of Regional Development Activities

The Service will actively participate in environmental planning, protection and studies for ongoing and future projects including: regional land protection planning partnerships, identifying threats to natural resources, and other potential concerns that may adversely affect refuge wildlife resources, habitats, and/or environmental quality. The Service will actively cultivate partnerships with nongovernmental organizations', private landowners, Tribes, county, state, and federal agencies to stay abreast of current and potential developments, land protection opportunities and will utilize outreach and education techniques to raise awareness of the refuges resources.

2.5 Actions Considered but Dismissed

2.5.1 No Mammalian Predator Control

No mammalian predator (coyote, mountain lion, and bear) control would be conducted on Julia Butler Hansen Refuge. This action and its effects were evaluated in the Service's final Julia Butler Hansen Refuge Predator Management Plan and Environmental Assessment (PMP/EA) (USFWS 1997) and a supplemental document. The lack of mammalian predator control would not protect adult and juvenile CWT deer on the refuge that are vulnerable to predation. Based upon available scientific information (refuge studies, monitoring, and population modeling), not conducting predator control would not achieve Julia Butler Hansen Refuge goals and population objectives for CWT deer necessary to promote its recovery in the lower Columbia River region. In accordance with 43 CFR 46.135, the Service incorporates through reference, the action (no mammalian predator control) and evaluation of its environmental effects described in the PMP/EA.

2.5.2 Nonlethal Techniques to Remove Coyotes

In accordance with 7 RM 14 (Pest Control), nonlethal methods of vertebrate pest management would be considered before lethal control measures. In the final PMP/EA and its supplemental document we addressed the following nonlethal methods for controlling coyotes: trapping and permanent relocation, and trapping and temporary relocation. We also considered the use of birth control (sterilization) and aversive taste conditioning in the PMP/EA, but dismissed these methods from further consideration. In accordance with 43 CFR 46.135, the Service incorporates through reference the descriptions of these nonlethal techniques and the evaluation of environmental effects described in the PMP/EA. Birth control (sterilization) and aversive taste conditioning were dismissed from further consideration for this CCP/EIS because the published scientific studies of these techniques have not shown them to be more effective than lethal methods for removing coyotes.

2.5.3 Public Trapping and Hunting to Remove Coyotes

After addressing nonlethal techniques, 7 RM 14 requires consideration of lethal control of vertebrate pests by public harvest before "means other than public harvest." In the PMP/EA and its supplemental document we addressed public trapping and hunting. In accordance with 43 CFR 46.135, the Service incorporates through reference the descriptions of public trapping and hunting as well as associated evaluation of environmental effects described in the PMP/EA. These actions are dismissed from consideration for this CCP/EIS for the following reasons:

- Potential disturbance to CWT deer;
- Lower effectiveness of coyote removal;
- Safety of and potential conflicts with other refuge users; and
- Potential conflicts with refuge staff implementing on-the-ground management actions.

2.6 Alternatives Descriptions Summary

2.6.1 Lewis and Clark Refuge

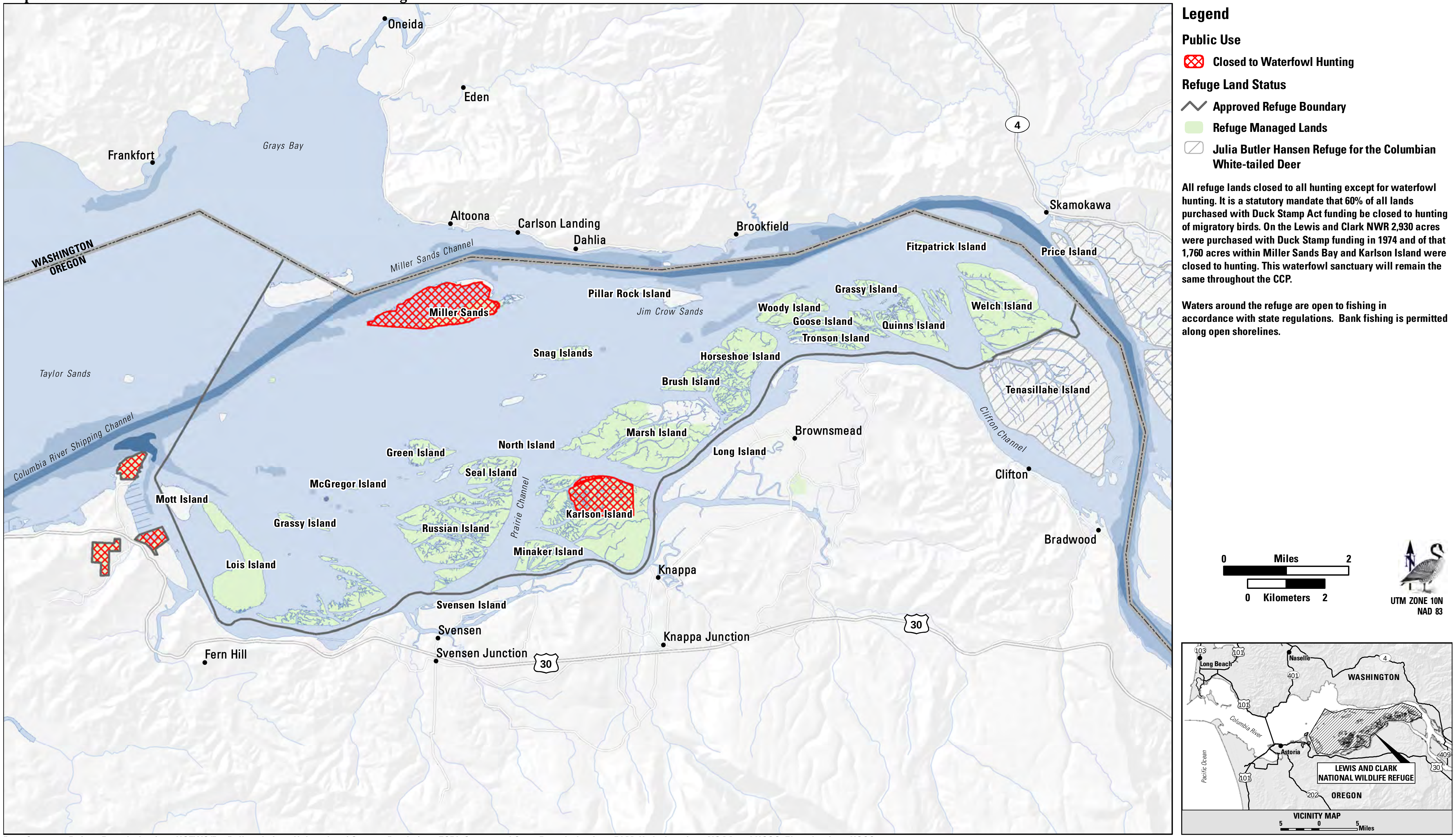
2.6.1.1 Alternative 1 Continue Current Management (No Action)

Alternative 1 assumes no change from past management programs and is considered the base from which to compare the other alternatives (Map 4). Under this alternative, refuge management practices already underway or funded would continue. No significant changes would be initiated by the Service. A detailed description of current refuge management programs is found in the Social and Economic Environment section of this CCP/EIS (Chapter 5). Although the refuge currently has no integrated plan to guide the management of all of its resources and uses, current management efforts on the refuge focus on the protection of sensitive species, the enhancement of their habitats, and the management of public access to and use of refuge lands. Current management of the refuge is guided by the following existing "step-down" plans which include:

- Lewis and Clark Refuge Public Use Management/Development Plan (1984)
- Lewis and Clark Refuge Sport Hunting Plan and Environmental Assessment (1985)
- Lewis and Clark Refuge Management Plan (1986)
- Lewis and Clark Refuge Animal Control Plan (1989)
- Julia Butler Hansen/Lewis and Clark Refuge Fire Management Plan (2004b)

Under Alternative 1 the Lewis and Clark Refuge islands would continue to be managed using natural processes with limited human intervention. These management actions include noxious weed control, wildlife/habitat surveys, and law enforcement patrol. There would be no new or expanded habitat management activities planned under this alternative. Public use opportunities

Map 4. Alternative 1 – Lewis and Clark National Wildlife Refuge



Data Sources: Refuge Boundaries from USFWS/R1; Railroads from University of Oregon; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; Elevation from USGS

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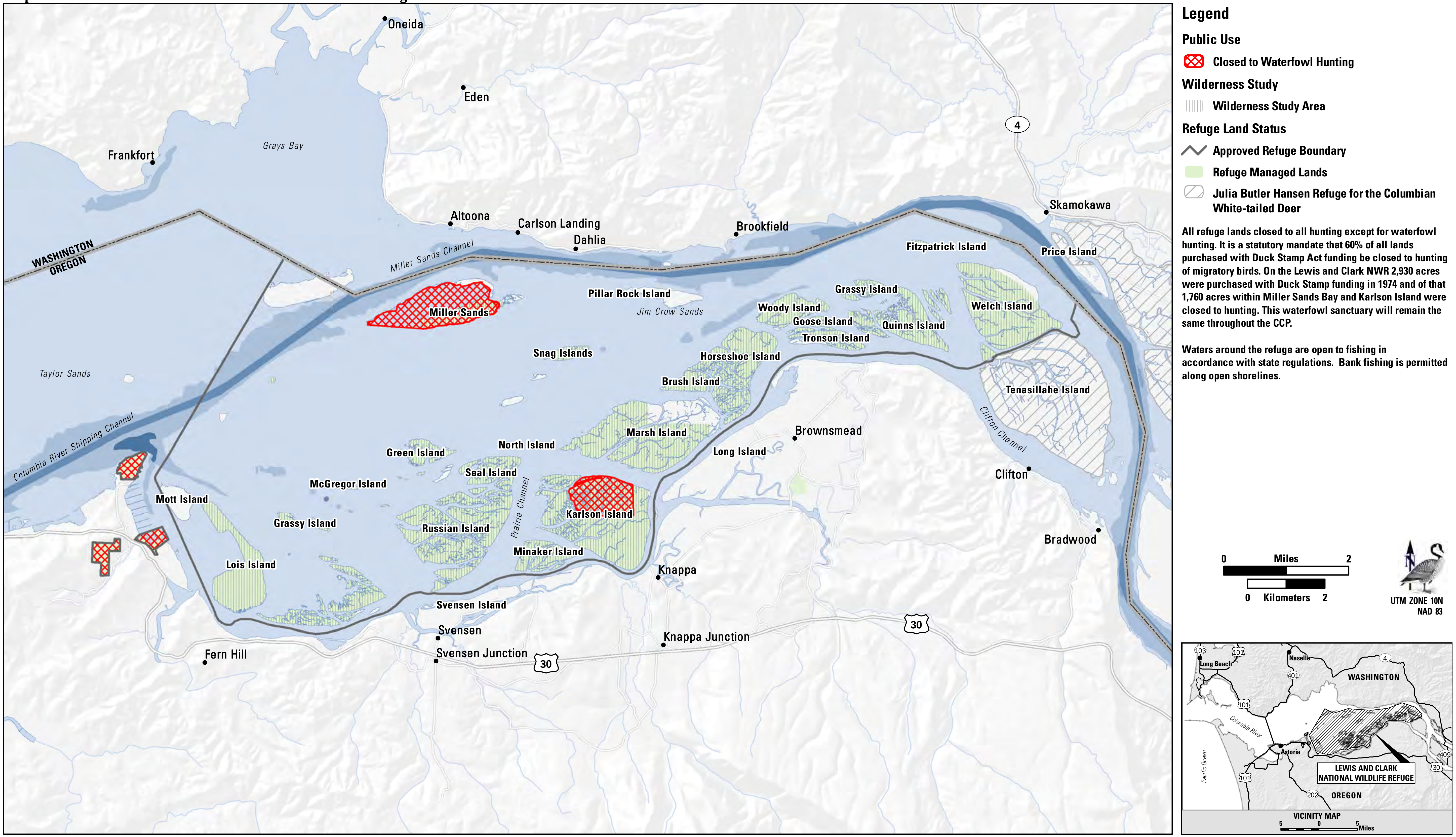
Map 5. Alternative 2 – Lewis and Clark National Wildlife Refuge



Data Sources: Refuge Boundaries from USFWS/R1; Railroads from University of Oregon; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; Elevation from USGS

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would continue to focus on wildlife oriented recreation. Visitor information for the refuge would be available from the Julia Butler Hansen Refuge headquarters office near Cathlamet, Washington, and the Willapa National Wildlife Refuge Complex office near Ilwaco, Washington. This scenario would keep the public use opportunities at the current level with no new or expanded activities planned.

2.6.1.2 Alternative 2 (Preferred Alternative) Enhance Resource Protection/Provide Wildlife-dependent Public Use

Under Alternative 2 most of the existing management practices and public use programs would be retained (Map 5). Additional emphasis would be placed on working with the ODSL to allow the refuge to acquire or manage State-owned lands within the acquisition boundary of the refuge; increase invasive species control efforts on and off the refuge; facilitate research opportunities; develop/enhance habitat on dredge spoil islands; increase volunteer opportunities; work with area landowners to address camping needs; develop an interpretive water trail through the refuge; and improve signage for refuge visitors.

2.6.2 Julia Butler Hansen Refuge for the Columbian White-tailed Deer

2.6.2.1 Alternative 1, Current Management (No Action)

No change to current management programs would occur under Alternative 1; it is considered the base from which to compare the other alternatives (Map 6). Under Alternative 1 refuge management consistent with available funding and staffing would continue. No significant changes would be initiated by the Service. A detailed description of current refuge management programs is available in Chapter 5 of this CCP/EIS. Management efforts on the refuge would continue to focus on the protection of threatened and endangered species and migratory birds, and the maintenance/enhancement of their habitats; and the management of wildlife-dependent recreational uses of refuge lands. Current management of the refuge is guided by the following existing step-down plans:

- Columbian White-tailed Deer Refuge Public Use/Development Plan (1983)
- Columbian White-tailed Deer Refuge Sport Fishing Plan and Environmental Assessment (1984)
- Columbian White-tailed Deer Refuge Sport Hunting Plan and Environmental Assessment (1984)
- Columbian White-tailed Deer Refuge Habitat Management Plan (1987)
- Julia Butler Hansen Refuge Animal Control Plan (1989)
- Julia Butler Hansen Refuge Predator Management Plan and Environmental Assessment (1997)
- Julia Butler Hansen Refuge Elk Management Plan and Environmental Assessment (2004a)
- Julia Butler Hansen/Lewis and Clark Refuge Fire Management Plan and Environmental Assessment (2004b)
- Wallace Island Waterfowl Hunt Plan and Environmental Assessment (2007)

In addition to the step-down plans, several other existing documents have provided management direction for the refuge in recent years, including the Columbian White-tailed Deer Recovery Plan (1983); the Habitat Site Plan (2003); and the interim Habitat Management Plan (2005).

Under this alternative, the Mainland and Tenasillahe Island units would continue to be actively managed for a mosaic of short-grass pasture (680 existing acres), early successional riparian forest (120 existing acres), and managed wetlands (130 existing acres). The habitat management emphasis in both units would continue to be CWT deer forage and cover, whereas pasture for wintering goose use and wetlands for wintering waterfowl would continue to be secondary. Managed wetlands would also provide amphibian breeding habitat focusing on native species such as long-toed salamanders, northwestern salamanders, and red-legged frogs. Management of riparian sites would continue to be focused on the needs of CWT deer primarily, and providing habitat for migratory land birds, bald eagles, and other raptors secondarily.

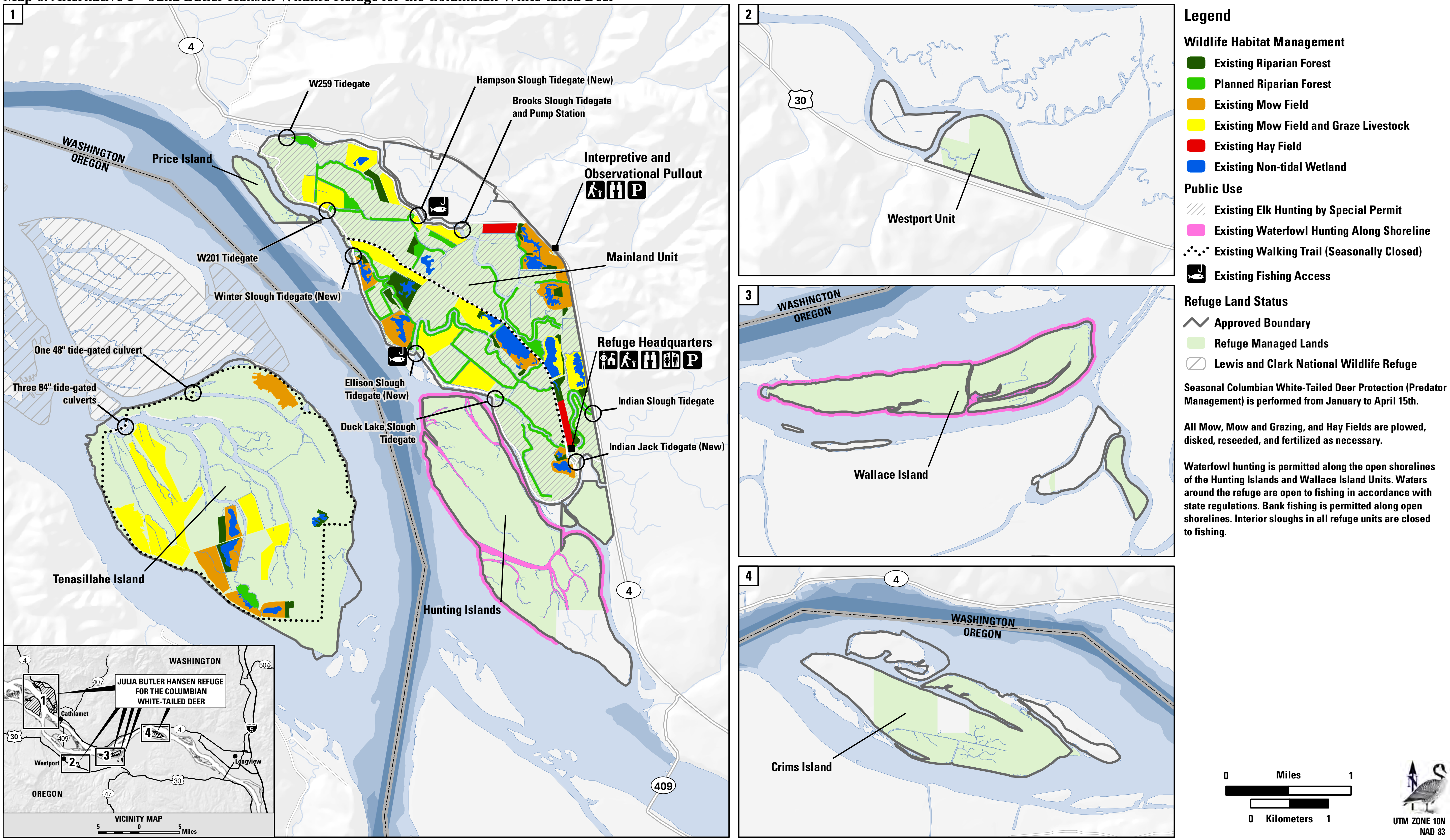
Existing riparian sites, short-grass fields, and wetlands would be maintained and new sites would be established or enhanced. Habitat improvements (short-grass fields, riparian sites, and managed wetlands) would be completed on a limited basis, as funding and staff time permits. Although current management of refuge habitats (e.g., mowing, disking, reseeding) would continue, refuge-wide habitat goals and objectives would generally not be met due to limited habitat enhancement efforts.

Existing water control structures (including culverts and risers) would be repaired or replaced and new structures would be installed based upon available funding and opportunity. Expulsion pump operations at the head of Brooks Slough would continue during periods of high water levels in the Mainland Unit's interior, and the tidegates would be managed as currently designed. The tidegates on the Mainland and Tenasillahe Island units would continue to be managed to prevent/minimize flooding of CWT deer habitat. Opportunities to improve water exchange between sloughs and the Columbia River as well as to allow two-way fish passage (consistent with CWT deer habitat management) would continue to be developed and implemented, where appropriate (e.g., through modifying existing tidegates and installing new tidegates designed to be conducive to water exchange and fish passage).

A variety of other management activities would occur on both diked units in existing managed habitat, including invasive plant control, wildlife/habitat monitoring, fence construction, ditch and slough maintenance, law enforcement patrols, habitat restoration actions, and wildfire suppression. Active management activities on undiked units would include invasive plant control, wildlife/habitat monitoring, law enforcement patrols, and wildfire suppression.

Based upon a supplement to the final PMP/EA (USFWS 1997), the current integrated (nonlethal and lethal) control of coyotes would continue to occur on refuge lands. Although nonlethal (temporary or permanent relocation of coyotes) would be considered first for the integrated approach, state agencies in Oregon and Washington currently have not or would not grant permits to relocate coyotes trapped on the refuge. As a result, lethal control (trapping and euthanizing as well as shooting) would be used to remove coyotes from refuge lands. The specific details for implementing lethal control on the refuge for Alternative 1 are described in Section 2.2.2 of the final PMP/EA (USFWS 1997). Moreover, this method of coyote control

Map 6. Alternative 1 – Julia Butler Hansen Wildlife Refuge for the Columbian White-tailed Deer



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; Elevation from USGS

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would be "temporary in nature" where removals would only occur during years meeting criteria described in Section 2.2.1.

The current wildlife-dependent public use opportunities would continue with no new or expanded activities. On the Mainland Unit, the small interpretive center and viewing deck would continue to be available to the public at the refuge's headquarters. Refuge staff members would provide information and assistance when the office is open and staff are available. Steamboat Slough and Brooks Slough dike roads, which surround the Mainland Unit, and the viewing site on State Highway 4 would be open for wildlife viewing opportunities. Center Road, which bisects much of the Mainland Unit, would continue to be open from June through September as a walking trail, which would not conflict with refuge management activities. With construction of the new refuge maintenance shop, only the northwestern end of the road is open for public access. The remainder of the Mainland Unit's interior would continue to be closed to general public use to limit disturbance to the CWT deer. Fishing opportunities would continue along the outside perimeter of the county-owned dike roads and at the Brooks Slough Pump Station. Except for a regulated elk hunt identified in the Julia Butler Hansen Refuge Elk Management Plan and EA (2004a), there would continue to be no hunting allowed inside the Mainland Unit.

At the Tenasillahe Unit, walking, wildlife viewing, and fishing would continue to be permitted around the 6.6-mile perimeter dike of the refuge. The remainder of the interior of this unit would be closed to public use, including hunting. At the other undiked refuge units (Wallace Island, Hunting Island, Price Island, Crims Island, and the area around Westport, Oregon), wildlife-dependent public use activities would continue to be allowed along the shorelines. Although not closed to visitor use, access to the interior of these islands is not feasible due to the dense vegetation and uneven terrain. Moreover, there is limited wildlife viewing potential. Waterfowl hunting along the shoreline of Hunting and Wallace islands would continue during the State waterfowl season, but Crims Island would remain closed to waterfowl hunting.

Hunting in areas considered outside the jurisdiction of the refuge, such as navigable sloughs, rivers, and other waterways, is subject to Oregon and Washington hunting regulations. It should be noted that the interior waterways of the Mainland and Tenasillahe Island units are considered nonnavigable. Therefore, they would remain closed to any visitor access.

2.6.2.2 Alternative 2, Enhanced Habitat and Columbian White-tailed Deer Management with Increased Wildlife-dependent Public Use Opportunities (Preferred Alternative)

Under this alternative, the Mainland, Crims, and Tenasillahe Island units would be actively managed for a mosaic of short-grass fields, riparian forests, and wetlands to benefit CWT deer and a diverse assemblage of other native wildlife (Map 7). The acreage of short-grass fields would increase from 680 to 790 acres.

The refuge currently maintains 120 acres of early successional riparian forest on the Mainland and Tenasillahe Island units, as well as the recently established 115 acres on Crims Island. Under this alternative, early successional riparian forest would be increased by 190 acres.

This alternative also would increase the acreage of nontidal wetlands by 40 acres (total of 170 acres). In addition, the Service would work with watershed partners to restore aquatic habitats and work with landowners adjacent to the Mainland Unit to conduct habitat restoration that would benefit CWT deer.

This alternative would promote establishing new subpopulations of CWT deer in one or more suitable locations in the lower Columbia River region. Identifying locations considered “secure habitat” as defined in the recovery plan, would be important. Specifically, there may be opportunities to reintroduce CWT deer to public lands that are within their historical range.

The lethal control methods for removing coyotes described under the integrated approach (Alternative 1) also would be used for Alternative 2. However, the time period for coyote control under Alternative 2 would be January 1 to December 31 whereas the time period under Alternative 1 would be January 1 to April 15. In addition, removal of mountain lions and black bears by nonlethal or lethal means would occur anytime one or more of these predators are present on the refuge. As it would be for coyote control, these removal activities would be conducted by the State or U.S. Department of Agriculture’s Animal and Plant Health Inspection Service (USDA-APHIS) that would act as a Service-authorized agent. Because these large mammalian predators could prey upon juvenile and adult CWT deer, they would be removed from the refuge as quickly as possible to prevent substantial reductions in deer population levels. Although bears and mountain lions have not been observed on the refuge, there has been one documented cache of a CWT deer likely attributable to a mountain lion.

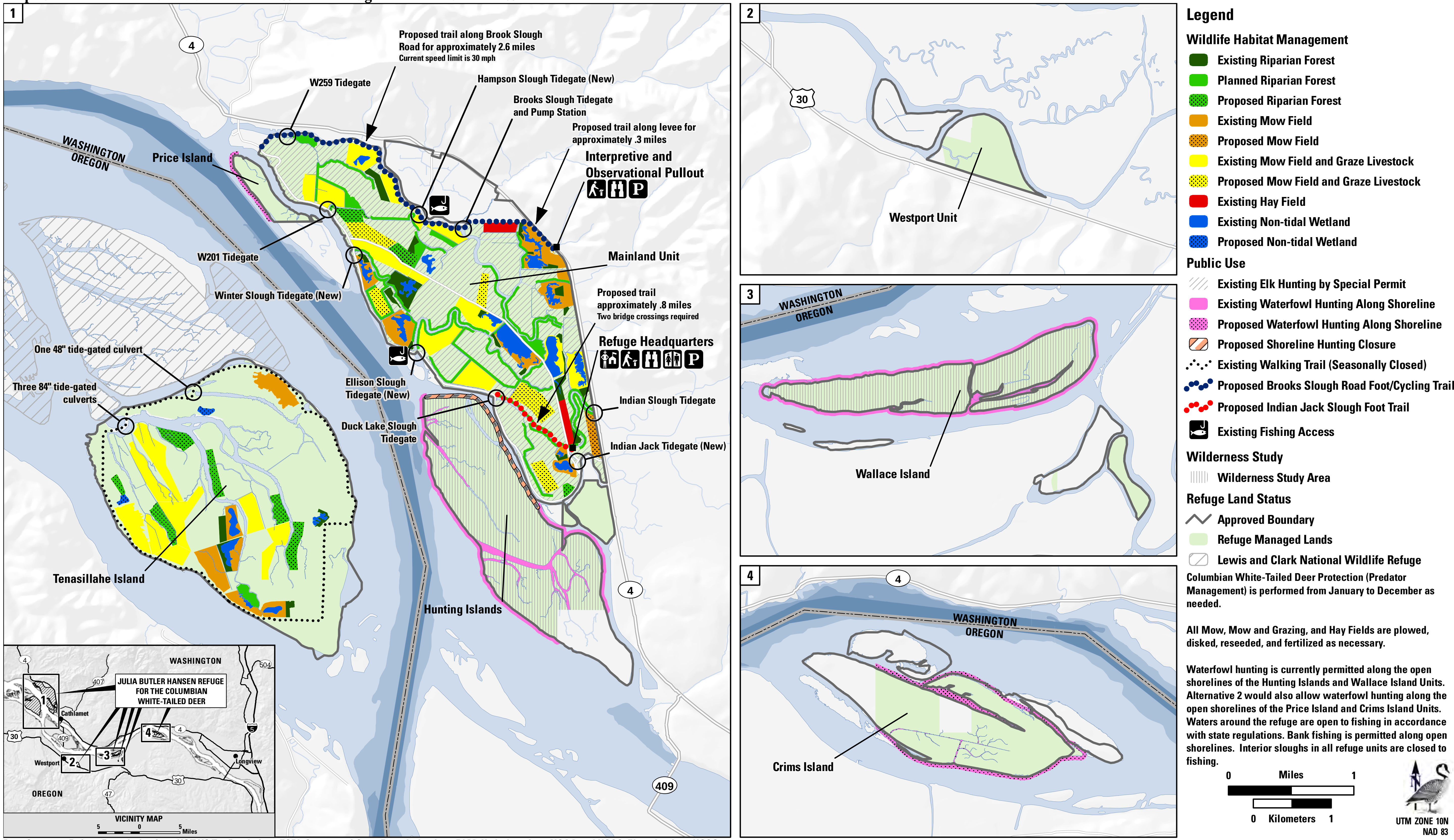
For Alternative 2, the decision to implement coyote control would be made unit-by-unit based on the previous fall’s fawn:doe ratios and the unit’s deer population. No coyote control would occur when a unit’s deer numbers were greater than 25 percent above the population objective. Coyote control would be triggered by 1) very low fawn:doe ratios, 2) very low deer numbers, or 3) a moderate combination of both. The specific criteria are as follows:

1) Deer numbers are above but within 25 percent of population objectives, and fawn:doe ratios are below 20:100 (see Objective 2.9.5.1).
2) Deer numbers are more than 25 percent below population objectives, and fawn:doe ratios are below 45:100 (see Objective 2.9.5.1).
3) Deer numbers are below but within 25 percent of population objectives, and fawn:doe ratios are below 37:100 (see Objective 2.9.5.1).

In comparison with Alternative 1, research and monitoring activities would be increased to include amphibian monitoring, intensive habitat monitoring, and facilitating graduate level research through cooperative efforts with interested universities.

Public use opportunities would be similar to Alternative 1, except wildlife observation and photography would be expanded under Alternative 2. There would be an additional interpretive panel at the Columbia River overlook, and modifying the visitor overlook on State Highway 4 from a wildlife viewing site to an interpretive site. This alternative would also create a new trail replacing the Centerline Trail. The new 0.8-mile trail called the Indian Jack Slough Trail would offer an easy loop through a riparian forested area with the return located along the county road.

Map 7. Alternative 2 – Julia Butler Hansen Wildlife Refuge for the Columbian White-tailed Deer



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; Elevation from USGS

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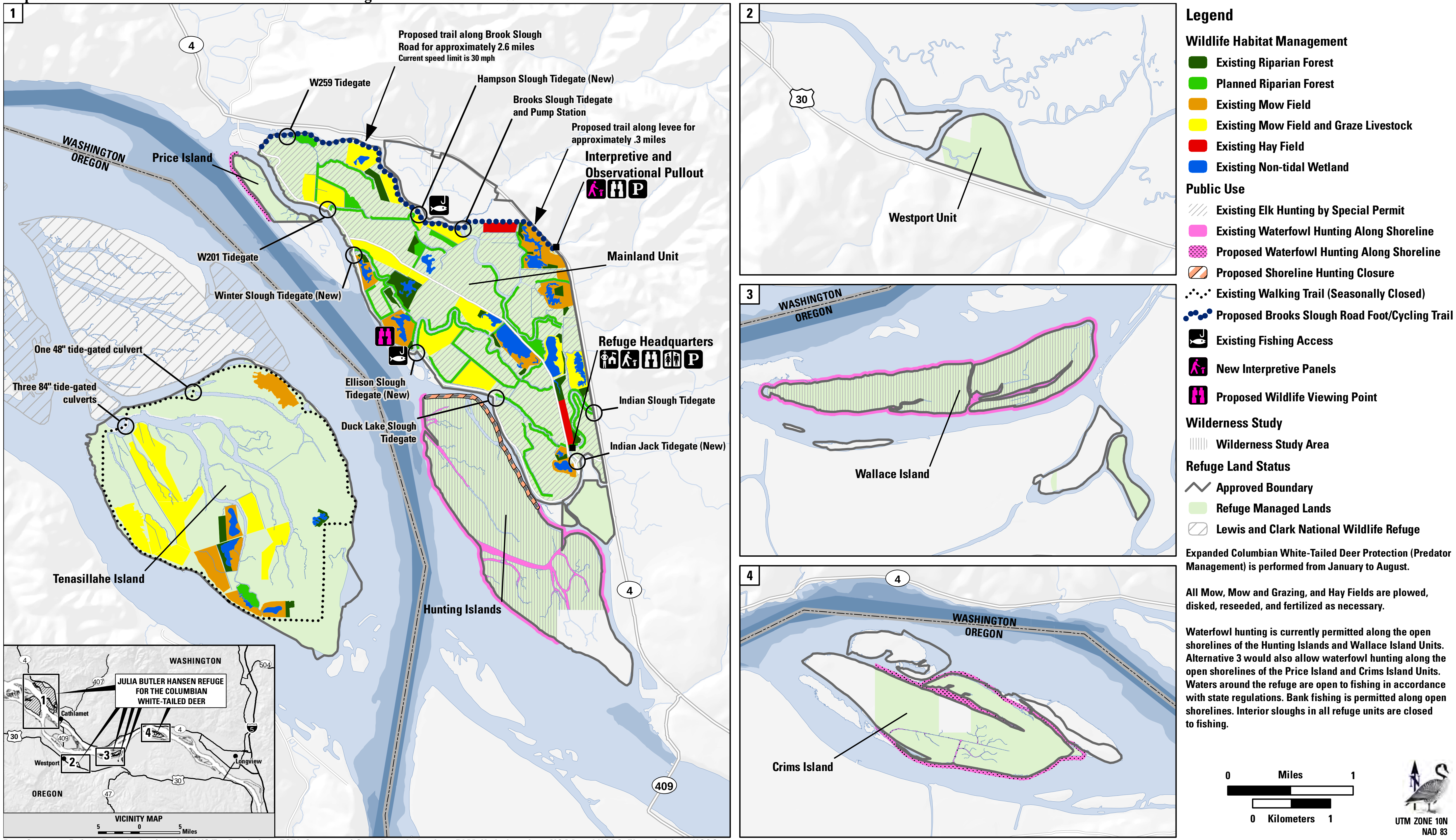
Map 8. Alternative 3 – Julia Butler Hansen Wildlife Refuge for the Columbian White-tailed Deer



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; Elevation from USGS

The back sides of map pages are blank to facilitate map readability.

The 2.6-mile county-maintained Brooks Slough Road and a 0.3-mile section along a refuge levee would be promoted as a foot/cycling trail. Waterfowl hunting would be permitted on Crims and Price islands, but waterfowl hunting along the portion of Hunting Island's shoreline that runs parallel to the Elochoman Slough would be closed for public safety. Available fishing areas would be similar to Alternative 1.

The environmental education program would continue to provide brochures and other information while developing partnerships with other agencies. This program would be expanded primarily through establishment of a refuge Youth Conservation Corps (YCC) program. Interpretive panels and information would be updated.

2.6.2.3 Alternative 3, Maintain Current Habitat Management; Enhance Columbian White-tailed Deer Population Management and Wildlife-dependent Public Use

Habitat management would be similar to Alternative 1, but research and monitoring efforts overall would be reduced for Alternative 3 (Map 8). Within the diked portion of the refuge, riparian forest establishment would be restricted to the 210 acres that is being planted under the Corps' Section 536 habitat enhancement program. There would be no habitat improvements for amphibians. Except for the Section 536 tidegate installations, which are already underway, efforts to improve habitat conditions for native fish would be limited. For areas outside any dikes and subject to Columbia River tidal action, management actions would not differ from those described for Alternative 1.

Under this alternative, CWT deer protection would be the same as Alternative 1, with an extension of the coyote control date. Coyote control measures would occur from January 1 to August 31. As in Alternative 1, the refuge would continue to coordinate with the states when CWT deer predators are present on the refuge and/or are impacting the CWT deer population.

Lethal control methods for removing coyotes described for Alternatives 1 and 2 would also be used for Alternative 3. However, the time period for coyote control under Alternative 3 would be January 1 to August 31 (the coyote control time period for Alternative 1 would be January 1 to April 15; and for Alternative 2 it would be January 1 to December 31). For Alternative 3, criteria to implement coyote removal on the refuge during any year would be the same as Alternative 2. Similar to Alternative 2, removal of mountain lions and black bears by nonlethal or lethal means would occur anytime one or more of these predators are present on the refuge, under Alternative 3. These removal activities would be conducted by the State or USDA-APHIS, acting as a Service-authorized agent.

Under this alternative, wildlife observation and photography opportunities would be enhanced through the following facility improvements:

- Adding two auto pull-outs with interpretive panels;
- Installing two spotting scopes;
- Establishing a new foot/cycling trail along Brooks Slough Road; and
- Upgrading and adding interpretive panels at the Highway 4 Interpretive Site.

Where appropriate, a water trail would be developed as part of the Columbia River Trail System adjacent to the refuge, in partnership with the Lower Columbia River Estuary Partnership. The hunting program would be the same as Alternative 2 and there would be no change in the current fishing program.

2.7 Goals, Objectives, and Strategies Introduction

Goals and objectives are the unifying elements of successful refuge management. They identify and focus management priorities, resolve issues, and link to refuge purposes, Service policy, and the Refuge System mission. A vision broadly reflects the refuge purposes, the Refuge System mission and goals, other statutory requirements, and larger scale plans as appropriate. A CCP describes management actions that help bring a refuge closer to its vision. Public use and wildlife/habitat management goals define general targets in support of the vision, followed by objectives that direct effort into incremental and measurable steps toward achieving those goals. Strategies identify specific tools and actions to accomplish objectives.

In the development of this CCP/EIS, the Service evaluated a reasonable range of alternatives associated with achieving refuge management goals and objectives. Although alternatives can differ with respect to objectives (e.g., acres to be restored), they mainly vary in terms of the management actions to be implemented over the lifetime of the CCP.

2.7.1 Reviewing the Goals, Objectives and Strategies

The goals and objectives for the Julia Butler Hansen and Lewis and Clark Refuges are presented within this section. Each goal is followed by one or more objectives that pertain to it. Similarly, management strategies are presented for each objective where there are actions needed to achieve the objective. Below each objective statement are management strategies that would be implemented to achieve it, presented in a tabular format. For these tables, note the following:

- Each management strategy is presented on a row in a table.
- A checkmark in an alternative column denotes that a specific management strategy would apply to that alternative.

2.8 Lewis and Clark National Wildlife Refuge Goals, Objectives, and Strategies

Before human influence, the Columbia River estuary was a high-energy environment dominated by physical forces, with extensive sand beds and highly variable river flows. Several authors have suggested that the biological processes in this environment may have been unique on the Pacific Coast. The estuary of today, however, has been extensively modified in terms of physical and biological processes. The development and operation of the Columbia River's hydroelectric system has contributed significantly to these changes. Direct effects have occurred through changes in seasonal flow rates and reduced sediment discharges, resulting in changes in the estuary's energy balance. Despite these changes, much of the refuge islands remain in a relatively natural state, with tidal inundation occurring twice daily in the lower marshy areas of the refuge.

Pintail ducks / USFWS

2.8.1 Goal 1. Protect and Maintain Natural Forested Wetland (Swamp) Habitats Characteristic of the Historic Lower Columbia River for the Benefit of Migratory Birds, Columbian White-tailed Deer, and Other Native Wildlife

2.8.1.1 Objective for Scrub-Shrub Swamp

Throughout the life of the CCP, protect all existing acreages of scrub-shrub wetlands (an estimated 2,165 acres) for the willow flycatcher, CWT deer, yellow warbler, and other wildlife. This habitat includes the following characteristics.

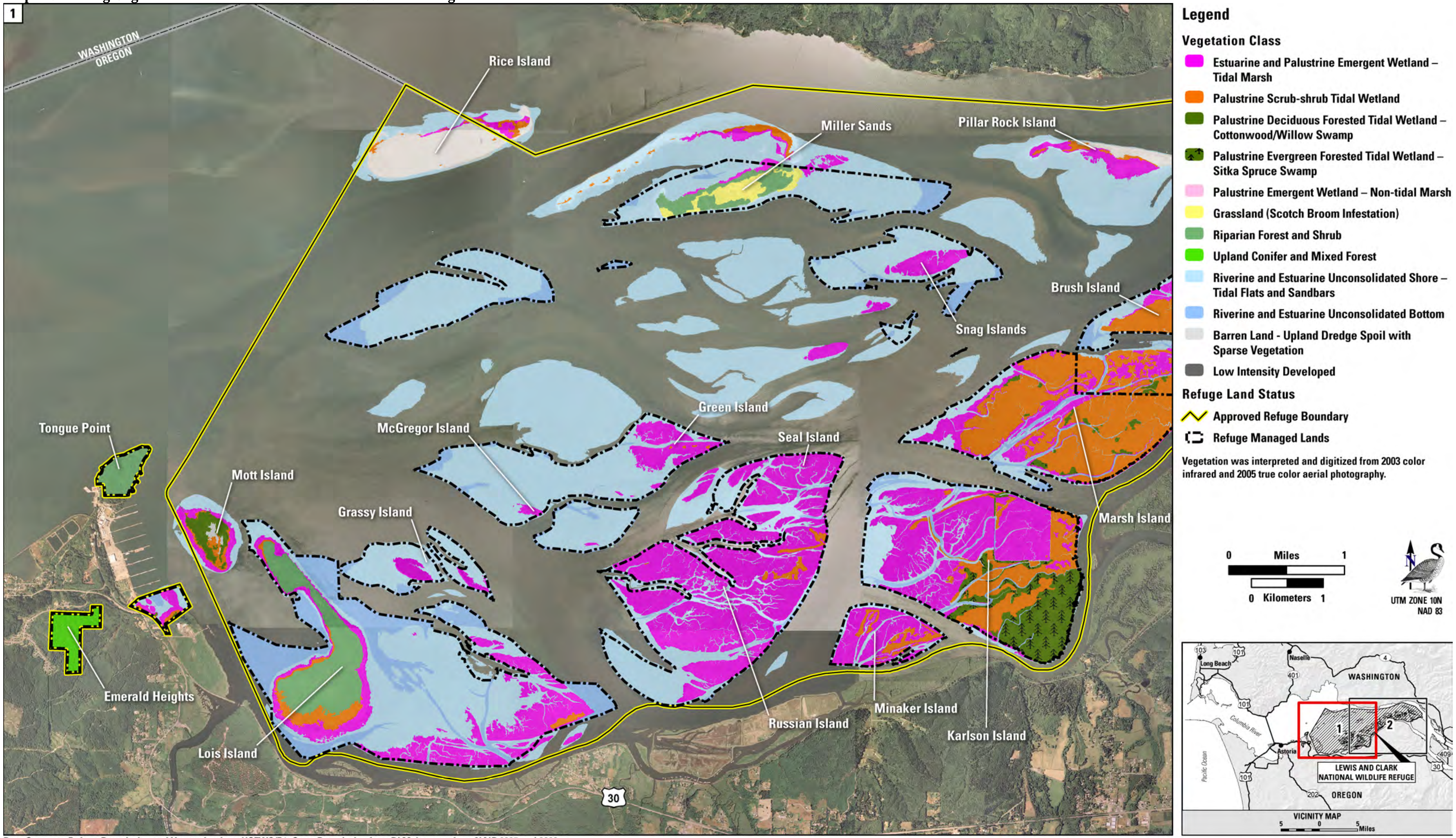
- Shrubs are the dominant vegetation, with native species such as Sitka willow, Pacific willow, red-osier dogwood, salmonberry, Pacific ninebark, and hardhack.
- Interspersed scattered trees taller than 13 feet are present, made up of native species including Sitka spruce, black cottonwood, and tree willows.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Allow natural processes to drive vegetative changes.	✓	✓
B. Monitor vegetation and wildlife composition changes over time and threats to biological integrity such as contamination and invasive species.	✓	✓
C. Work with partners to control invasive species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓

Rationale: The hydrology of the lower Columbia River and its estuary are related to the daily rising and falling of the tides. As it nears the ocean, the slowing current deposits the river's silt load to form low, marshy islands and sandbars. Islands farther downstream tend to have more of a willow shrub component and, because of their relatively low topography, are more susceptible to tidal fluctuations. Because these islands are outside of any flood protection dikes and subject to natural processes, little if any physical management actions are appropriate for these areas.

Scrub-shrub swamp is a climax vegetative community in parts of the lower estuary (Maps 9a and 9b). It provides essential habitat for shrub-dependent birds such as the little willow flycatcher and the yellow warbler. Waterfowl forage in the scrub-shrub at higher tide levels. Red-legged frogs also utilize this habitat. Of the principal habitats of the Columbia River estuary, tidal swamps have been the most heavily impacted by human activities such as diking and drainage. The extent of the swamps has been reduced by approximately 77 percent since 1870 (USFWS 1983). The Lower Columbia River Estuary Plan calls for the preservation of existing wetlands in the lower Columbia River (LCREP 1999).

Map 9a. Existing Vegetation – Lewis and Clark National Wildlife Refuge



Data Sources: Refuge Boundaries and Vegetation from USFWS/R1; State Boundaries from BLM; Imagery from NAIP 2005 and 2006

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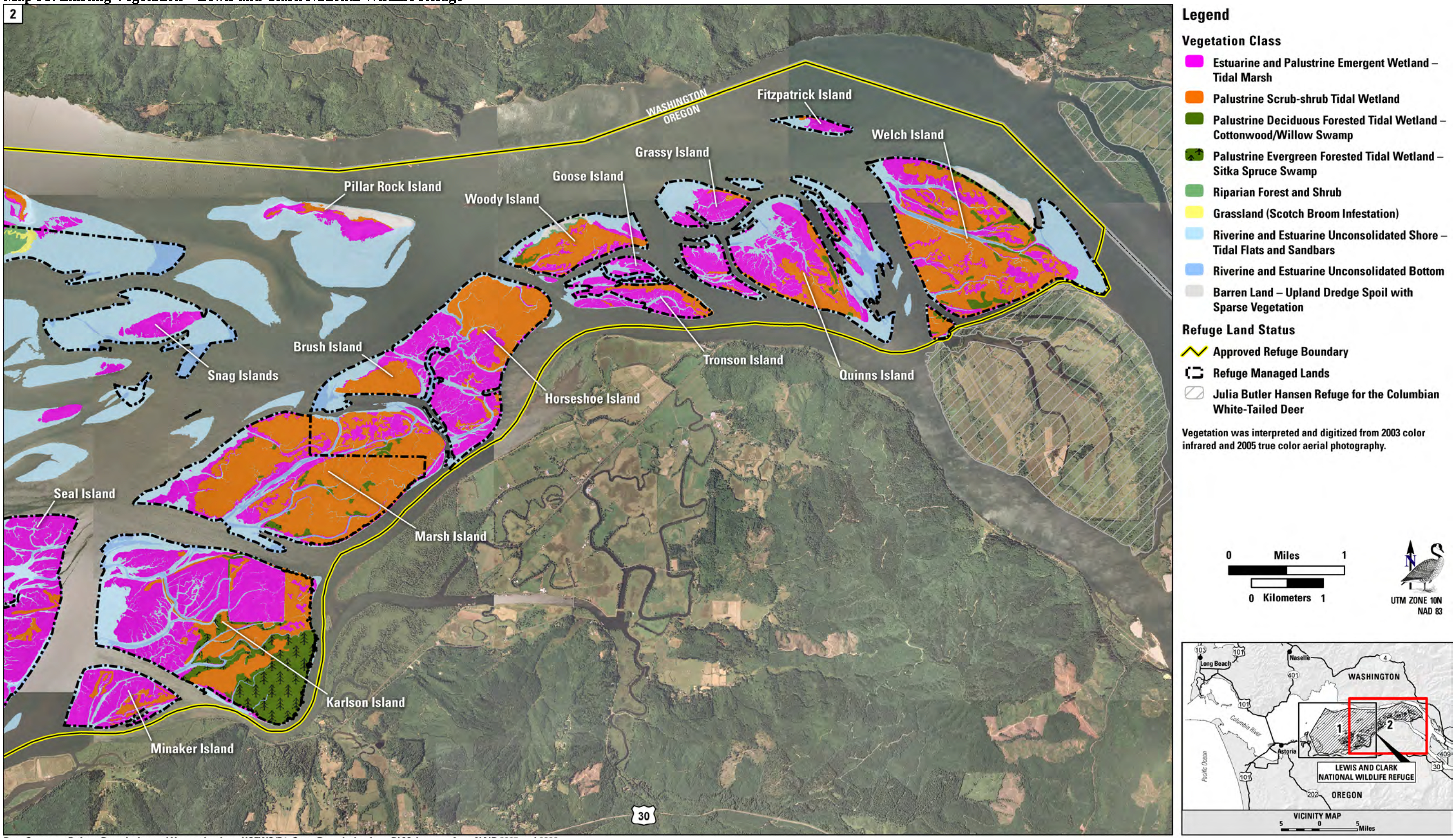
Map 9b. Existing Vegetation – Lewis and Clark National Wildlife Refuge



Data Sources: Refuge Boundaries and Vegetation from USFWS/R1; State Boundaries from BLM; Imagery from NAIP 2005 and 2006

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2.8.1.2 Objective for Sitka Spruce Swamp

Throughout the life of the CCP, protect all existing acreages (estimated 285 acres) of Sitka spruce swamp (palustrine evergreen forested wetland) for the bald eagle, red crossbill, CWT deer, and other wildlife. Habitat characteristics include:

- Late-succession mature trees predominantly composed of Sitka spruce; black cottonwood, red alder, and western red cedar may also be present;
- More than seven mature spruce trees per acre; and
- Typically located within 5,000 feet of water.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Allow natural processes to dictate vegetative changes.	✓	✓
B. Monitor vegetation and wildlife composition changes over time and threats to biological integrity such as contamination and invasive species.	✓	✓
C. Work with partners to control invasive species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓

Rationale: The hydrology of the lower Columbia River and its estuary are related to the daily tidal rise and fall. As the river nears the ocean, the slowing current deposits the river's silt load to form low, marshy islands and sandbars. Sitka spruce swamp habitat is a diverse and rich wildlife habitat. The large spruce trees are often spaced far enough apart to permit the growth of a dense understory of shrubs, particularly Sitka willow and red-osier dogwood.

Fingers of tidal emergent marsh and areas of pure scrub-shrub are intermixed with the spruce swamp (Maps 9a and 9b). The trunks and root masses of long-fallen trees form hummocks, where terrestrial mammals such as CWT deer can escape tidal flooding. The spruce cones provide a source of seeds for red crossbills, and the branches provide a nesting platform for great blue herons, bald eagles, and other birds. Sitka spruce swamps have been heavily impacted by land diking and clearing. Of the original 14,000 acres found in the estuary, only 2,200 acres remain (Christy and Putara 1992).

Preservation of this habitat is a high priority for the refuge. Because these islands are outside of any flood protection dikes and subject to natural processes, little if any physical management actions are appropriate for these areas. The Lower Columbia River Estuary Plan calls for the preservation of existing wetlands in the lower Columbia River (LCREP 1999).

2.8.1.3 Objective for Cottonwood/Willow Swamp

Throughout the life of the CCP, maintain and protect 120 acres of mid- to late-succession tidal cottonwood/willow swamp (palustrine deciduous forested wetland) for the benefit of bald eagles, Swainson's thrush, and other native wildlife. Mid- to late-succession tidal cottonwood/willow swamp is characterized by:

- A canopy cover with greater than 50 percent mature, native trees, including black cottonwood, tree willows, and Oregon ash; and
- A shrub layer composed of native species including red-osier dogwood, salmonberry, trailing blackberry, and shrub willows.

Strategies for Achieving the Objective	Alt.1	Alt. 2
A. Allow natural processes to drive vegetative changes.	✓	✓
B. Monitor vegetation changes over time and threats to the biological integrity such as contamination and invasive species.	✓	✓
C. Work with partners to control invasive species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓

Rationale: The hydrology of the lower Columbia River and its estuary are related to daily tidal fluctuations. As it nears the ocean, the slowing current deposits the river's silt load to form low, marshy islands and sandbars with cottonwood/willow forested swamps. This habitat type is similar to the Sitka spruce swamp habitat, but it tends to be located farther upriver. Although this habitat has a more significant cottonwood tree component, it is still affected by tidal fluctuations.

Because these islands are outside of any flood protection dikes and subject to natural processes, little if any active management is appropriate for these areas. These cottonwood/ willow swamps are a minor habitat type on the Lewis and Clark Refuge, occurring mostly along the periphery of and along the banks (high ground) of interior sloughs of Lois, Miller Sands, and Karlson islands in the downriver portion of the refuge; and on Welch and Quinns islands in the upriver portion (Maps 9a and 9b). Even though the acreage is relatively small, these narrow swaths of habitat are important for a wide variety of forest wildlife including the focal species Swainson's thrush, red-legged frog, and bald eagle (nesting). Of the principal habitats of the Columbia River estuary, tidal swamps have been the most heavily impacted by human activities such as diking and drainage. The extent of the swamps has been reduced by approximately 77 percent since 1870 (Thomas 1983). The Lower Columbia River Estuary Plan calls for the preservation of existing wetlands in the lower Columbia River (LCREP 1999).

2.8.2 Goal 2. Protect Unique Palustrine and Estuarine Emergent Tidal Marsh, Characteristic of the Historic Lower Columbia River

2.8.2.1 Objective for Emergent Tidal Marsh

Throughout the life of the CCP, all existing acres of emergent tidal marsh (approximately 3,720 acres) will be preserved and protected for the needs of migratory waterfowl, salmonids, bald eagles, and a variety of other benefiting species. Habitat characteristics include:

- Marsh elevations between mean low low water (MLLW) and slightly above mean high high water (MHHW), dominated by herbaceous emergent vegetation and low shrubs, and often including tidal channels;
- Water depth from 0 to 3 feet depending on river and tide levels; and
- Native emergent and submergent seed-bearing vegetation including soft-stem bulrush, Lyngby's sedge, smartweed, wapato, sedges, and rushes.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Allow natural processes to dictate vegetative changes and water depths.	✓	✓
B. Monitor vegetation and wildlife composition changes over time, and threats to biological integrity such as contamination and invasive species.	✓	✓
C. Work with partners to control invasive species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓

Rationale: The tidal marshes on the refuge (Maps 9a and 9b) provide an extremely diverse habitat for a wide variety of species from waterfowl to fish to seals to birds of prey. These marshes are a major source of nutrients for aquatic life, including juvenile salmonids, in the estuary. They also provide forage for waterfowl and hunting grounds for bald eagles, northern harriers, peregrine falcons, and other raptors.

The management strategies used in this unique ecosystem are focused on protection of this special habitat. Because this habitat is outside of any flood protection dikes and subject to natural processes, little if any physical management actions are appropriate for these areas. Control of invasive species would likely provide the best opportunity to improve habitat in the emergent tidal marsh. Tidal marshes in the Columbia River estuary declined by 43 percent from historic levels (Thomas 1983). The Lower Columbia River Estuary Plan calls for the preservation of existing wetlands in the lower Columbia River (LCREP 1999).

2.8.3 Goal 3. Protect Tidal Mudflats and Sandbar Habitats Characteristic of the Historic Lower Columbia River

2.8.3.1 Objective for Mud Flats and Sand Bars

Throughout the life of the CCP, protect all existing acres of sand bars and largely unvegetated mud flats (an estimated 4,825 acres) for the needs of shorebirds, marine mammals, salmonids, and a variety of other benefiting species. Habitat characteristics include:

- Soft substrates for benthic invertebrates;
- Sand bars for haul-outs of marine mammals; and
- No vegetation present.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Allow natural processes to dictate availability of open habitat.	✓	✓
B. Monitor vegetation and wildlife composition changes over time, and threats to biological integrity such as contamination and invasive species	✓	✓
C. Work with partners to control invasive species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓

Rationale: The largely unvegetated mud flats and sandbars are generally exposed twice daily at low tide (Maps 9a and 9b). Large numbers of invertebrates thrive in this habitat. The amphipod *Corophium salmonis* is particularly abundant and is an important food of juvenile salmon (NOAA 1995). Shorebirds forage almost exclusively on the mud and sand flats. Upwards of 100,000 shorebirds may be present in the estuary during spring migration. Seals and sea lions haul out on the sandbars to rest. Because this habitat is outside of any flood protection dikes and subject to natural processes, only limited management actions are appropriate.

Sanderlings and other shorebirds forage for invertebrates on refuge sand bars and mudflats. Photo: USFWS

2.8.4 Goal 4. Protect Upland Forest Characteristic of the Historic Lower Columbia River for Marbled Murrelets, Bald Eagles, Forest Birds, and a Diverse Assemblage of Other Native Species

2.8.4.1 Objective for Upland Forest

Throughout the life of the CCP, protect all existing acres of upland coniferous forest (approximately 89 acres) for migratory landbirds and bald eagles. The forest is characterized by:

- Large, dominant or co-dominant trees (live and dead) in a heterogeneous stand of mature or old-growth coniferous forest dominated by western hemlock, and located near large bodies of water for bald eagle nesting habitat; and
- Relatively open canopies with some habitat discontinuity or edge, or much foliage height diversity, providing access to trees for potential marbled murrelet nesting.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Allow natural processes to dictate vegetative changes.	✓	✓
B. Monitor vegetation and wildlife composition changes over time and threats to biological integrity such as contamination and invasive species.	✓	✓
C. Work with partners to control invasive species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓

Rationale: There are few habitat types on the refuge protected from the daily tidal cycles of the lower Columbia River. This forest habitat is different than all other refuge habitats in that it resides outside the estuary boundaries. The forested hillsides provide cover for a variety of forest-dwelling birds such as the varied thrush, brown creeper, and pileated woodpecker. This habitat has historically been utilized by bald eagles for nesting, foraging, and perching.

The Emerald Heights Unit is an 89-acre parcel located just south of Tongue Point and Oregon Highway 30. The unit's elevations range from 50 feet to 266 feet. The unit is completely forested, with 120-year-old western hemlock being the dominant species. Sitka spruce are scattered throughout the stand. The southwest part of the unit contains a small amount of 65-year-old western hemlock, Sitka spruce, Douglas fir, and western red alder (Maps 9a and 9b).

2.8.4.2 Objective for Riparian Forest

Throughout the life of the CCP, protect all existing acres of riparian forest (approximately 470 acres) for migratory landbirds and bald eagles. This habitat is characterized by:

- Late-succession forest, with a heterogeneous stand of mature or old-growth tree species, adjacent to water, consisting of mature western hemlock/Sitka spruce/western red alder forest with some Douglas fir and bigleaf maple.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Allow natural processes to dictate vegetative changes.	✓	✓

B. Monitor vegetation and wildlife composition changes over time and threats to biological integrity such as contamination and invasive species.	✓	✓
C. Work with partners to control invasive species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓

Rationale: There are few habitat types on the refuge that are protected from the daily tidal cycles of the lower Columbia River. The riparian forests provide cover for a variety of forest-dwelling birds such as the varied thrush, brown creeper, and pileated woodpecker. This habitat has historically been utilized by bald eagles for nesting, foraging, and perching.

The Tongue Point Unit comprises 79 acres at the northern tip of the point. The vegetation is mature western hemlock/Sitka spruce/western red alder forest with some Douglas fir and bigleaf maple. The topography is essentially a hill, with steep to moderate slopes rising from the water to a crest. The west slope has a steep (95 percent) slope, and there are tall cliffs in the northwest corner, where an old rock pit and shooting range were once located. The unit is bordered on the south by the Tongue Point Job Corps Center and a U.S. Coast Guard (USCG) Navigation Station. Other riparian forest habitats, primarily dominated by black cottonwood, are located at Lois and Miller Sands islands (292 and 94 acres respectively), and smaller fragments elsewhere (Maps 9a and 9b).

Riparian forest habitat. Photo: Rebecca Young / USFWS

2.8.5 Goal 5. Protect Riverine and Estuarine Open Water and Slough Habitats Characteristic of the Historic Lower Columbia River Estuary

2.8.5.1 Objective for Open Water

Throughout the life of the CCP, the refuge will protect 1,360 acres of open water and slough habitat in the lower Columbia River—for migrating and rearing salmonids, wintering and foraging waterfowl, and resting and foraging marine mammals—characterized by:

- Medium to deep water depths (elevations from 3 feet to more than 18 feet below MLLW); and
- Shallows and flats (elevations between MLLW and 6 feet below MLLW) absent of vegetation.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Allow natural processes to dictate vegetative changes and water depths.	✓	✓
B. Work with other agencies and partners to reduce contaminants.	✓	✓
C. Work with other agencies and partners to preserve and protect open water habitat for wildlife.	✓	✓
D. Monitor vegetation and wildlife composition changes over time (identify threats to the biological integrity).	✓	✓

Rationale: The open water channels and sloughs of the river are home to fish and a variety of invertebrate animals and aquatic plants. They serve as pathways for adult salmon, shad, eulachon, lamprey, and steelhead migrating upriver to spawn, and for juveniles moving downstream to the ocean. White sturgeon forage in the deeper channels and holes. Clams, mussels, aquatic worms, amphipods, and other small organisms are found on the bottom. Rooted aquatic plants are scarce in the main channels because of the strong, erosive currents, but are found in backwaters.

Through an active role in local, state, and Federal partnerships, the refuge would work to maintain the water quality and ecological integrity of the lower Columbia River estuary to provide resting and foraging habitat for waterfowl, shorebirds, and marsh and wading birds; and maintain or enhance migratory fish populations, including endangered salmonids. Although much of the estuary's open water habitat is within the designated boundaries of the refuge, the refuge has limited authority over the activities that occur in these waters. The USCG has authority over navigable waters in the river, and ODSL controls much, but not all of the river bottom and tidelands. Also, the Columbia River ship channel, which runs though much of the refuge, is an integral part of the transportation system in the Pacific Northwest.

The refuge must work with these and other partners such as the Corps (the river maintenance authority), in order to provide the necessary protection to wildlife in these open water locations and the adjacent river islands and tidal sloughs. As with other estuary habitats, these areas are outside of any flood protection dikes and subject to natural processes, therefore, little if any physical management actions are appropriate for these areas.

2.8.6 Goal 6. Foster and Strengthen Partnerships to Enhance Estuary Protection, Wildlife and Habitat Conservation, and Public Understanding and Appreciation of the Natural Resources in the Lower Columbia River Estuary

2.8.6.1 Objective for Oregon Department of State Lands

Within 5 years of completing the CCP, the refuge will work with ODSL to develop an agreement covering issues such as land exchanges, acquisitions, public uses, and development of other specific management agreements on lands and waters within refuge boundaries.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Meet with ODSL representatives to discuss management options on ODSL lands.		✓
B. Work with ODSL to acquire islands and tidelands within the acquisition boundary as the opportunity exists.		✓
C. Draft an interim State Lands management agreement for review.		✓

Rationale: Not all the islands within the boundaries of the refuge are owned by the Service. A portion of the islands in the lower river estuary within the Lewis and Clark Refuge's boundary are owned and managed by the ODSL. In order to provide the highest level of protection to wildlife and habitat both on and adjacent to refuge uplands and tidelands, the Service would work with the ODSL to develop a management agreement to increase habitat protection for all lands within the boundaries of the refuge. Of particular importance are the public use activities that occur inside the refuge acquisition boundary. A balanced approach that puts the needs of wildlife first, but still recognizes the need for wildlife-dependent recreation along with State mandated laws, will be the focus of this management agreement.

2.8.6.2 Objective for Lower Columbia River Estuary

Throughout the life of the CCP, the refuge will initiate, develop, and continue to strengthen partnerships with interested groups to protect, maintain, and enhance the natural resources of the lower Columbia River estuary.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Maintain a working relationship with the USCG to alert in case of law enforcement incidents in the estuary.	✓	✓
B. Work with partners to identify, monitor, and control invasive species.	✓	✓
C. Cooperate with National Park Service and others to explore Natural Heritage Area designation for the lower Columbia River.		✓
D. Work with other organizations to develop outreach and education programs on the lower Columbia River estuary.		✓

Rationale: Refuge jurisdiction is generally limited to areas down to mean high tide within the boundaries of the Lewis and Clark Refuge. Therefore, partnerships with other Federal and state agencies, local communities, anglers, watershed associations, conservation groups, and researchers are essential to improving habitat on the refuge and in adjacent areas of the lower Columbia River estuary. Resources in the estuary waters include anadromous fish; wintering, migratory, and breeding waterfowl and waterbirds; seabirds; and marine mammals. There are many jurisdictions and sometimes competing national interests in the estuary. States have authority over submerged lands and overlying water in the estuary, while the USCG oversees law enforcement of navigable waters.

In the report America's Living Oceans Charting a Course for a Sea of Change (Pew Oceans Commission 2003), threats to the overall ocean ecosystem are linked to activities on land. Millions of people live and work on tributaries adjacent to the Columbia River. Threats to the river and estuary ecosystem include nonpoint source pollution (e.g., oil runoff from streets and driveways and nitrogen release), point source pollution (e.g., waste from feedlots and industry), invasive species, aquaculture (e.g., accidental escape of fish, nitrogen, phosphorus and fecal matter discharge), coastal development, overfishing, bycatch, and climate.

The Pew Commission's documentation shows that coastal development and associated sprawl destroys and endangers 20,000 acres of coastal wetlands and estuaries each year that serve as nurseries for fish, and "paved surfaces have created expressways for oil, grease, and toxic pollutants into coastal waters." In addition to raising alarms nationally about the state of our marine and estuarine waters, the Pew Commission provided a detailed set of recommendations toward a more sustainable future for coastal ecosystems. Many of the recommendations are beyond the scope of the Lewis and Clark Refuge; however, the refuge can contribute in several areas including confronting urban sprawl and controlling invasive species.

2.8.6.3 Objective for Dredge Spoil Islands

Throughout the life of the CCP, coordinate with estuary partners to manage dredge spoil islands within the refuge acquisition boundary for the benefit of streaked horned larks, other migratory birds, and benefiting wildlife species.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Work with the Corps to develop a plan for sequencing dredge material placement, to maintain sparsely vegetated habitat for streaked horned larks on refuge managed dredge spoils.		✓
B. Where appropriate, work with other agencies to establish vegetation on selected sites for the benefit of wildlife species.	✓	✓
C. Work with partners to control invasive species such as Scotch broom using IPM techniques.	✓	✓

Rationale: The sandy dredge spoil islands constitute a unique habitat. The vegetation ranges from none on recent spoil sites to dense growths of shrubs and trees on old sites. Most of these islands are active disposal sites and the defining vegetative characteristic is a sparse growth of grasses, forbs, and shrubs. The lack of vegetation and absence of mammalian predators make the islands an attractive nesting location for colonial waterbirds such as glaucous-winged and western gulls, Caspian terns, and double-crested cormorants. Canada geese also nest on the spoil islands. The rare streaked horned lark is fairly common here.

Not all the islands within the boundaries of the refuge are owned by the Service. Many of the islands in the lower river estuary are owned and managed by the ODSL. Many of the ODSL lands primarily consist of sand and are used as dredge spoil sites, which are continually being replenished with sand from dredging on the lower Columbia River. Wildlife values on the dredge spoil islands are generally very different than in other areas of the estuary. Both short- and long-term habitat\wildlife objectives are needed for these areas, and the refuge will be working with other involved agencies to begin a dialogue on the wildlife values for these areas.

2.8.6.4 Objective for Pest Management

Develop partnerships to support the achievement of refuge habitat objectives regarding invasive species control (Objectives 2.8.1.1, 2.8.1.2, 2.8.1.3, 2.8.2.1, 2.8.3.1, 2.8.4.1, and 2.8.4.2), and where possible eradication, of invasive plant and animal species using IPM strategies. The tolerable threshold for treatment of established invasive plants is 10 percent cover; however, the threshold for treatment of new invasive species is presence.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Work with the states to monitor and control invasive species with IPM techniques using mechanical, biological, and/or chemical means.	✓	✓
B. Share training opportunities and information with members of the public, other groups, and other agencies.		✓
C. Share equipment and resources for collaborative projects with other agencies, groups, and landowners.		✓
D. Identify high-priority areas for intensive control and monitoring.	✓	✓
E. Control invasive animal species such as nutria and the New Zealand mud snail using all appropriate methods.	✓	✓
F. Focus on prevention by communicating with landowners, recreational users of the estuary, and members of the general public.		✓

Rationale: Expansion of invasive plants (including noxious weeds) in the estuary continues to be one of the more serious issues affecting the refuge. Being at the lower end of the entire Columbia River system presents challenges as seeds and other plant debris are funneled down through the lower river islands, where they tend to become established. Because of the immense area included within the refuge boundary—more than 30,000 acres—much of the initial work would likely involve monitoring of invasive species to determine extent of infestation and control needs. Coordination with a variety of other groups and agencies would be required to make an impact, and funding would need to be secured before any wide scale control efforts can begin in such a dynamic ecosystem. Targeted efforts with minimal funding and staffing may be successful in smaller areas where the weeds are just beginning to take hold.

Aerial photo of some of the Julia Butler Hansen Refuge (foreground) and Lewis and Clark Refuge (islands across the river). Photo: Rebecca Young / USFWS

2.8.7 Goal 7. Gather Scientific Information (Inventories, Monitoring, Research, and Studies) in Support of Adaptive Management Decisions on the Refuge under Goals 1-6

2.8.7.1 Objective for Scientific Information

Conduct high priority inventory and monitoring (survey) activities as well as research, assessments and studies to enhance endangered and threatened species protection and recovery as well as habitat management and restoration activities. The gathering of scientific information will assist in evaluating resource management and public use activities to facilitate adaptive management and contribute to the enhancement, protection, use, preservation and management of wildlife populations and their habitats on- and off-refuge lands. Specifically, they can be used to evaluate achievement of resource management objectives identified under Goals 1-6 in the CCP. These activities have the following attributes:

- Data collection techniques would likely have minimal animal mortality or disturbance and minimal habitat destruction.
- Minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements would be collected for identification and/or experimentation in order to minimize long-term or cumulative impacts.
- Proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, would minimize the potential spread or introduction of invasive species.
- Projects will adhere to scientifically defensible protocols for data collection, where available and applicable.

Throughout the life of the CCP, conduct research, monitoring, and inventory of wildlife and habitats, to provide information for management decision making.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Monitor species composition and distribution, and the timing of refuge use by migratory birds, including a mid-winter waterfowl survey, a bald eagle survey, and a dusky Canada goose survey.	✓	✓
B. Work with graduate school programs and others (e.g., appropriate agencies and groups) to conduct research and monitoring studies.		✓
C. Monitor the species composition, distribution, and life history attributes of fishery resources.		✓
D. Maintain a full-time refuge biologist to ensure biological information is obtained for management actions and regional/national data needs.	✓	✓
E. Conduct wilderness study.		✓

Rationale: Monitoring and research are essential to assessing the progress we have made toward achieving habitat and population management goals and objectives. Wildlife population and habitat management practices must be monitored to evaluate their effectiveness. Refuges must collect site specific information and conduct defensible research to design and implement management practices. The refuge spans nearly the entire width of the Columbia River estuary. For threatened/endangered salmonids, eight evolutionarily significant units (ESUs) of Pacific salmon and five distinct population segments (DPSs) of steelhead occur within refuge waters; however, very little is known about the interactions between these fish and refuge habitat. Additional research is needed on salmonid use of refuge habitats, and potential impacts of invasive plant and animal species at the refuge.

A wilderness study will be conducted to identify which islands, if any, contain the necessary wilderness elements such as primeval character, solitude, and special features of value (e.g., ecological, geological, or other features of scientific, educational, scenic, or historical value). The findings of the study determine whether or not the study areas merit recommendation for inclusion in the Wilderness System. The study will be completed by 2015. The wilderness inventory was conducted as part of this CCP process (Appendix E).

A biologist using radio telemetry to track and monitor Columbian white-tailed deer.
Photo: USFWS

2.8.8 Goal 8. Provide a Variety of Quality, Wildlife-dependent Recreational Opportunities Focusing on Lewis and Clark Refuge's Unique Solitude and Abundant Wildlife Resources While Minimizing Negative Impacts on Wildlife

2.8.8.1 Objective for Hunting

Throughout the life of the CCP, maintain opportunities for quality waterfowl and snipe hunting and maintain current waterfowl sanctuary area.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Improve signage.	✓	✓
B. Update maps and hunting brochures for the public.	✓	✓
C. Increase law enforcement to ensure quality hunting experiences for hunters.	✓	✓
D. Work with the State on law enforcement issues and regulation publications.	✓	✓

Rationale: Waterfowl hunting is a traditional use of the refuge and surrounding area in both Washington and Oregon (Map 10). This compatible, wildlife-dependent public use provides waterfowl hunters and others an opportunity to find solitude on the waters and shorelines of refuge islands. Access is by boat only in a remote area of the lower Columbia River, which generally limits the number of hunters on the refuge. Hunters on refuge islands are generally contained to shorelines, and the interiors are largely inaccessible due to the islands' dense vegetation. A waterfowl sanctuary encompassing 1,760 acres is closed to hunting, in accordance with the Duck Stamp Act.

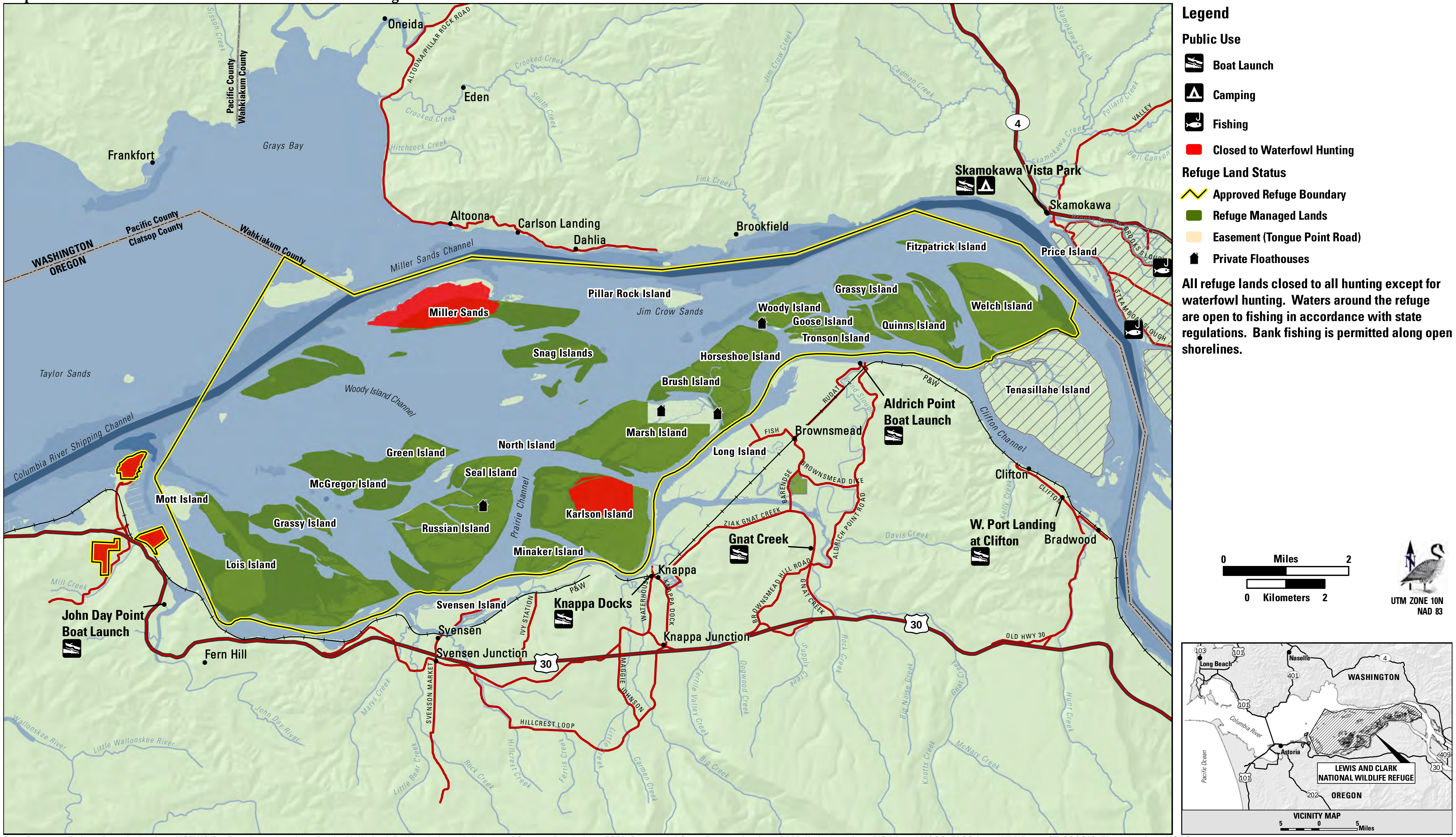
2.8.8.2 Objective for Fishing

Throughout the life of the CCP, anglers will be provided with the opportunity to enjoy fishing experiences unique to the lower Columbia River estuary and associated waterways.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Improve signage.	✓	✓
B. Update maps and fishing brochures for the public.	✓	✓
C. Increase law enforcement to ensure quality, public fishing experiences.	✓	✓
D. Work with state agencies on law enforcement issues including publishing regulations.	✓	✓

Rationale: Anglers enjoy fishing in refuge waters, including channels, sloughs, and open waters. This activity would remain along the perimeter of the islands of Lewis and Clark Refuge. Most of the fishing occurs from boats in the State's navigable waterways and is a traditional outdoor activity. Boat access is provided by off-refuge boat ramps identified on Map 10. Fish resources include salmon, steelhead, and sturgeon.

Map 10. Public Use – Lewis and Clark National Wildlife Refuge



Data Sources: Refuge Boundaries from USFWS/R1; Boat Launches from Ducks Unlimited; Railroads from University of Oregon; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; PLSS from WDNR and OR SSCGIS; Elevation from USGS

The back sides of map pages are blank to facilitate map readability.

2.8.8.3 Objective for Education and Interpretation

Throughout the life of the CCP, refuge staff and volunteers will work with other agencies and organizations to develop, conduct, or host environmental education and interpretation programs that focus on the unique qualities of the lower Columbia River estuary.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Refuge staff members and volunteers will provide refuge information at one or more community festivals or events each year.		✓
B. Work with area schools and volunteers to develop refuge awareness.	✓	✓
C. Maintain and develop partnerships with other organizations such as school districts, LCREP, volunteers, and others to conduct and develop education programs.	✓	✓
D. Work with nearby landowners to develop campsites for use by refuge visitors and others.		✓

Rationale: Because the Lewis and Clark Refuge largely consists of islands located in the Columbia River, hosting environmental and interpretive programs on the refuge is impractical. Large groups would displace wildlife from the refuge's relatively small land area and shallow water feeding grounds. By partnering with other organizations, the refuge can still educate the public about topics of concern such as endangered species, water quality, and refuge goals.

2.8.8.4 Objective for Wildlife Observation and Photography

Throughout the life of the CCP, the public will continue to have a unique opportunity to photograph and observe wildlife in the pristine, natural setting of the refuge.

Strategies for Achieving the Objective	Alt. 1	Alt. 2
A. Work with other groups to develop safe, educational water trails that minimize disturbance to wildlife.		✓
B. Work with partners to produce a map of water trails for refuge visitors.		✓
C. Eliminate illegal camping on refuge lands to protect wildlife.	✓	✓
D. Work with nearby landowners to develop campsites for use by refuge visitors and others.		✓

Rationale: Most wildlife observation and photography occurs in combination with various forms of boating activities on the Columbia River and within the estuary, including kayaking and canoeing. The Lower Columbia River Estuary Partnership has developed a Columbia River Trails System for boaters, primarily kayakers and canoeists. Partnering with the boating community, providing important refuge information, identifying points of interest, and locating trails away from sensitive habitats and wildlife needing protection (closed zones, nesting areas) are needed to help protect refuge resources. Developing partnerships is needed to identify and locate camping areas off of refuge property for boating visitors.

2.9 Julia Butler Hansen Refuge for the Columbian White-tailed Deer Goals, Objectives, and Strategies

Prior to European settlement of the area in the late nineteenth century and the construction of dikes to prevent tidal flooding in the early twentieth century, all refuge lands were subject to routine and natural tidal inundation. Refuge habitats were historically a mix of tidal forested swamp, tidal emergent marsh, and tidal channels. The construction of dikes around much of the areas that now compose the refuge's Mainland and Tenasillahe Island units drastically changed the habitat types where tidal swamps and marsh were displaced by riparian woodlots and agricultural lands. Other refuge units, however, including Price, Hunting, and Wallace islands, remain in a relatively natural state, except that Columbia Basin dams have altered the water flow regime in the river. Crims Island is unique because tidal flow has been re-established to a large portion of the island.

2.9.1 Goal 1. Provide Short-Grass Fields for the Benefit of Columbian White-tailed Deer, Dusky Canada Geese, and Other Grassland Dependent Wildlife

Goals 1, 2, and 3 pertain to Julia Butler Hansen Refuge's lands enclosed within dikes with little or no tidal inundation.

2.9.1.1 Objective for Short-grass Fields

Throughout the life of the CCP, maintain between 680 acres and 790 acres split between the Mainland and Tenasillahe Island units as short-grass fields protected from riverine fluctuations. Because actively growing grasses will provide quality foraging habitat for CWT deer, dusky Canada geese, and other grassland wildlife, these short-grass fields will be characterized by:

- An average height of 4-6 inches during the winter (Dec-Feb);
- A field size larger than 50 acres within approximately 820-feet of riparian forest habitat (Goal 2) to allow maximum use by CWT deer;
- A composition of 20-40 percent clover, birdsfoot trefoil, and native forbs;
- A composition of 20 percent orchard grass;
- A composition of 20 percent timothy and ryegrass; and
- A maximum composition of 30-40 percent unpalatable/invasive plant species including reed canarygrass, thistle, tussock, and tall fescue.

Alternatives	**Alt. 1**	**Alt. 2**	**Alt. 3**
Acres Managed to Achieve Objectives by Alternative	**140-680**	**680-790**	**140-680**
Strategies for Achieving the Objective			
A. Mow fields (when not grazing livestock) to a height of 4-6 inches at least twice per year, once in July and once in mid-September to mid-October. An early mowing in May is desirable if fields are dry enough.	✓	✓	✓
B. Graze livestock in fenced pastures from mid-April to early October. Use rotational grazing so that livestock are	✓	✓	✓

moved periodically from one pasture to another to maintain a vegetation height of 4-6 inches.			
C. Manage short-grass fields by haying during the summer months.	✓	✓	✓
D. Plow, disk, reseed, and fertilize fields that have a cover of unpalatable/invasive plant species greater than 50 percent.	✓	✓	✓
E. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓	✓
F. Maintain the integrity of the refuge's managed habitats by maintaining the dikes on the Tenasillahe Island and Mainland units.	✓	✓	✓

Rationale: Immature (palatable), nutritious grasses are an important food source for CWT deer on the refuge's Mainland and Tenasillahe Island units. A food habits study conducted by the refuge found that grasses made up more than 50 percent of the CWT deer's diet during the winter months (A. Clark, unpublished data). Suring and Vohs (1979) and Gavin et al. (1984) also noted high use of grasses by CWT deer. Creeping buttercup and white clover (forbs heavily utilized by foraging deer) thrive in short-grass fields. Canada geese (including dusky and cackling geese) utilize the refuge and forage exclusively in short-grass fields and marshes. Raptors such as red-tailed hawks, northern harriers, American kestrels, and various species of owls utilize the short-grass fields as foraging grounds.

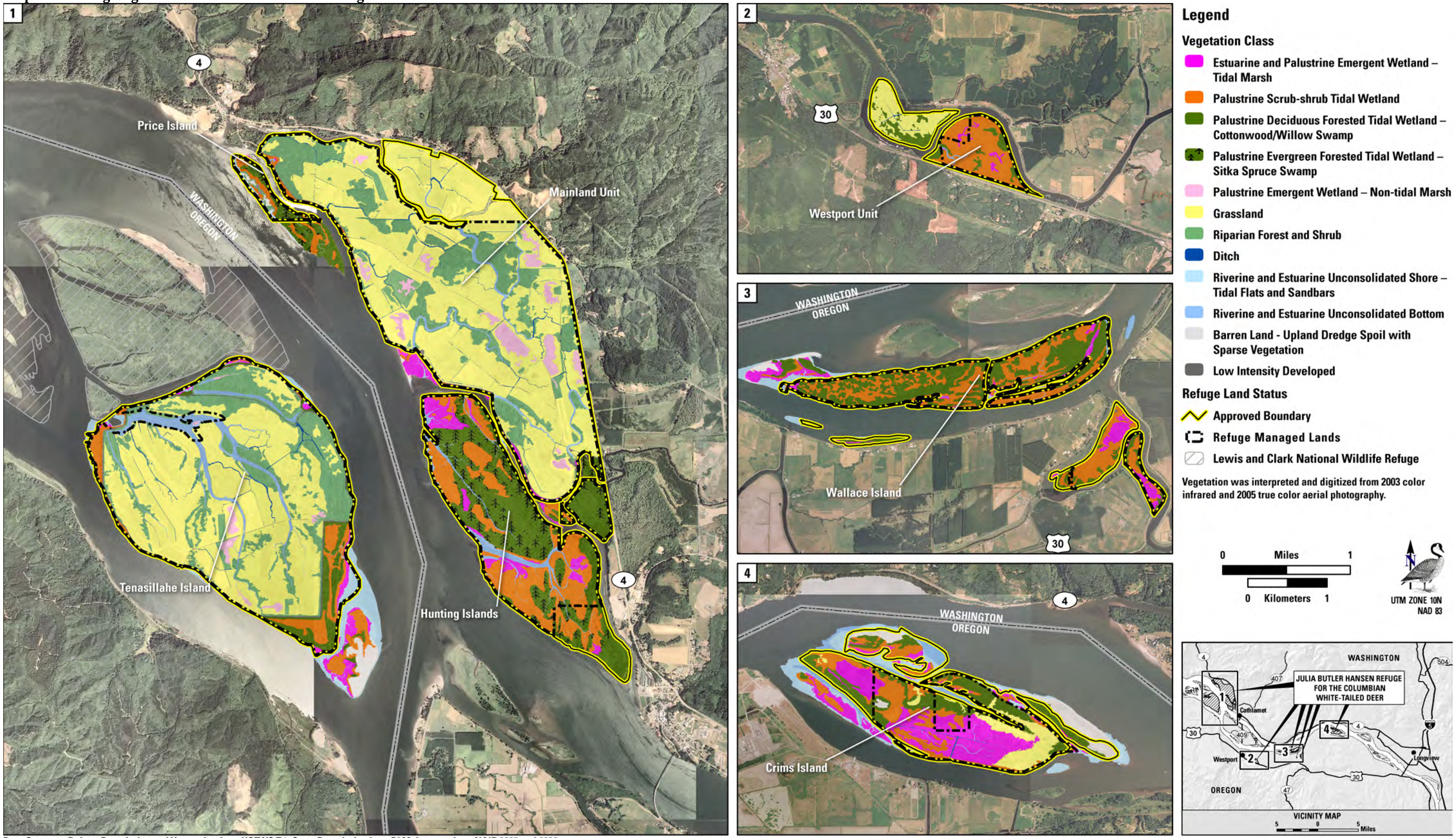
It is important to maintain the grass in a short, immature growth form by repeated mowing or livestock grazing during the growing season prior to arrival of migrating waterfowl. Once grass matures, it becomes coarse and much less digestible, and it has less protein (Blair et al. 1977). Deer on the refuges prefer grazed fields over mowed fields for winter forage (Gavin et al. 1984). Managed short-grass fields and other habitats for the CWT deer on the Tenasillahe Island and Mainland units (Map 11) require protection from inundation by the daily tidal cycles of the Columbia River; therefore, maintaining the integrity of the dikes is necessary for protecting CWT deer.

2.9.2. Goal 2. Restore and Maintain Riparian Forests with Diverse Age and Structural Features Characteristic of the Historic Lower Columbia River

Goals 1, 2, and 3 pertain to Julia Butler Hansen Refuge's lands enclosed within dikes with little or no tidal inundation.

2.9.2.1 Objective for Early Successional Riparian Forest			
Throughout the life of the CCP, establish a minimum of 210 acres or more of early successional riparian forest on the Mainland Unit and 70 acres on the Tenasillahe Island Unit; maintain 120 acres of the Crims Island Unit for the benefit of CWT deer, migratory landbirds and resident birds, native reptiles and amphibians, and other riparian dependent wildlife. Establish an additional 100 acres under Alternative 2 on the Mainland Unit. Early successional riparian forest is characterized as follows: • Predominantly composed of native shrubs and small trees less than 30 feet tall, including red-osier dogwood, salmonberry, Pacific nine-bark, willows, Sitka spruce, red cedar, red alder, and black cottonwood; • Relatively few trees taller than 30 feet; and • Trees are shallowly rooted in the refuge's wet soils so wind damage and natural tree diseases will continually create openings that stimulate understory vegetation for CWT deer, migratory landbirds, and small mammals.			
Alternatives	**Alt. 1**	**Alt. 2**	**Alt. 3**
Acres Managed to Achieve Objectives by Alternative	**400**	**500**	**400**
Strategies for Achieving the Objective			
A. Plant tree and shrub seedlings in selected areas. Fence the planted seedlings to exclude deer and elk when seedlings are small and fencing is reasonably cost efficient. Remove fencing when most seedlings are taller than 10 feet (usually after the third growing season).	✓	✓	✓
B. Maintain newly established riparian forest on Crims Island.	✓	✓	✓
C. Evaluate disking grassy areas as a tool to encourage natural seeding of trees and shrubs.	✓	✓	✓
D. Use tree protectors on seedlings to prevent damage from meadow voles.	✓	✓	✓
E. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological and/or chemical means.	✓	✓	✓
F. Control beaver and other wildlife damage when necessary using fencing, trapping, and where appropriate, lethal control.	✓	✓	✓
G. Establish riparian forest along slough banks to lower water temperatures (by shading and lower soil temperatures) and reduce erosion.	✓	✓	✓

Map 11. Existing Vegetation – Julia Butler Hansen Refuge for the Columbian White-tailed Deer



Data Sources: Refuge Boundaries and Vegetation from USFWS/R1; State Boundaries from BLM; Imagery from NAIP 2005 and 2006

The back sides of map pages are blank to facilitate map readability.

Rationale: Riparian forest provides both cover and browse (leaves and stems of woody plants) for CWT deer. The deer seldom stray far from cover, and trees and shrubs are preferred for cover over tall grasses and forbs (Suring and Vohs 1979). Forest understory shrubs are a major source of browse, which constitutes 20-30 percent of the deer's diet during winter and spring (A. Clark, unpublished data). Palatable browse plants such as red-osier dogwood and Pacific ninebark are among the deer's most preferred food items during winter (Dublin 1980). Early successional riparian forest is characterized by an abundance of shrubs that provide browse. The forest floor also provides palatable grasses and forbs for CWT deer. The shrubby, early successional forest is habitat for migratory landbirds, including yellow warblers and rufous hummingbirds. Red-legged frogs frequent all stages of forest succession.

Early successional forest is a transitional stage. These stands will grow over time into mid-successional and finally late-successional (mature) stages. This is a desirable progression, and the refuge does not intend to hold back succession by cutting larger trees. Rather, new stands will be created in existing fields largely dominated by reed canarygrass until the goal of 50 percent forest cover is attained. Trees are shallowly rooted in the refuge's wet soils, so wind damage and natural tree diseases will continually create openings that stimulate understory vegetation and achieve a desirable forest structure for priority wildlife species. Note: the 50 percent figure when achieved will involve a total of approximately 920 acres of planted early successional riparian forests plus 92 acres of mid-successional forests and 875 acres of late-successional forests for both the Mainland and Tenasillahe Island units (Map 11).

2.9.2.2 Objective for Mid-successional Riparian Forest

Throughout the life of the CCP, enhance and maintain 70 acres on the Mainland Unit and 22 acres on the Tenasillahe Island Unit of existing mid-successional riparian forest for the benefit of the CWT deer and other riparian dependent wildlife. Mid-successional riparian forest is characterized by:

- A canopy cover of less than 70 percent;
- A canopy and subcanopy composed of native species, including Sitka spruce, black cottonwood, red alder, and red cedar; and
- A shrub layer of native species, including red-osier dogwood, salmonberry, ninebark, trailing blackberry, and willows.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. As specified in the refuge's elk management plan, maintain an elk herd of 20 elk or less, to prevent over browsing of understory shrubs.	✓	✓	✓
B. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓	✓
C. Consider selective thinning of planted stands if canopy cover is greater than 70 percent, to allow light penetration to stimulate growth of understory shrubs and herbaceous species.		✓	
D. Use fencing to protect forested areas from livestock grazing in short-grass fields.	✓	✓	✓

Rationale: During the life of the CCP, the existing 92 acres of planted early successional riparian forest (Map 11) will naturally transition into mid-successional forest. This forest habitat will benefit CWT deer during the winter by providing thermal and hiding cover. The early successional stands are usually planted thickly to compensate for expected losses to deer, elk, meadow voles, and grass competition. It may be necessary to selectively thin stands with high tree survival to achieve a multi-layered, varied mid-successional forest, to benefit native wildlife species such as Cooper's hawk, red-eyed vireo, band-tailed pigeon, Swainson's thrush, yellow warbler, and red-legged frog.

2.9.2.3 Objective for Late-successional Riparian Forest

Throughout the life of the CCP, enhance and maintain 445 acres on the Mainland Unit and 430 acres on Tenasillahe Island Unit as late-successional riparian forest characterized by:

- A canopy cover of more than 50 percent mature trees, including native species such as Sitka spruce, black cottonwood, red alder, and red cedar; and
- A cover of more than 50 percent shrubs, including native species such as salmonberry, red-osier dogwood, willows, and Pacific ninebark (along slough edges).

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. As specified in the refuge's elk management plan, maintain elk herd at 20 elk or less to prevent over browsing.	✓	✓	✓
B. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological and/or chemical means.	✓	✓	✓
C. Use fencing to exclude livestock grazing in short-grass fields from forested areas.	✓	✓	✓
D. If a stand is dominated by one or two tree species (e.g., red alder and black cottonwood), under-plant Sitka spruce and red cedar in openings to enhance forest diversity.		✓	

Rationale: The existing 875 acres of remnant forest on the diked portions of the Mainland and Tenasillahe Island units (Map 11) will be managed as late-successional riparian forest. For much of this acreage, management will be limited to habitat protection and invasive species control. Wind throw and natural disease losses will periodically topple some larger trees and create openings where shrubs and tree seedlings can thrive, and naturally create a multi-layered, structurally diverse forest. The old-growth forest will be dominated by Sitka spruce with some red cedar and scattered red alder and black cottonwood. The late-successional forest provides most of the wildlife benefits of early and mid-successional forest because of the abundant understory in the openings and around the edges. In addition, the late-successional forest contains large snags that benefit species such as Vaux's swift and purple martin. The older trees contain cavities for cavity-nesting birds such as the wood duck. Because this late-successional forest type is under represented in the lower Columbia River, it is important for biological integrity, diversity, and environmental health. Natural processes will drive the structure, composition, and function of this habitat type. Active management will sustain or mimic natural processes in late-successional riparian forest.

2.9.3 Goal 3. Restore and Maintain Nontidal Wetlands and Sloughs as a Mosaic with Other Refuge Habitat Types, Especially Riparian Forest and Short-Grass Fields

Goals 1, 2, and 3 pertain to Julia Butler Hansen Refuge's lands enclosed within dikes with little or no tidal inundation.

2.9.3.1 Objective for Nontidal Wetlands

Throughout the life of the CCP, restore and maintain 125 acres (105 acres existing; 20 acres to be restored) on the Mainland Unit and 45 acres (25 acres existing; 20 acres to be restored) on Tenasillahe Island Unit as nontidal marshes (palustrine emergent wetlands) for the benefit of CWT deer, waterfowl, other waterbirds, and amphibians. These nontidal wetlands will have the following attributes:

- Less than 30 acres;
- Cover of more than 40 percent desirable native wetland plants (such as smartweeds) and emergent vegetation (e.g., bulrushes, wapato, cattail) in the fall.
- Invasive plant species such as purple loosestrife will be maintained at less than 5 percent cover in the wetlands; invasive plant species such as reed canarygrass and common rush will be maintained at less than 40 percent plant species composition; and
- Seasonally (approximately October through June) flooded to a depth of 4 to 18 inches.

Alternatives	**Alt. 1**	**Alt. 2**	**Alt.3**
Acres Managed to Achieve Objectives by Alternative	**130**	**130-170**	**130**
Strategies for Achieving the Objective			
A. Manage water levels at desired depths by installing water control structures.	✓	✓	✓
B. Excavate and contour wetland basins to ensure water depth and habitat heterogeneity as well as manage invasive species.		✓	
C. Disk wetlands to promote germination of native aquatic and desirable forage species for waterfowl.	✓	✓	
D. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological and/or chemical means.	✓	✓	✓
E. Place large woody debris in wetlands to provide habitat for amphibians.	✓	✓	
F. Control non-native nutria population to enhance the growth of desirable wetland plants, when necessary.	✓	✓	

Rationale: Seasonal nontidal wetlands occur naturally in low areas of the Mainland and Tenasillahe Island units (Map 11). Without active management, these areas are dominated by invasive plants such as reed canarygrass and common rush (tussock). Recontouring wetlands to increase depth and installing water control structures will greatly enhance the wildlife values of these wetlands. Desirable wetland plant species such as spike rush, bulrush, smartweed, and bur-reed become established and provide forage for waterfowl. The managed wetlands hold water longer into the summer, providing breeding habitat for native amphibians such as red-legged frogs, Pacific chorus (tree) frogs, and long-toed salamanders. Periodic draining in summer (after the amphibian larvae have metamorphosed) promotes a flush of new vegetative growth that provides forage for CWT deer when most other forages are at their lowest nutritive value. Disking mimics the natural disturbance process of scouring associated with flood events. Draining wetlands also permits mechanical control of invasive plants.

2.9.3.2 Objective for Sloughs

Throughout the life of the CCP, maintain and protect the existing 143 acres of sloughs (riverine unconsolidated bed habitats) for the benefit of juvenile salmonids and other native fish, waterfowl, bald eagles, other native wildlife, and native aquatic species. Sloughs also will minimize potential flooding impacts to CWT deer. The sloughs will be characterized by:

- Tidal exchange (with respect to magnitude, frequency, duration, and hydraulics conducive to juvenile fish passage) without flooding CWT deer habitat;
- Maximum mean daily water temperature lower than 65 degrees Fahrenheit (ºF) during primary period of juvenile salmon migration;
- Native aquatic vegetation (e.g., sago pondweed) and invertebrates (e.g., chironomids and gammarid amphipods);
- Relatively low abundance of nutria;
- Relatively low abundance of carp;
- Cover of less than 30 percent invasive plants including purple loosestrife and milfoils; and
- Native riparian vegetation (woody and nonwoody) on banks.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Install new and maintain currently existing tidegates designed to improve tidal exchange and fish passage on sloughs that are enclosed by dikes on the Mainland and Tenasillahe Island units.	✓	✓	✓
B. Monitor for the presence of invasive species such as purple loosestrife, carp, nutria, and milfoils.	✓	✓	✓
C. Work with partners to monitor and control invasive species such purple loosestrife, nutria, and milfoils.	✓	✓	✓
D. Plant native woody and nonwoody riparian vegetation adjacent to sloughs as a source for woody debris in sloughs.		✓	✓
E. Recontour Risk Creek to provide more natural meanders and channel form between State Highway 4 and Brooks Slough.		✓	✓
F. Study the potential for rerouting Nelson Creek back to its historical channel through the southeast portion of the Mainland Unit to restore salmon habitat.		✓	✓

Rationale: Sloughs on the diked areas of the refuge (Map 11) are largely cut off from the Columbia River. Some, but not all of the sloughs have tidegates that permit a one-way passage of water from inside the refuge to the Columbia River. The existing tidegates impede fish passage and are an impediment to quickly removing water from the interior of the refuge. Compared to the river channel, current velocities in the sloughs are low and aquatic vegetation and invertebrate organisms are abundant. There is potential, therefore, to provide off-channel rearing habitat for juvenile salmonids, by replacing the existing tidegates with tidegates that allow water movement to and from the Columbia River, that open wider, and that stay open longer. Increasing the exchange of water with the Columbia River would also be expected to improve water quality and reduce water temperatures in the sloughs. Increasing the number of tidegates will help expel water from the refuge during high water events for better CWT deer habitat. The invasive parrotfeather milfoil is the dominant vegetation in the sloughs and warm water species of fish such as largemouth bass and yellow perch are abundant. Control of these invasive species may further improve habitat for juvenile salmonids. Installing additional tidegates and modifying existing tides would be expected to not only improve aquatic habitats for juvenile salmonids but also minimize potential flooding of CWT deer habitat.

Sloughs benefit salmon and other fish and minimize flooding impacts. Photo: USFWS

2.9.4 Goal 4. Maintain and Protect Tidally Influenced Freshwater Wetlands and Swamp Habitats Characteristic of the Historic Lower Columbia River

Goals 4 and 5 pertain to lands not enclosed within dikes subject to frequent tidal inundation, and all refuge lands and waters.

2.9.4.1 Objective for Scrub-Shrub Swamp

Throughout the life of the CCP, protect 847 acres of tidally influenced palustrine scrub-shrub swamp for the benefit of CWT deer, willow flycatchers, red-legged frogs, fish, and other native, wetland-dependent wildlife. Tidally influenced palustrine scrub-shrub swamp is characterized by:

- Native shrubs are dominant vegetation, including Sitka willow, Pacific willow, red-osier dogwood, salmonberry, Pacific ninebark, and hardhack; and
- Scattered large native trees taller than 13 feet are present, including Sitka spruce, black cottonwood, and willows.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Protect and promote natural processes to maintain the scrub-shrub habitat.	✓	✓	✓
B. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological and/or chemical means.	✓	✓	✓
C. Monitor for protection of natural resources.	✓	✓	✓

Rationale: The hydrology of the lower Columbia River and its estuary are related to daily tidal fluctuations. As it nears the ocean, the slowing current deposits the river's silt load to form low, marshy islands, and sandbars. Islands near the lower end of the refuge tend to have more of a willow shrub component, and because of their relatively low topography are more susceptible to tidal fluctuations than some up the upriver islands. Because these areas are outside of any flood protection dikes and subject to natural processes, little if any physical management actions are appropriate for these areas.

Scrub-shrub swamp is a climax vegetative community in parts of the lower estuary (Map 11). The refuge will protect the existing acreage and control invasive species such as Japanese knotweed. Scrub-shrub constitutes a valuable browse resource for CWT deer. It also provides habitat for shrub-dependent migratory landbirds such as the little willow flycatcher and the yellow warbler. Waterfowl forage in the scrub-shrub at higher tide levels. Native amphibians such as red-legged frogs also utilize this habitat. Of the principal habitats of the Columbia River estuary, tidal swamps have been the most heavily impacted by human activities such as diking and drainage. The overall acreage of the swamp habitats in the lower Columbia River has been reduced by approximately 77 percent since 1870 (Thomas 1983).

2.9.4.2 Objective for Sitka Spruce Swamp

Throughout the life of the CCP, protect existing acreages of tidal Sitka Spruce Swamp habitat (approximately 353 acres) (palustrine evergreen forested wetland) for the benefit of CWT deer, bald eagles, red crossbills, fish, and other native wildlife. This late-succession forest habitat type is characterized by:

- Mature, native trees that are predominantly Sitka spruce, black cottonwood, red alder, willow and western red cedar; and
- More than seven mature spruce trees (larger than 32 inches diameter breast height [dbh]) per acre.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Protect and promote natural processes to drive vegetative changes.	✓	✓	✓
B. Control invasive or undesirable plant species with IPM using mechanical, physical, biological, and/or chemical means.	✓	✓	✓

Rationale: The hydrology of the lower Columbia River and its estuary are related to the daily rising and falling of the tides. As it nears the ocean, the slowing current deposits the river's silt load to form low, marshy islands and sandbars.

Sitka spruce swamp is a diverse and rich wildlife habitat. The large spruce trees are often spaced far enough apart to permit the growth of a dense understory of shrubs, particularly Sitka willow and red-osier dogwood. Fingers of tidal emergent marsh and areas of pure scrub-shrub are intermixed with the spruce swamp (Map 11). The trunks and root masses of long-fallen trees form hummocks, where terrestrial mammals such as CWT deer can escape tidal flooding. The spruce cones provide a source of seeds for red crossbills; the branches provide a nesting platform for great blue herons, bald eagles, and other birds.

Sitka spruce swamps have been heavily impacted by land diking and clearing. Of the original 14,000 acres found in the estuary, only 2,200 acres remain (Christy and Putara 1992). Preservation of this habitat is a high priority for the refuge. Natural processes are expected to maintain the spruce swamps. Active management will be limited to invasive species control and habitat and wildlife monitoring.

2.9.4.3 Objective for Cottonwood/Willow Swamp

Throughout the life of the CCP, maintain and protect 611 acres of mid- to late-successional tidal cottonwood/willow swamp (palustrine deciduous forested wetland) for the benefit of CWT deer, red-legged frogs, bald eagles, Swainson's thrush, fish, and other swamp-dependent wildlife. Mid- to late-succession tidal cottonwood/willow swamp is characterized by:

- A canopy cover of more than 50 percent mature trees, including black cottonwood, tree willows, and Oregon ash; and
- A cover of more than 30 percent native shrubs, including red-osier dogwood, salmonberry, trailing blackberry, and shrub willows.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Protect and promote natural processes to drive vegetative changes.	✓	✓	✓
B. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓	✓

Rationale: The hydrology of the lower Columbia River and its estuary are related to the daily rising and falling of the tides. As it nears the ocean, the slowing current deposits the river's silt load to form low, marshy islands and sandbars. Islands with this vegetative type are similar in topography to Sitka Spruce swamp habitat, but tend to be located farther upriver. Although this habitat has a more significant cottonwood tree component than the Sitka spruce swamp, it is still affected by tidal fluctuations.

The cottonwood/willow forested swamps are the principal habitat type on Crims Island, Wallace Island, and south Hunting Island (Map 11). They provide forage and cover for CWT deer. This habitat occupied much of the deer's original range along the lower Columbia River until the advent of dikes and agriculture in the late nineteenth and early twentieth centuries. Of the principal habitats of the Columbia River estuary, tidal swamps have been the most heavily impacted by human activities such as diking and drainage. The extent of the swamps has been reduced by approximately 77 percent since 1870 (Thomas 1983).

Oregon ash is a major component of the swamps on Crims Island. In addition providing important habitat to the deer, these swamps are important habitat for a wide variety of forest wildlife including the focal species Swainson's thrush, red-legged frog, and bald eagle (nesting). Natural processes are expected to maintain the cottonwood/willow swamps. Active management will be limited to invasive species control and habitat/wildlife monitoring.

2.9.4.4 Objective for Emergent Tidal Marsh

Throughout the life of the CCP, all existing acres of emergent tidal marsh (approximately 300 acres) will be protected to benefit migratory waterfowl, salmonids, bald eagles, and a variety of other species. Characteristics of this habitat include:

- Elevations between MLLW and slightly above MHHW, dominated by native herbaceous emergent vegetation, and often includes tidal channels;
- Water depth ranging from 0- to 3-feet deep depending on river and tide levels;
- Native emergent and submergent plants, including soft-stem bulrush, Lyngby's sedge, smartweeds, wapato, sedges, and rushes.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Protect and promote natural processes to drive vegetative changes and water depths.	✓	✓	✓
B. Control invasive or undesirable plant species with IPM techniques using mechanical, physical, biological, and/or chemical means.	✓	✓	✓

Rationale: The tidal marshes on the refuge (Map 11) provide an extremely diverse habitat for a wide variety of species including waterfowl, fish, seals, and terns. These marshes are a major source of nutrients for aquatic life, including juvenile salmonids, in the estuary. They also provide forage for waterfowl and hunting grounds for bald eagles, northern harriers, peregrine falcons, and other raptors. CWT deer graze on marsh plants. Tidal marsh occurs primarily on Hunting, Wallace, and Crims islands, although there are some small areas of marsh fringing the outside of the dikes on the Tenasillahe Island and Mainland units. The management strategies used in this unique ecosystem are focused on protection of this special habitat. Because this habitat is outside of any flood protection dikes and subject to natural processes, little if any physical management actions are appropriate for these areas.

2.9.4.5 Objective for Open Water and Tidal Slough

Throughout the life of the CCP, the refuge will protect 105 acres of open water and tidal slough habitat in the lower Columbia River for migrating and rearing salmonids, wintering and foraging waterfowl, and resting and foraging marine mammals. Open water habitats are characterized by the following:

- Medium to deep water depths (at elevations from 3 feet to more than 18 feet below MLLW); and
- Shallows and flats (elevations between MLLW and approximately 6 feet below MLLW) and largely absent of vegetation.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt.3
A. Protect and promote natural processes to dictate vegetative changes and water depths.	✓	✓	✓
B. Work with other agencies and partners to identify off-refuge sources of contaminants and to reduce impacts when possible.	✓	✓	✓
C. Work with other agencies and partners to preserve open water habitat for wildlife.		✓	✓

Rationale: The open water channels of the river (Map 11) are home to fish and a variety of invertebrate animals and aquatic plants. They serve as pathways for adult salmon, American shad (an introduced species), eulachon, Pacific lamprey, and steelhead migrating upriver to spawn, and for juveniles migrating downstream to the ocean. White sturgeon forage in the deeper channels and holes. Clams, mussels, aquatic worms, amphipods, and other small organisms are found on the bottom. Rooted aquatic plants are scarce in the main channels because of the strong, erosive currents, but are found in backwaters.

Through an active role in local, State, and Federal partnerships, the refuge will work to maintain and improve the overall water quality and ecological integrity of the lower Columbia River estuary. High-quality open water habitat in the estuary is important for resting and foraging waterfowl, shorebirds, marsh birds, wading birds, migratory fish populations, including threatened and endangered salmonids. The USCG has authority over the navigable waters in the river, and the ODSL controls much, but not all of the river bottom and tidelands.

The refuge works with these and other partners, such as the Corps, in order to protect wildlife in open water locations and in adjacent river islands and tidal sloughs. As with other estuary habitats, these areas are outside of any flood protection dikes and subject to natural processes, therefore, little if any physical management actions are appropriate for these areas.

2.9.5 Goal 5. Maintain a Healthy, Sustainable Population of Endangered Columbian White-tailed Deer to Promote the Recovery of this Species

Goals 4 and 5 pertain to lands not enclosed within dikes subject to frequent tidal inundation, and all refuge lands and waters.

2.9.5.1 Objective for Columbian White-tailed Deer Recovery

Throughout the life of the CCP, contribute to the recovery of the CWT deer by maintaining a minimum total population greater than or equal to 330 CWT deer on the refuge, with approximately 125 CWT deer on the Mainland Unit, 125 CWT deer on the Tenasillahe Island Unit, and 80 CWT deer divided among the other refuge units.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Manage a mosaic of habitats (see objectives for Goals 1, 2, 3, and 4) to meet the life history requirements of CWT deer.	✓	✓	✓
B. Utilize a permit hunt and exclusionary fencing to manage competing wildlife, particularly Roosevelt elk, as identified in the elk management plan.	✓	✓	✓
C. Remove coyotes when necessary. See description of control actions in Section 2.6.2.	✓ Jan 1-Apr 15	✓ Jan 1-Dec 31	✓ Jan 1-Aug 31
D. Remove (by lethal or nonlethal means) mountain lions and bears when present on the refuge, in coordination with states.		✓	✓
E. Monitor CWT deer population size and fawn mortality factors on refuge management units.	✓	✓	✓
F. Limit disturbance by humans and pets.	✓	✓	✓
G. Maintain integrity of refuge dikes at the Tenasillahe Island and Mainland units to eliminate/minimize the frequency and intensity of flooding CWT deer wintering habitat.	✓	✓	✓

Rationale: Currently, there are an estimated 600 to 800 CWT deer in the lower Columbia River region. The Columbian White-tailed Deer Recovery Plan (USFWS 1983) recommends that greater than 400 CWT deer be maintained in three viable subpopulations occupying secure habitat. Most secure habitat (free from adverse human activities and relatively safe from natural phenomena that would destroy its value to CWT deer) is on the refuge. At present, there are only about 1,600 acres of secure habitat off the refuge, which is owned by the states of Oregon and Washington or the Columbia Land Trust in a relatively contiguous block capable of supporting a viable subpopulation of about 100 deer. Given such small numbers in the lower Columbia River region, the population is vulnerable to extirpation by events such as prolonged severe weather, excessive predation, loss of habitat, and the spread of virulent diseases.

Intensive management actions to directly benefit CWT deer (including predator control) would be necessary to ensure herd health and genetic integrity necessary for a long-term sustainable population on the refuge. Active management of the habitat (mowing, grazing, haying, pasture improvements) would be needed for both the Mainland and Tenasillahe Island units to support the life history needs of greater than 125 CWT deer. Based upon results from previous studies and population modeling for the refuge, it would be necessary to periodically remove coyotes as well as mountain lions and black bears, when present, in order to maximize survival rates of adults and juveniles and promote healthy CWT deer herds on refuge management units at objective levels.

In establishing CWT deer population objectives for refuge management units, the following factors were considered: Recovery Plan goals, the health of the herd, the quality of refuge habitats, and opportunities for public viewing on refuge lands. The identified objective levels represent the best balance between a relatively large, healthy deer population (to help achieve recovery goals) and a thriving natural vegetative habitat (to sustain deer and other native wildlife).

The Mainland and Tenasillahe Island units are managed to maintain healthy and sustainable populations of CWT deer at relatively higher densities. Forty deer per square mile is a reasonable density for Tenasillahe Island, which is less vulnerable to flooding. Because the Mainland Unit is more susceptible to flooding, a density of 35 deer per square mile is appropriate for this refuge unit. Unmanaged islands (Wallace, Hunting, Price, and Kinnunen Cut) are more likely to support densities of 20 deer per square mile while still maintaining biodiversity. Crims Island (presently a mix of riparian forest, old fields, and tidal swamp) is likely to support 30 deer per square mile until forest habitat replaces the old fields during the next 10 to 20 years. Given the sizes of these refuge units and the units' deer densities, the population objectives would be 125, 125, and 80 respectively for the Mainland Unit, Tenasillahe Island Unit, and other refuge units (see Table 4-12). The total population objective for the refuge (greater than 330 CWT deer) would provide the best balance between managing for a healthy, sustainable herd over the long term based upon the CWT deer Recovery Plan while providing refuge visitors with an opportunity to view this endangered species. Other lands in public or conservation ownership (e.g., Fisher Island, Lord Island, Hump Island, White Island, and Willow Grove wetlands) would be expected to support enough CWT deer to satisfy the recovery goal of 400 deer on secure habitat in the lower Columbia River.

Deer populations are naturally cyclic over time. Herd size can vary in response to climate, predation, and other factors. Population objectives provide a reference point for determining when population numbers are too low and other management actions (e.g., coyote removal) may be needed to protect the CWT deer herd. The CWT deer numbers may rise above population objectives, and in fact, it is expected that population levels would be above unit objectives much of the time. Under this scenario, surplus deer could be trapped for reintroduction elsewhere, if appropriate reintroduction sites are available. The population objectives are conservative estimates to ensure refuge habitats support a healthy, sustainable deer herd.

2.9.5.2 Objective for Establishing Healthy Populations of Columbian White-tailed Deer off of Refuge Lands

Throughout the life of the CCP, encourage the establishment and maintenance of healthy CWT deer subpopulations off of refuge lands and establish where appropriate, experimental subpopulations of CWT deer.

- Establish new CWT deer subpopulation(s) upstream of Longview, Washington, and/or other sites deemed to be appropriate.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Maintain a full-time biologist position at the refuge to ensure that biological information needed for management actions is obtained on CWT deer.	✓	✓	✓
B. Relocate CWT deer to establish new subpopulations or enhance existing ones where appropriate.	✓	✓	✓
C. Encourage travel corridors between subpopulations and habitats.	✓	✓	
D. Encourage the enhancement of CWT deer habitat off of refuge lands by providing technical advice and participating in interagency and private lands agreements.	✓	✓	✓
E. Work with other national wildlife refuges and State wildlife areas to reintroduce CWT deer into its former range to establish secure sites.	✓	✓	✓

Rationale: The lower Columbia River population of CWT deer presently occupies only a small fraction of its historical habitat. Although some of the original habitat is no longer suitable because of urban, industrial, and agricultural development, there are still thousands of acres that could support reintroduced CWT deer. Increasing the deer's range and numbers above the minimum recovery objectives would lessen the risk of catastrophic losses, help ensure there will never be a need to put the deer back on the endangered species list, and restore and maintain a portion of the lower Columbia's natural ecosystem.

Work with partners such as the ODFW and WDFW, the CWT Deer Recovery Team, Columbia Land Trust, The Nature Conservancy, private corporations, and private landowners to establish new and experimental subpopulations of CWT deer. Approximately half of the current population of CWT deer resides on private lands. Continued efforts to protect habitat on these lands are vital to maintaining the health of the population. Potential reintroduction and/or experimental population sites need to include sufficient acreage and habitat to support greater than 50 deer. An example of a potential suitable site is Ridgefield National Wildlife Refuge.

2.9.6 Goal 6. Provide and Encourage Establishment of Aquatic Habitat Conditions that Benefit Salmonids and Other Native Aquatic Species of the Lower Columbia River

2.9.6.1 Objective for Aquatic Habitat

Throughout the life of the CCP, assess, manage, and monitor aquatic habitat conditions and distribution of fish species, including biological characteristics; develop management activities to protect and restore habitats; and assess effects of implementing aquatic habitat management activities at the Mainland and Tenasillahe Island units and other areas where applicable.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Conduct aquatic habitat and fish species surveys.	✓	✓	
B. Modify existing tidegates to improve connectivity between the Columbia River and regulated sloughs.	✓	✓	✓
C. Protect existing conditions of well connected sloughs with high quality aquatic habitats for salmonids and other native species.	✓	✓	✓
D. Eliminate barriers to fish passage within interconnected ditches and sloughs of the Mainland Unit.	✓	✓	
E. Within small watersheds that cross the Mainland Unit develop agreements with landowners and local governments to conduct appropriate habitat restoration actions and improvements to fish passage.		✓	
F. Analyze data concerning physical habitats, riparian areas, and fish assemblages, to assess efficacy of aquatic habitat management activities especially relative to appropriate reference sites, and generate information to improve management actions and develop additional actions.	✓	✓	

Rationale: In the nineteenth century, the Columbia River was known as one of the greatest salmon producing rivers in the world with annual runs of 10 million to 16 million salmon (NPCC 2000). Today, 13 stocks of Pacific salmon and steelhead that traverse the lower Columbia River are considered threatened or endangered. Interior sloughs and the Mainland and Tenasillahe Island units could play a critical role in the survival and recovery of these listed stocks. These refuge units could provide food, refuge, and habitat for juvenile salmon during their transition, called smoltification, from fresh water to salt water. Improved quality and diversity of interior slough habitat in the estuary can directly influence the abundance and diversity of salmon populations that use the area. The lower Columbia River estuary has lost over 70 percent of its historical salmon habitat (50 percent since 1950), due primarily to construction of agricultural levees in floodplain habitat and to floodplain development (Thomas 1983). The importance of estuary sloughs in the life cycle of the Pacific salmon—the region’s iconic species—is well documented. Protection and restoration of sloughs is vital to the recovery of the region’s salmon and steelhead. Because these interior sloughs are managed by the refuge, the refuge can have a greater role in the assessment, monitoring, and management actions affecting aquatic habitat in the refuge’s sloughs.

2.9.7 Goal 7. Gather Scientific Information (Inventories, Monitoring, Research, and Studies) in Support of Adaptive Management Decisions on the Refuge Under Goals 1-6

2.9.7.1 Objective for Scientific Information

Conduct high priority inventory and monitoring (survey) activities as well as research, assessments and studies to enhance endangered and threatened species protection and recovery as well as habitat management and restoration activities. The gathering of scientific information will assist in evaluating resource management and public use activities to facilitate adaptive management and contribute to the enhancement, protection, use, preservation and management of wildlife populations and their habitats on- and off-refuge lands. Specifically, they can be used to evaluate achievement of resource management objectives identified under Goals 1-6 in the CCP. These activities have the following attributes:

- Data collection techniques would likely have minimal animal mortality or disturbance and minimal habitat destruction.
- Minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements would be collected for identification and/or experimentation in order to minimize long-term or cumulative impacts.
- Proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, would minimize the potential spread or introduction of invasive species.
- Projects will adhere to scientifically defensible protocols for data collection, where available and applicable.

Throughout the life of the CCP, monitor habitat and wildlife to enhance endangered species protection, habitat management/restoration activities, and public use activities; annually complete CWT deer status report (survival, movement, productivity).

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Maintain a full-time biologist position at the refuge to ensure biological information is obtained for management actions and regional/national data needs.	✓	✓	✓
B. Monitor the health status of CWT deer.	✓	✓	✓
C. Monitor survival of CWT deer, with an emphasis on the causes of fawn mortality.	✓	✓	✓
D. Monitor growth and species composition of short-grass fields, riparian forest, and wetlands.	✓	✓	✓
E. Formulate habitat management recommendations based on analysis of the refuge's CWT deer nutrition study.	✓	✓	✓
F. Work with graduate school programs to conduct research and monitoring, utilizing the bunkhouse for students and other researchers.		✓	

G. Monitor species composition and distribution of amphibians.		✓	
H. Monitor species composition, distribution, and timing of avian use of the refuge, including a mid-winter waterfowl survey, a bald eagle survey, and a dusky Canada goose survey.	✓	✓	
I. Monitor species composition, distribution, life history attributes, and habitats of fishery resources to assist in evaluating and guiding management decisions.		✓	
J. Conduct wilderness study.		✓	

Rationale: Monitoring and research are essential to habitat and population management. For example, Goal 5, Objective 2.9.5.1 calls for maintaining a minimum of 345 CWT deer on the refuge. Conducting CWT deer population surveys is essential to determining if the recovery goal is being met. Similarly, wildlife population and habitat management practices must be monitored to evaluate their effectiveness. Refuges must collect site-specific information and conduct defensible research to provide information for devising and adapting management practices.

A wilderness study will be conducted to identify which islands, if any, contain the necessary wilderness elements such as primeval character, solitude, and special features of value (e.g., ecological, geological, or other features of scientific, educational, scenic, or historical value). The findings of the study determine whether or not the study areas merit recommendation for inclusion in the Wilderness System. The study will be completed by 2015. The wilderness inventory was conducted as part of this CCP process (Appendix F).

2.9.8 Goal 8. Provide Refuge Visitors with the Opportunity to Participate in Wildlife Observation, Hunting, Fishing, Photography, Interpretation, and Environmental Education

2.9.8.1 Objective for Wildlife Observation and Photography

Throughout the life of the CCP, provide quality opportunities for wildlife observation and photography in a manner that minimizes impacts on wildlife and habitats.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Maintain and enhance the interpretive area and wildlife viewing site located along State Highway 4, by increasing interpretive messages about the refuge and Refuge System with new displays.	✓	✓	✓
B. Develop, maintain, and improve auto pull-outs for wildlife observation on Steamboat Slough Road.		✓	✓
C. Install spotting scopes at the wildlife viewing site on State Highway 4 and the Steamboat Slough Road Tenasillahe Island Overlook.			✓
D. Add mile markers at quarter-mile intervals on the auto tour route and trails to assist birdwatchers with posting their observation data.			✓
E. Look for an alternative to the Center Road Trail, by working with the county to develop Brooks Slough Road as an access point and as an all-season hiking and cycling route, or an alternate route accessed from the refuge.		✓	✓
F. Look for a second alternative to the Center Road Trail by developing a nature trail extending from refuge headquarters, southwest along Indian Jack Slough.		✓	
G. Install interpretive panel and map at the Steamboat Slough Road Tenasillahe Island Overlook.			✓

Rationale: Currently, there are very few places in the surrounding area to view and interpret the region's once-common, now-rare habitat type, Sitka spruce swamp. Two developed wildlife viewing sites, available on the Mainland Unit, offer viewing opportunities of mostly managed short-grass field habitat (Map 12). The State Highway 4 refuge wildlife viewing site was originally established for safe observation/photography of a large elk herd, which caused unsafe traffic congestion. In recent years, to reduce competition for CWT deer habitat by using fencing and an elk management hunt, the elk have been encouraged to shift their use of the refuge's CWT deer habitats and utilize habitats off the refuge. The State Highway 4 viewing site lacks adequate interpretive displays and needs updated refuge information. Updating this display to interpret the refuge's mission, natural resources, and programs would provide the public an opportunity to understand the refuge's purposes and resources.

The refuge currently has one walking trail bisecting the refuge's Mainland Unit, the Centerline Trail. This trail has several drawbacks: it doubles as a service road, it is closed much of the year to limit disturbance to CWT deer, it generally floods in winter months, and it is in a poor location to observe/photograph wildlife. The refuge will improve and expand wildlife observation/photography opportunities for the public, while limiting potential disturbance to CWT deer by working with the county to identify and where appropriate, develop walking trails along Brooks Slough Road connecting through the refuge.

As a second alternative the refuge will look at developing a nature trail that starts at the refuge office and follows along the edge of Indian Jack Slough to the Steamboat Slough Road. This trail could be extended by following the roadside of Steamboat Slough Road back to the refuge office forming an approximate 2.5-mile nature trail loop.

By developing a new walking trail(s) and viewing area/auto tour pull-out for interpreting important habitat types—Sitka spruce swamp and the riparian forests—visitor experiences and knowledge about the resource could be enhanced. Development of a new walking trail and/or viewing areas would be limited to areas that do not create a wildlife or resource disturbance.

The refuge's headquarters viewing platform provides a good opportunity to view/photograph wildlife and has an excellent interpretive display. No changes to this area are proposed.

2.9.8.2 Objective for Hunting

Throughout the life of the CCP, allow quality waterfowl, snipe, and elk hunting on the refuge.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Improve signage to better delineate the refuge's hunting boundaries.	✓	✓	✓
B. Update maps and hunting brochures for the public.	✓	✓	✓
C. Increase law enforcement to ensure a quality hunting experience for everyone.	✓	✓	✓
D. Work with state agencies on law enforcement issues and publication of regulations.	✓	✓	✓
E. Allow waterfowl and snipe hunting on Hunting Islands and Wallace Island only.	✓		
F. Allow waterfowl and snipe hunting on Wallace, Crims, Price and Hunting islands.		✓	✓
G. Provide opportunities for elk hunting on the refuge's Mainland Unit when the elk population exceeds 20 individuals. Follow current Elk Hunt Plan and Environmental Assessment.	✓	✓	✓
H. For safety reasons close waterfowl hunting on refuge lands along the outside of the mainland dike by the Lower Elochoman and along the shoreline of Hunting Island by the Lower Elochoman. Refuge lands in this area would be closed because the hunt zone is directly adjacent to the Steamboat Slough Road Dike. Designation of a waterfowl hunt zone immediately adjacent to a county road where visitors also come to observe wildlife could lead to conflicting public	✓	✓	✓

uses as well as safety issues.			

Rationale: An Elk Hunt Plan/EA was completed in 2004. The Elk Hunt Plan/EA is up-to-date, and the refuge is currently implementing it. High numbers of elk on the refuge result in unacceptable levels of competition for food between elk and CWT deer. The current plan keeps competition for browse (food) at an acceptable level while maintaining a sufficient population of elk, to maintain the biological integrity of the habitat and provide for public viewing.

Waterfowl and snipe hunting have been traditional uses of the refuge in the lower Columbia River estuary for a long period of time. Currently, the waterfowl hunting program allows hunting on Hunting Islands and the Wallace Island shoreline and the open navigable waterways within the refuge boundary (Map 12). The refuge staff has identified a potential safety hazard in the waterfowl hunt zone along the Lower Elochoman. This area includes the outside of the mainland dike and the shoreline of Hunting Island in the vicinity of the lower Elochoman River. Designation of a waterfowl hunt zone immediately adjacent to a county road where visitors also come to observe wildlife could lead to conflicting public uses as well as safety issues. The status of the Elochoman River as well as the private beach and its tidelands adjacent to the refuge will remain unchanged under the preferred alternative.

2.9.8.3 Objective for Fishing

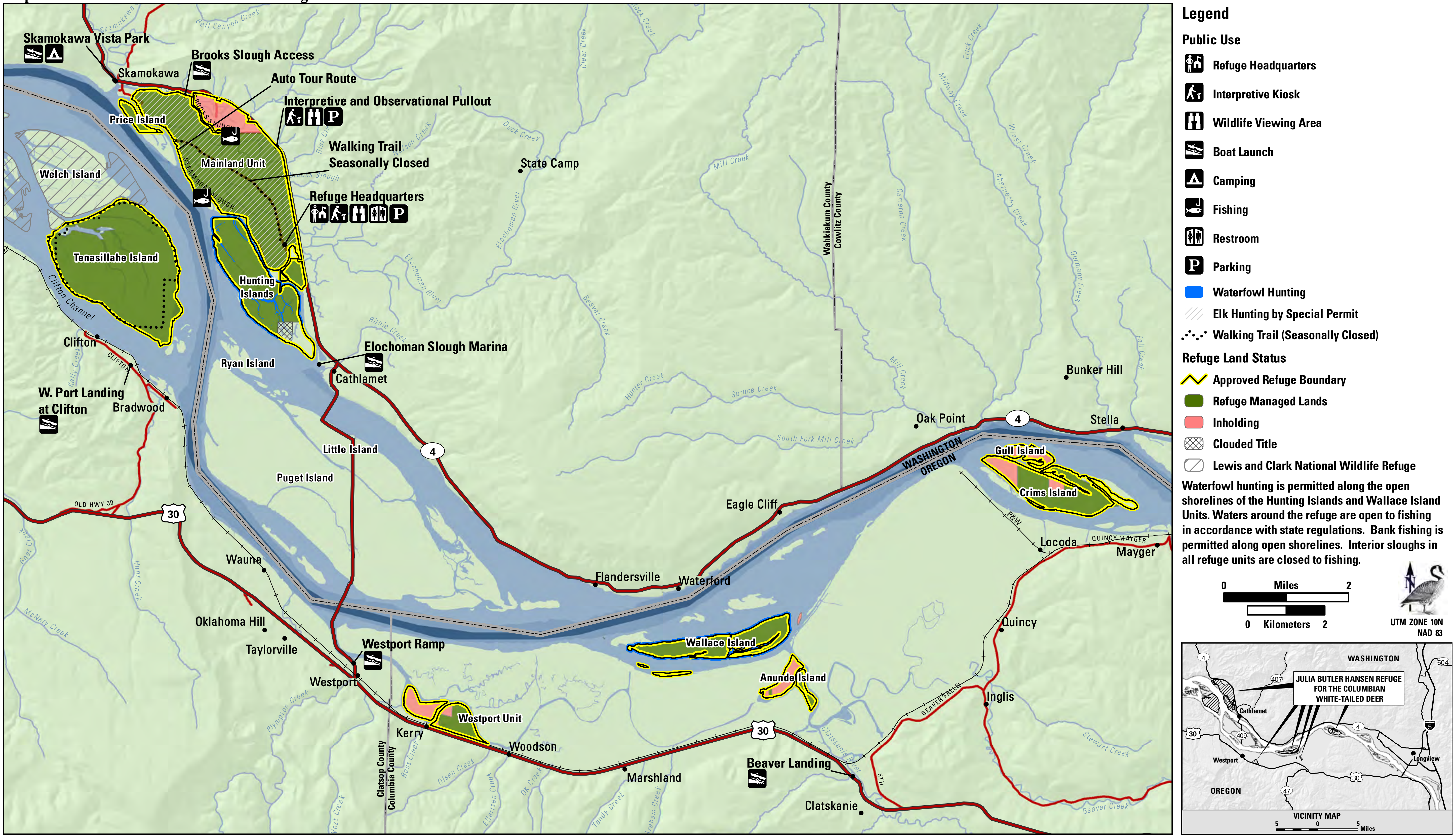
Throughout the life of the CCP, anglers will continue to enjoy current levels of quality fishing opportunities unique to the Columbia River estuary and associated waterways.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Improve location signage to more clearly delineate fishing opportunities for fisherman.		✓	✓
B. Update maps and fishing brochures for the public.		✓	✓
C. Work with ODFW and WDFW to ensure refuge regulations are accurately described in state publications.	✓	✓	✓
D. Increase law enforcement to ensure a quality fishing experience for everyone.	✓	✓	✓

Rationale: The majority of fishing opportunities on the Mainland Unit occur along Steamboat Slough and Brooks Slough roads, which are both county roads and overlay refuge lands (Map 12). Additional fishing occurs along the narrow strip on the outside of the Mainland Unit dike. All other areas of the interior Mainland Unit, (except the seasonal walking trail) are closed to all public access including fishing. In addition, the interior of Tenasillahe Island is closed to all public access including fishing.

A boat is required to access most other refuge units; therefore, although technically open to fishing, the shorelines of refuge islands receive little or no fishing use, because fishing from a boat can be more successful.

Map 12. Public Use – Julia Butler Hansen Refuge for the Columbian White-tailed Deer



Data Sources: Refuge Boundaries from USFWS/R1; Boat Launches from Ducks Unlimited; Railroads from University of Oregon; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; PLSS from WDNR and OR SSCGIS; Elevation from USGS

The back sides of map pages are blank to facilitate map readability.

2.9.8.4 Objective for Interpretation and Environmental Education

Throughout the life of the CCP, provide opportunities for visitors and students to understand and appreciate the unique purposes, wildlife resources, and management activities of the refuges in the lower Columbia River ecosystem.

Strategies for Achieving the Objective	Alt. 1	Alt. 2	Alt. 3
A. Improve refuge boundary signage.	✓	✓	✓
B. Maintain and update maps, brochures, and interpretive messages.		✓	✓
C. Work with other organizations to provide refuge information.		✓	✓
D. Install a new interpretive panel at the Columbia River Tenasillahe Island Overlook on Steamboat Slough Road.		✓	✓
E. Improve refuge resource interpretation by installing new and improved exhibit panels along State Highway 4.		✓	✓
F. Maintain the State Highway 4 interpretive/viewing area.	✓	✓	✓
G. Maintain the interpretive/viewing area at Refuge Headquarters.	✓	✓	✓
H. Develop curriculum based learning opportunities for students of all ages.			✓
I. Work with area schools to develop refuge-specific study sites that provide hands-on science opportunities that could be incorporated into the school curriculum.			✓
J. Establish YCC program specific to the Julia Butler Hansen/Lewis and Clark Refuges.		✓	✓
K. Work with the states to install information/interpretive panels about the refuges along highway pullouts and boat ramps.			✓

Rationale: National wildlife refuges are often mistaken for other land management systems such as national or state parks. Providing information through programs, written materials, and interpretive panels presents opportunities for the public to understand and appreciate the unique purposes and activities of the Refuge System. Providing information to visitors regarding the mission of the Service, the purposes of the refuge, along with specific resource information may alleviate potential impacts to wildlife.

Providing opportunities for interested local teachers to develop curriculum-driven learning opportunities and bring students to the refuge is one way to increase school visits. Creating and developing specific study sites for classes to utilize on the refuge would reduce potential disturbances to wildlife, yet allow students to get hands-on experiences in science and nature.

A YCC program on the refuge would provide jobs for high-school-aged students with opportunities to learn more about refuge resources, and natural resource related careers. Students often receive high school credits for working in YCC positions. The YCC crew would assist refuge staff with resource management activities (fencing, tree planting, and invasive species removal).

Table 2-1 Alternatives Summary Table – Lewis and Clark Refuge

Key Themes/Issues	Alternative 1 Current Management (No Change)	Alternative 2 (Preferred) Enhance Resource Protection Provide Wildlife-dependent Public Use
Habitat Management		
Scrub-shrub Swamp	Protect 2,165 acres	Same as Alt. 1
Sitka Spruce Swamp	Protect 285 acres	Same as Alt. 1
Cottonwood/Willow Swamp	Protect 120 acres	Same as Alt. 1
Emergent Tidal Marsh	Protect 3,720 acres	Same as Alt. 1
Mud Flats and Sandbars	Protect 4,825 acres	Same as Alt. 1
Upland Forest	Protect 89 acres	Same as Alt. 1
Riparian Forest	Protect 470 acres	Same as Alt. 1
Open Water	Protect 1,360 acres	Same as Alt. 1
Resource Management		
Oregon Department of State Lands Agreement	No change (no agreement)	Meet with ODSL to discuss management options for State lands within the refuge boundary and potential future opportunities to acquire islands and tidelands
Lower Columbia River Estuary	No Change	Coordinate with National Park Service regarding Natural Heritage Area designation and develop educational programs with other groups
Dredge Spoil Islands U.S. Army Corps of Engineers	Limit focus to Service-owned habitats	Work with the Corps and other partners to ensure islands provide vegetative benefits for the unique species using these areas
Pest Management	Maintain partnerships for monitoring and priority control of invasive species	Same as Alt. 1 plus work with others to share resources, education, training, inventory and control invasive species
Research, Monitoring, and Inventory	Maintain current monitoring and research activities; maintain refuge biologist	Same as Alt. 1 plus improve monitoring and research utilizing graduate students and others
Public Use		
Waterfowl Hunting	Maintain existing waterfowl hunting; maintain sanctuary areas closed to hunting	Same as Alt. 1
Fishing Opportunities	Maintain current fishing program	Same as Alt. 1
Environmental Education and Interpretation (EEI)	Maintain current EEI by providing talks on a case by case basis; maintain limited refuge signs, displays, and brochures	Same as Alt. 1 plus increase refuge visibility by developing informational signs, attending festivals, posting additional boundary signs, and updating brochures
Wildlife Observation and Photography	Refuge lands are open to wildlife observations but no facilities are provided	Work to increase wildlife viewing opportunities, install interpretive signs, and identify off-refuge campsites
Wilderness		
Wilderness	No Wilderness	Wilderness inventory and future study

Table 2-2 Alternatives Summary Table–Julia Butler Hansen Refuge

Key Themes/Issues	Alternative 1 Current Management (No Change)	Alternative 2 (Preferred) Enhanced Habitat and CWT Deer Management with Increased Wildlife-dependent Public Use Opportunities	Alternative 3 Maintain Current Habitat Management, Increase CWT Deer Management with Enhanced Wildlife-dependent Public Use Opportunities
Habitat Management			
Short-grass Fields	Maintain 680 acres on the Mainland and Tenasillahe Island units	Same as Alt. 1 plus establish additional 110 acres on Mainland and Tenasillahe Island units	Same as Alt. 1
Early Successional Riparian Forest	Establish 210 acres on the Mainland Unit and 70 acres on the Tenasillahe Island Unit, and maintain 120 acres on the Crims Island Unit	Same as Alt. 1 plus establish additional 100 acres on Mainland and Tenasillahe Island units	Same as Alt. 1
Mid-successional Riparian Forest	Maintain 70 acres on the Mainland Unit and 22 acres on the Tenasillahe Island Unit	Same as Alt. 1	Same as Alt. 1
Late-successional Riparian Forest	Maintain 445 acres on the Mainland Unit and 430 acres on the Tenasillahe Island Unit	Same as Alt. 1	Same as Alt. 1
Nontidal Wetlands	Maintain existing 130 acres	Same as Alt. 1 plus establish additional 40 acres	Same as Alt. 1
Sloughs	Maintain 143 acres	Same as Alt. 1	Same as Alt. 1
Tidal Scrub-shrub Swamp	Maintain 847 acres	Same as Alt. 1	Same as Alt. 1
Tidal Sitka Spruce Swamp	Maintain 353 acres	Same as Alt. 1	Same as Alt. 1
Tidal Cottonwood/ Willow Swamp	Maintain 611 acres	Same as Alt. 1	Same as Alt. 1
Emergent Tidal Marsh	Maintain 300 acres	Same as Alt. 1	Same as Alt. 1
Open Water	Maintain 105 acres	Same as Alt. 1	Same as Alt. 1
Columbian White-tailed Deer			
CWT Deer Population Management (Endangered Species Recovery)	Follow Recovery Plan guidelines	Same as Alt. 1 plus expand population by establishing experimental population up river	Same as Alt. 1

Key Themes/Issues	Alternative 1 Current Management (No Change)	Alternative 2 (Preferred) Enhanced Habitat and CWT Deer Management with Increased Wildlife-dependent Public Use Opportunities	Alternative 3 Maintain Current Habitat Management, Increase CWT Deer Management with Enhanced Wildlife-dependent Public Use Opportunities
CWT Deer Protection	Integrated coyote control from January to mid-April	Lethal coyote control year round to achieve fawn:doe ratios and population objectives; removal of mountain lions and bears when present on refuge	Lethal coyote control January through August to achieve fawn:doe ratios and population objectives; removal of mountain lions and bears when present on refuge
Aquatic Habitats			
Aquatic Habitat	Assess, monitor, and restore aquatic habitat as appropriate and as funding becomes available	Same as Alt. 1 plus modify existing tidegates; work with partners to restore aquatic habitats; protect sloughs	Same as Alt. 1
Conduct Research And Monitoring			
Research and Monitor Habitats	Maintain a full-time biologist position and monitor CWT deer	Same as Alt. 1 plus monitor growth and various species composition using research assistance from colleges	Same as Alt. 1
Public Use Opportunities			
Wildlife Observation and Photography	Maintain current viewing/interpretive areas at State Highway 4 and refuge headquarters	Same as Alt. 1 plus develop Brooks Slough Road (as a foot/cycling trail) and Indian Jack Slough (as a walking trail)	Same as Alt. 2 plus develop Brooks Slough Road and additional wildlife viewing points and install spotting scopes
Hunting	Maintain waterfowl hunting on Wallace and Hunting Islands and elk hunting as needed on the Mainland Unit	Same as Alt. 1 plus open Price and Crims islands to waterfowl hunting; close a section of Hunting Islands for safety	Same as Alt. 2
Fishing	Fishing on mainland at Steamboat Slough	Same as Alt. 1	Same as Alt. 1
Interpretation and Environmental Education	Provide brochures and maps, and work with other agencies to provide refuge information; maintain viewing areas	Same as Alt. 1, plus establish YCC program, update interpretive media, and work with partners to provide information	Same as Alt. 1, plus install new interpretive exhibit panels, and develop school curriculum and refuge study sites
Wilderness			
Wilderness	No Wilderness	Wilderness inventory and future study	Same as Alt. 1

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Chapter 3. Physical Environment

Top, an eagle's nest on the Lewis and Clark Refuge. Above, a Canada geese brood. Photos: USFWS

Chapter 3. Physical Environment

3.1 Refuge Introductions

Where the Columbia River nears the end of its journey to the Pacific Ocean, the river's fresh water merges with the Pacific Ocean's salt water forming the lower Columbia River estuary. In an estuary, the river has a direct, natural connection with the open sea. This transition from fresh to salt water creates a special environment that supports unique communities of plants and animals, adapted for life at the margin of the sea. Estuarine environments are among the most productive ecosystems on earth (Gulf South Research Institute 1977; Jerrick 1999; Odum 1971; Reimold 1977). It is at this area of the Columbia River that two national wildlife refuges, Julia Butler Hansen and Lewis and Clark, become intertwined with the Columbia River and the lower Columbia River estuary.

Both refuges are located in the lower reach of the Columbia River with lands and waters in southwest Washington (Wahkiakum County) and in northwest Oregon (Clatsop and Columbia counties). Since the early 1970s both refuges have played important roles in the protection and management of this ecologically rich area. Both refuges are part of the Willapa National Wildlife Refuge Complex. The refuge complex office is located approximately two miles west of Cathlamet, Washington, along Washington State Highway 4, within the Julia Butler Hansen Refuge.

The Lewis and Clark Refuge's acquisition boundary encompasses 33,000 acres of the lower Columbia River estuary, including 18 named islands and numerous sand bars, mud flats, unnamed intertidal marshes, and areas of open water in northern Clatsop County, Oregon (Map 2). The refuge also includes three small units on the Oregon mainland; Tongue Point, Emerald Heights, and Brownsmead. Both the Service and the State of Oregon own land within the refuge's land acquisition boundary, with the refuge owning 12,166 acres and the State owning the remainder, including uplands and tidelands. At one time, the refuge had agreements with the State and County to manage their lands within the refuge's acquisition boundary as part of the refuge. Both agreements have expired, with Clatsop County donating all county lands to the refuge and the ODSL retaining ownership and management authority over State lands.

The Julia Butler Hansen Refuge is divided into seven management units (Map 3). The Mainland, Hunting Islands, and Price Island units are located in Washington. The Tenasillahe Island, Wallace Island, Westport, and Crims Island units are located in Oregon.

The Mainland Unit contains 2,000 acres and is located along the Columbia River between the towns of Cathlamet and Skamokawa, Washington. The Elochoman River joins the Columbia River in the southeast part of the unit. Most of the unit is diked along the rivers to prevent tidal flooding. Drainage is accomplished by six tidegates, a pump, and a system of ditches and natural sloughs that move water from within the diked area into the rivers and sloughs outside the dikes. The unit's vegetative cover is a mosaic of brushy woodlots, actively managed pastures, and old grass fields. The Mainland Unit also includes approximately 60 acres of forested intertidal swamp and marsh on the east side of the Elochoman River that is not diked. The Elochoman River separates the Hunting Island Unit from the southwestern edge of the Mainland Unit. The refuge owns the majority of the island, while parts of the southern tip are being held in trust by the Bureau of Indian Affairs. Forested intertidal swamp and shrub/scrub occupy most of the island, although there are a few areas of intertidal marsh totaling perhaps 100 acres.

Price Island lies along the northwestern edge of the Mainland Unit, separated from the mainland by Steamboat Slough. The northern 57 acres of Price Island are owned/managed by the refuge, and Wahkiakum County owns approximately 61 acres of the southern end of the island. The island is primarily a Sitka spruce intertidal swamp, although there is a sandy upland of 4 acres that was created by dredge spoil.

Tenasillahe Island lies just across the main channel of the Columbia and west of the Mainland, Hunting Island, and Price Island units. The island is approximately 1,950 acres in size, of which 1,700 acres are surrounded by a dike. The diked area is similar to the Mainland Unit in water drainage and land cover. The interior drainage of the island is accomplished by ditches, sloughs, and four tidegates in two locations. The island's vegetation is a mix of woodlots, brush, pastures, and old grass fields. The southern tip of the island consists of a black cottonwood/Sitka spruce intertidal swamp that encompasses 175 acres and is not diked.

Wallace Island is located in the Columbia River between river miles 47 and 50, approximately 10 miles upstream (southeast) of the Mainland Unit. It is on the south side of the Columbia, at the mouth of the Clatskanie River and is separated from the Oregon mainland by Wallace Slough. The 579-acre Wallace Island consists almost entirely of a cottonwood/willow intertidal swamp, with two small reed canarygrass dominated meadows. This unit also includes Kinnunen Cut, a 47-acre island located in the lower Clatskanie River one-half mile south of the eastern end of Wallace Island, and 3.55 acres on adjacent Anunde Island. The remaining acreage of Anunde Island is privately owned. The vegetation on Kinnunen Cut and Anunde Islands is a mix of cottonwood/willow swamp and wet meadows dominated by reed canarygrass.

Crims Island is located at the far upstream end of the refuge on the Columbia River between river miles 54 and 56. It is the newest addition to the refuge and consists of a main island and peninsula separated by a slough channel to the north. The island is separated from the Oregon mainland by the Bradbury Slough to the south, and to the north it is separated from the Washington mainland by the Columbia River ship channel. The refuge owns 473 acres and shares ownership of the remainder of the island with four adjacent owners. Gull Island which is located at the tip of the northern peninsula is separated by a narrow channel to the east from the peninsular portion of Crims Island and by a larger slough channel to the south from the main part of the island. This 750-acre Crims-Gull Island Complex is dominated by a large reed canarygrass meadow in its center with, a 90-acre cottonwood/willow intertidal swamp to the west and an accreted spoil site with cottonwoods on the northern peninsula.

The Westport Unit is located on the Oregon mainland approximately four miles southeast of the Mainland Unit and one mile east of the town of Westport. The Westport Unit is 145 acres and bordered on three sides by Westport Slough and on one side by Oregon State Highway 30. The unit's vegetation is dense cottonwood/willow and shrub/scrub swamp. Three small parcels, which total less than 18 acres, are located between the refuge boundary and the Westport Slough.

3.2 Climate

The refuge has a mild marine climate characterized by moderate temperatures, high humidity, copious rainfall, and breezy winds. National Weather Service stations in Kelso, Washington, and Astoria, Oregon, are representative of climate at the extreme easternmost and westernmost portions of the refuge. Both sites carry extensive historical records of temperature, wind, humidity, precipitation, and other climatic data. Two other Remote Automated Weather Stations are located within 12 miles of refuge headquarters but both are situated above 2,000 feet in elevation, therefore, are not representative of refuge climate. Data for refuge locations between Kelso and Astoria are very limited; however, an unofficial weather station, which records just precipitation and temperatures, has been maintained at refuge headquarters two miles north of Cathlamet, Washington, since 1980. In addition, data from other nearby weather recording sites at Grays River, Naselle, and six miles northeast of Cathlamet, Washington, are available.

Area temperatures are mild. The average annual temperature recorded at Astoria, Oregon is 51^{o}F. The annual average maximum and minimum temperatures for the Astoria area from 1953 to 2008 were 58.3^{o}F and 43.6^{o}F, respectively (WRCC 2009). Snow is very infrequent throughout the refuge and occurs less than three days per year. More extensive snow and ice storms with more than two or three inches of frozen precipitation occur on average every seven to 10 years. Cloud cover is extensive with over 75 percent of the days being mostly to partly cloudy. As would be expected, cloud cover at the coast is highest with the overcast marine layer being common on most summer mornings.

Minimum and maximum temperatures and precipitation throughout the refuges is extremely variable. Since 1980, an average of 64 inches of precipitation has fallen each year at refuge headquarters. Other local annual averages include 45 inches at Kelso, Washington, and 115 inches at Naselle, Washington. Approximately 75 percent of the annual precipitation occurs during November through March. In the wettest months of November, December, and January, precipitation is frequently recorded on 20 to 25 days or more each month. During the driest months of July and August, it is not unusual for two to four weeks to pass with only a few showers. In Astoria, July and August are the driest months of the year.

During the winter, rainfall is usually of light to moderate intensity and continuous over a period of time, rather than heavy downpours for brief periods. Thunderstorms are unusual but occur periodically every few years, most often in spring and summer. Fog and drizzle are common, occurring year-round and often from October through June. Snowfall occurs almost yearly with an average of 4.1 inches annually at Astoria. Unusual years can bring greater volumes of snow, as in the winter of 1949-1950 when over 39 inches of snow fell in the Astoria area. Snowfall in the area has become less common in the past 20 years possibly due to global climate change.

Onshore westerly winds from the Pacific Ocean are predominant year-round at the Julia Butler Hansen and Lewis and Clark refuges. The average annual wind speed at the airport in Astoria, Oregon, is 7.9 miles per hour (mph). Average monthly wind speeds in Astoria range from 6.8 mph in October to 9.1 mph in December. The prevailing wind direction in summer is northwest and in winter southwest and west. Drier east and southeasterly winds are uncommon, but occur periodically each year and are often associated with moderate down-slope winds off of the

Cascade Mountain range. Strong southwest winds usually accompany annual winter storms, which can result in sustained winds of 40 to 65 mph, with gusts from 90 mph to more than 100 mph. Hurricane force winds (greater than 74 mph) are experienced almost annually and occasionally produce a recognized hurricane.

A windstorm packing hurricane force winds battered the coasts of Washington and Oregon during December 1-3, 2007. Winds with this storm were second only to that of the 1962 Columbus Day Storm with a recorded gust of 129 mph at Bay City, Oregon (reports of as much as 147 mph at unpopulated areas); however, the longevity of winds with this storm far exceeded the Columbus Day Storm with sustained winds in excess of 50 mph for over two days. This storm also delivered significant wave heights (top one-third of wave heights) of up to 48 feet, before the storm unmoored the buoys that were being used to measure the storm's waves and caused significant flooding on coastal rivers. This led to the closure of all east-west roads through the Coast Range into the Willamette Valley and cut power to the area for at least four days (National Weather Service 2009). Tongue Point and the Emerald Heights Unit forests sustained a significant amount of damage from this storm.

Emerald Heights storm damage, December 2007. Photo: USFWS

3.3 Climate Change

A growing body of scientific evidence has emerged supporting the theory of human-caused global climate change. During the twentieth century, the global environment experienced increases in average worldwide temperatures, sea levels, and chemical concentrations. Average annual air temperatures on the earth's surface have increased by 1.3°F since the mid nineteenth century (IPCC 2007). Furthermore, the increasing trend in global temperatures over the last 50 years is approximately twice the trend of the previous 50 years (IPCC 2007). Globally, 11 of 12 years from 1995 to 2006 surface temperatures are the warmest on record since 1850 (IPCC 2007).

During the next 20 to 40 years, the climate of the Pacific Northwest (Washington and Oregon) is projected to change significantly. Global climate models project mid-twenty-first century temperatures in the northwest that are well outside the range of temperature observed in the twentieth century. They also suggest important changes in future precipitation: nearly all the climate models project wetter winters and drier summers in the 2020s and the 2040s (Mote et al. 2003).

3.4 Predicted Future Ecological Trends

Projected temperature increases for the coming century are expected to increase the proportion of winter precipitation falling as rain, increase the frequency of winter flooding, reduce snowpack, increase winter stream flow, result in earlier peak stream flow, and decrease late spring and summer stream flows (Hamlet and Lettenmaier 1999; Hamlet et al. 2007; Mote et al. 2003; Mote et al. 2005; Payne et al. 2004; Tague et al. 2008 cited in Lawler et al. 2008). Summer stream flow reduction is expected to continue and become more widely spread (Miles et al. 2000; Mote 2003a, 2003b; Mote et al. 1999; Snover et al. 2003; Stewart et al. 2005). For example, July to October decreases in the Tualatin Basin stream flows are expected to reach 10 to 20 percent by 2040 (Palmer et al. 2004).

While the region is forecast to become wetter overall, the projected increase in precipitation is less than the precipitation range associated with natural decadal variability (Hamlet et al. 2005). Furthermore, most increases in precipitation are projected for the winter months. Likewise, increases in winter stream flows have the potential to increase the risk of winter floods and streambed scouring events (UW Climate Impacts Group 2009). Secondary to warmer temperatures, some of the changes/effects in the Pacific Northwest that we are likely to see over the next 20 to 40 years include the following (Climate Impacts Group 2009).

- **Changes in water resources**
  - Decreased mountain snowpack
  - Earlier snowmelt
  - Higher winter stream flow in rivers that depend on snowmelt
  - Higher winter stream flow in rain-fed river basins if winter precipitation increases in the future as projected
  - Lower summer stream flow in rivers fed by snowmelt (most rivers in the Pacific Northwest)
  - Earlier peak (spring) stream flow in rivers fed by snowmelt (most rivers in the Pacific Northwest)
  - Decreased water for irrigation, fish, and summertime hydropower production

- **Changes in salmon**
  - Increased difficulties due to increased winter floods, decreased summer stream-flow, and increased water temperature

- **Changes in forests**
  - Overall, the Pacific Northwest is likely to see increased forest growth regionwide over the next few decades followed by decreased forest growth, as temperature increases overwhelm the ability of trees to make use of higher winter precipitation and higher carbon dioxide
  - Seed regeneration may be impeded by higher temperatures
  - Forest fires could potentially increase
  - Potential for extinction of local populations and loss of biological diversity if environmental shifts outpace species migration rates and interact negatively with population dynamics

- **Changes along the coasts**
  - Increased coastal erosion and beach loss due to rising sea levels
  - Increased landslides due to increased winter rainfall
  - Permanent inundation, especially in south Puget Sound around Olympia
  - Increased coastal flooding due to sea level rise and increased winter stream flow from interior and coastal watershed

- **Temperature Changes**
  - The temperature has increased. The average annual temperature increased 1.5°F in the Pacific Northwest between 1920 and 2003. The warming has been fairly uniform and widespread, with little difference between warming rates at urban and rural weather monitoring stations. Only a handful of locations recorded cooling. The warmest year was 1934, and, the warmest decade was the 1990s (Mote 2003b).
  - Warming trends have been most evident between 1930 and 1995 during the months of January through March. The minimum daily temperature rose faster than the maximum daily temperature through the mid-twentieth century. In the second half of the twentieth century, minimum and maximum temperatures rose at about the same rate (Hamlet and Lettenmaier 2007; Mote 2003b).

- **Precipitation Changes**
  - Decadal variability has dominated annual precipitation trends. Annual precipitation increased 14 percent for the period 1930-1995 for the Pacific Northwest region. Subregional trends ranged from 13 percent to 38 percent (Mote 2003b). However, these trends are not statistically significant and depend on the time frame analyzed. Decadal variability is, therefore, the most important feature of precipitation during the twentieth century.
  - Cool season precipitation variability has increased. Cool season precipitation in the Pacific Northwest is more variable from year to year, displays greater persistence, and is more strongly correlated with other regions in the West since about 1973 (Hamlet and Lettenmaier 2007).

- Between 1950 and 2000, April 1 snow water equivalent (SWE) declined at nearly all sites in the Pacific Northwest. The declines are strongest at low and middle elevations and can be explained by observed increases in temperature and declines in precipitation over the same period of record (Hamlet et al. 2005; Mote 2003b, 2006;). Many low elevation stations showed SWE declines of 40 percent or more (Mote 2003a; Mote et al. 2005). Timing of peak runoff has shifted. Timing of the center of mass in annual river runoff in snowmelt basins shifted 0-20 days earlier in much of the Pacific Northwest between 1948 and 2002 (Stewart et al. 2005). The largest change in these trends occurred in the Pacific Northwest, including the mountain plateaus of Washington, Oregon, and western Idaho. These findings are corroborated by modeling studies that show similar changes in runoff timing (Hamlet et al. 2007)

3.5 Detailed Future Climate Change in the Pacific Northwest

3.5.1 Sea Level Rise

The National Wildlife Federation engaged sea level rise modeling expert Jonathan Clough, of Warren Pinnacle Consulting, Inc., to simulate and report effects to coastal habitats in 10 areas in the Puget Sound, as well as coastal sites from the Willapa Bay in southwest Washington to the Tillamook Bay in northwest Oregon. One of the sites included in the report was the mouth of the Columbia River. While there have been several studies of sea level rise in the Pacific Northwest, Jonathan Clough's study provides the most comprehensive and detailed analysis to date of the potential impacts of sea level rise on the region's coastal habitats. The model used for the analysis is called Sea Level Affecting Marshes Model, Version 5.0 (SLAMM 5.0), which was designed to simulate the dominant processes involved in wetland conversion and shoreline modification under long-term sea level rise. The model integrates information about projected global sea level rise with area-specific National Oceanic and Atmospheric Administration (NOAA) tidal data, detailed wetland information from the Fish and Wildlife Service's National Wetlands Inventory, regional light-imaging detection and ranging (LiDAR) data, and U.S. Geological Survey (USGS) Digital Elevation Maps to project habitat changes associated with sea level rise. The study maintains that global average sea level increases could increase by an average of 0.28 meters (11.2 inches) by 2050 and by 0.69 meters (27.3 inches) for the study locations in the Willapa Bay, Columbia River, and Tillamook Estuary (Glick et al. 2007).

Some of the potential habitat losses that could occur by the year 2100 under a conservative estimate of sea level rise follow (Table 3-1).

- This region is predicted to lose at least 5,000 hectares (12,355 acres) of dry land.
- There is likely to be extensive loss of tidal flat and area beaches, especially at higher rates of sea level rise.
  Inland and tidal fresh marsh will be fairly vulnerable at this site to saltwater inundation. By 2100 the site could lose 32 percent of brackish marsh, 31 percent of tidal swamp, 47 percent of estuarine beach, and 63 percent of tidal flats.

Ocean beach disappears completely with a 1.5-meter (59.1-inch) sea level rise (Glick et al. 2007) Changes in annual precipitation are less certain. Most of the models analyzed by Climate

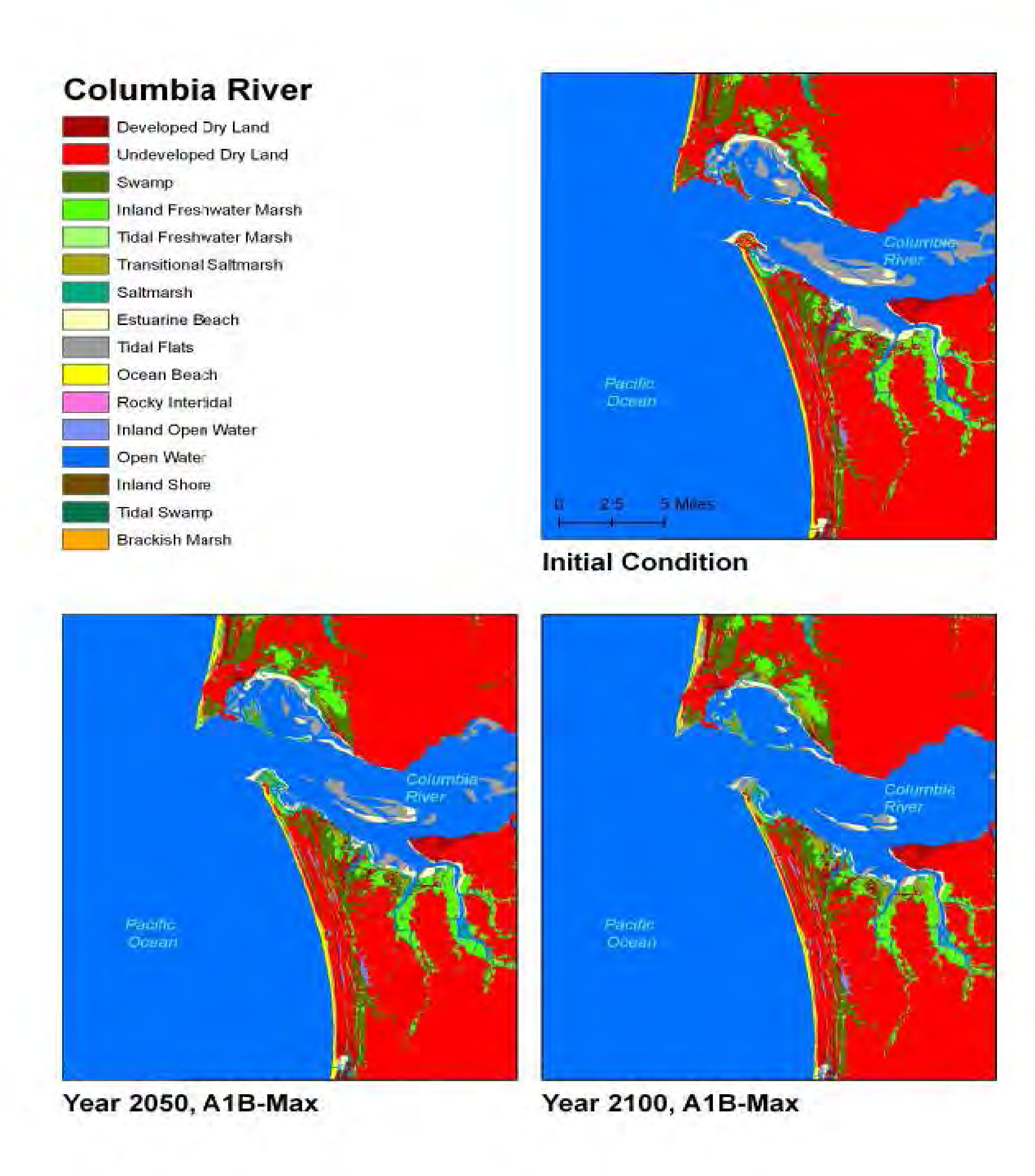
Impacts Group at the University of Washington project decreases in summer precipitation and increases in winter precipitation with little change in the annual mean.

Table 3-1 Projections of Changes for Columbia River Study Site

Percentage Change (Relative to Totals for This Site) [A1B Max for 2050, 2100 and 1.5 Meters for 2100)]			
Land Cover	**2050 (+0.28 meters/11.2 inches)**	**2100 (+0.69 meters/27.3 inches)**	**2100 (+1.5 meters/59.1 inches)**
Undeveloped Dry Land	1% loss	2% loss	2% loss
Developed	No change	No change	No change
Swamp	4% loss	11% loss	19% loss
Inland Fresh Marsh	7% loss	17% loss	25% loss
Tidal Fresh Marsh	8% loss	25% loss	37% loss
Inland Open Water	26% loss	31% loss	34% loss
Estuarine Open Water	21% expansion	48% expansion	65% expansion
Inland Shore	No change	No change	No change
Tidal Swamp	18% loss	31% loss	63% loss
Riverine Tidal	29% loss	39% loss	58% loss

Tundra swans landing. Photo: © Jim Cruce

Figure 3.1 Predicted sea level rises at the mouth of the Columbia River.



From *Sea-level Rise and Coastal Habitats in the Pacific Northwest. An Analysis for Puget Sound, Southwestern Washington, and Northwestern Oregon July 2007,* National Wildlife Federation.

3.5.2 Temperature/Precipitation Changes

Global climate models scaled to the Pacific Northwest project an increase in average Pacific Northwest temperature on the order of 0.2° to 1.0° F (0.1°-0.6° Celsius [C]) per decade throughout the mid-twenty-first century with a best estimate average of 0.5°F or 0.3°C per decade (Table 3-2). Temperature increases occur across all seasons with the largest increases in summer.

The best estimate rate of warming in the Pacific Northwest through the mid-twenty-first century—0.5°F (0.3°C) per decade—is three times the rate of change per decade observed in the Pacific Northwest during the twentieth century (0.15°F/0.8°C per decade). The rate of change per decade for the second half of the twenty-first century is dependent on the choice of emissions scenarios.

Precipitation changes are projected to be small compared to the inter-annual and decadal variability observed during the twentieth century. The majority of models show increases in winter precipitation and reduced summer precipitation. Analysis of future storm tracks indicates a basis for more confidence in wet season increases, particularly in the second half of the twenty-first century (Salathé 2006).

Coastal sea surface temperature (SST) helps determine the biological and physical conditions of the marine environment and estuaries of the Pacific Northwest. Climate models project warming in summer SSTs for the 2040s on the order of 2.7°F (1.5°C). This change is somewhat less than the warming projected in the 2040s for Pacific Northwest land areas (3.5°F/2.0°C) but is significant relative to the small inter-annual variability of the ocean.

Table 3-2 Change in Annual Mean Temperature and Precipitation

	Temperature	Precipitation
2020s		
Low	+ 1.1ºF *(0.6ºC)*	- 9%
Average	+ 2.2ºF *(1.2ºC)*	+ 1%
High	+ 3.4ºF *(1.9ºC)*	+ 12%
2040s		
Low	+ 1.6ºF *(0.9ºC)*	- 11%
Average	+ 3.5ºF *(2.0ºC)*	+ 2%
High	+ 5.2ºF *(2.9ºC)*	+ 12%
2080s		
Low	+ 2.8ºF *(1.6ºC)*	- 10%
Average	+ 5.9ºF *(3.3ºC)*	+ 4%
High	+ 9.7ºF *(5.4ºC)*	+ 20%

Average changes in Pacific Northwest climate from 20 climate models and two greenhouse gas emissions scenarios for the 2020s, 2040s, and 2080s. All changes are benchmarked to average temperature and precipitation for 1970-1999. Model values are weighted to produce the average.

3.5.3 Potential Changes to the Refuges

There have been no specific studies documenting potential effects to either refuge from future climate change. However, based on the various climate modeling scenarios for the Pacific Northwest, there are several potential problems that are envisioned by the refuge staff.

One of the main concerns is the Mainland and Tenasillahe Island units of the Julia Butler Hansen Refuge, which are protected by flood control dikes. The dikes prevent the Columbia and Elochoman rivers from flooding the units during the daily tidal cycles. In addition to refuge administrative facilities, critical CWT deer habitat is protected by the dikes. Under the modeling completed by the National Wildlife Federation study, the sea level could rise almost a foot by 2050. This would cause severe recurring flooding problems in both units during periods of high tide, and likely in time, undermine the integrity of the dikes.

A second concern is the projected loss of tidal wetland habitats due to sea level rise. By 2050 the Northwest Oregon and Southwest Washington coastal sites analyzed by the National Wildlife Federation may be expected to lose significant areas of vegetated marsh due to rising sea levels. Since much of the habitat in both refuges consists of low marshy islands, a rise in water levels could have major impacts on the management of the refuge and the type of species and numbers of wildlife that inhabit the area.

A third concern is the increasing temperatures projected by many of the climate models. The Climate Impacts Group at the University of Washington has averaged a large number of climate models–when averaged, the predicted average annual temperature increase is 3.5ºF by 2040. An increase of that magnitude may have grave implications for the unique estuary and riparian habitats of the lower Columbia River. The coastal Sitka spruce swamp habitat, which covers portions of the Julia Butler Hansen and Lewis and Clark Refuges, results in part from the mild coastal climate. This habitat occurs in the zone from around the Hunting Islands down toward the mouth of the Columbia River. An increase in annual temperatures could result in major reductions or elimination of this type of habitat from the area.

Numerous other changes to the refuges habitat and wildlife would likely result from increases in ambient temperature and precipitation over the next 50 to 100 years. However, until a more detailed analysis of the effects of global climate change can be completed on specific refuge units, more generalized modeling will continue to be used to assess how and what the refuge should do to prepare for upcoming changes to the natural environment. While this CCP/EIS covers a 15-year time span, it is clear that for the refuge to adequately plan for climate change, staff will have to look further into the future. During the CCP's 15-year time frame, the refuge will begin a focused effort to plan on how best to deal with climate changes in the lower Columbia River estuary.

3.6 Air Quality

The refuges are located within Clatsop and Columbia counties in Oregon, and Wahkiakum County, Washington. Within the vicinity of the estuary and refuges, air quality may be affected by marine vessels, industrial facilities, automobiles and other human-caused activities such as outdoor burning, wood stoves, and operation of various vehicles and machines (e.g., gasoline powered equipment, motorboats, etc.). The refuge staff (manager, biologist, and maintenance worker) utilizes various types of equipment and transportation methods to achieve the refuge habitat conservation projects and research. Habitat improvement projects and daily monitoring activities may include the use of a tractor or heavy equipment (bulldozer, backhoe) or the operation of a truck, boat, or other vessel to access remote islands of the refuges. Refuge visitors generally drive their automobiles to see the Julia Butler Hansen Refuge, and some may operate motor boats to visit the islands of both refuges.

3.7 Land Use

3.71 Julia Butler Hansen Refuge

Both the Mainland and Tenasillahe Island pastures have been extensively managed since the early seventies through grazing on the island and both grazing and haying the mainland. A dike failure on Tenasillahe Island caused grazing to cease from 1976 to 1982.

A 1987 Habitat Management Plan identified pasture management goals for the Julia Butler Hansen Refuge, which included managing about 40 percent (1,600 acres out of a total of 4,000 acres) of the Mainland and Tenasillahe Island units acreage as deer pasture. During 2005, about 20 percent of the mainland and 22 percent of the island were managed in this way. Acreage totals were as follows: 230 acres were grazed, 24 acres were hayed and 140 acres were mowed on the Mainland Unit. Approximately 391 acres were grazed on Tenasillahe Island. The focus of the pasture management program is to provide high-quality feeding sites for the CWT deer. Goose pasture is a secondary consideration and one that has become an issue now that depredation problems are becoming more of a concern.

Pastures managed for CWT deer are generally 2-3 feet higher in elevation than surrounding wetlands, have a much higher component of grasses than wetlands, and have somewhat better drainage. The condition of many pastures is poor because they have drainage/flooding problems and have been invaded by noxious weeds such as Canada thistle, tansy ragwort, and reed canarygrass. These undesirable plants have reduced the amount and quality of available deer forage. The loss of clover as a component of the pastures is also an important indicators of the degraded health of these sites.

Common rush, also called tussock, is found in many of the mainland and island pastures. It generally indicates a wetter zone with drainage problems. As with many diked wetlands, control of this plant is difficult. Wintering goose use on pasture lands is likely reduced by the extensive invasions of this plant. Some pasture renovation, including disking, seeding and replanting has been done in recent years on the mainland, but only in selected sites and not on a consistent basis.

Reed canarygrass is an exotic invasive grass from Eurasia. It is well established in wetter sites throughout much of North America. On the refuge, it is extremely abundant. It covers over 70 percent of the refuge grasslands, mostly in sunny, undisturbed, low-lying, wet sites. While it is somewhat palatable to the deer when it is short, it grows so fast that it out-competes the native grasses, brush, and trees. Chemicals commonly used for invasive plant control include Roundup, Vantage and Low-Vol Ester (2,4-D product).

Unmanaged wetlands are generally 1-2 feet lower than the surrounding pasture lands, have standing water from early fall through late spring, and are dominated in managed sites by monotypic stands of common rush (*Juncus effusus*). This rush limits availability of open water resting sites for waterfowl. In less disturbed sites, wetlands may also be dominated by dense stands of reed canarygrass (*Phalaris arundinacea*). Soils in these wetland sites are mostly clay, which drains poorly and is a source for silt deposition in ditches and sloughs. Management of water levels in these natural wetlands is not possible.

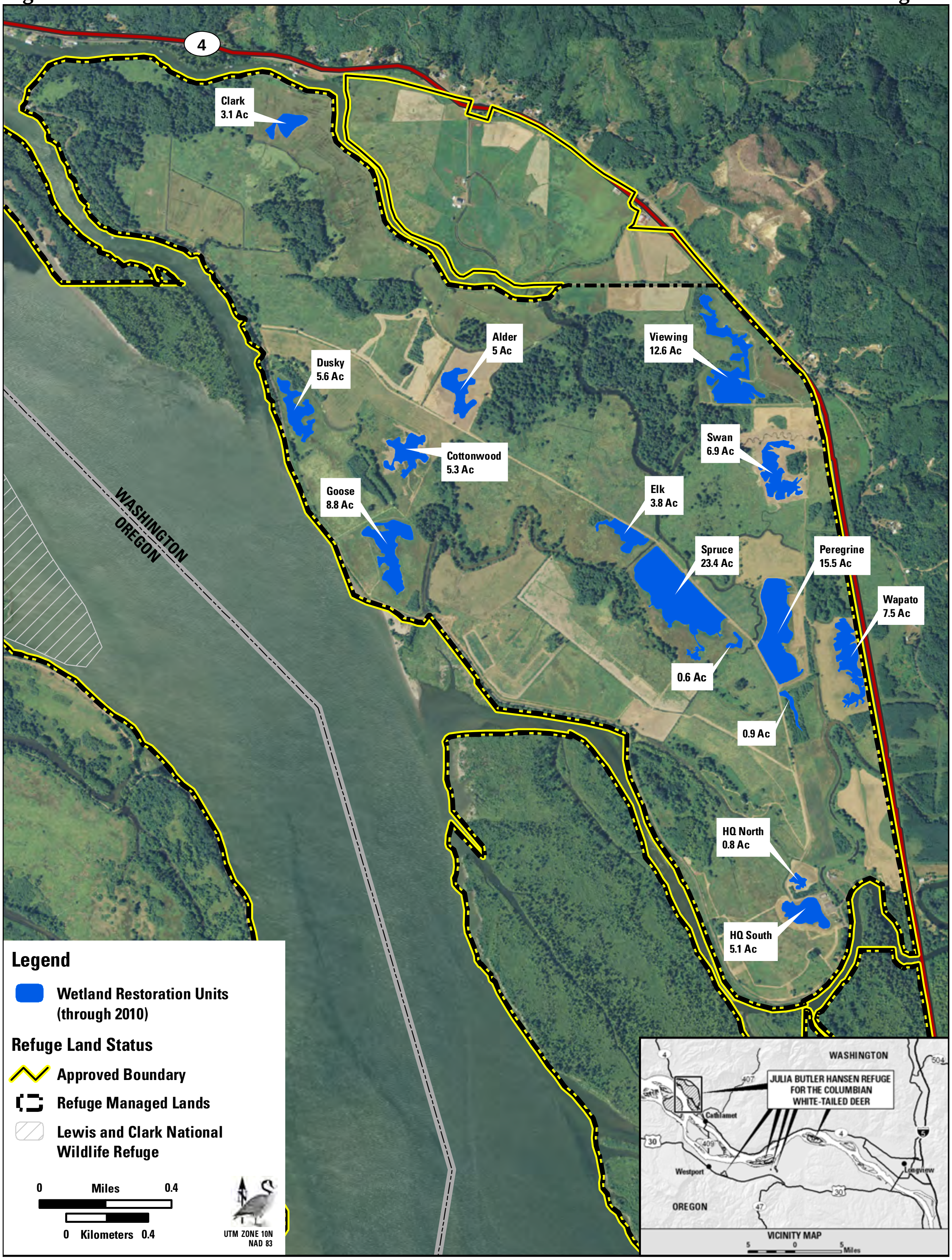
Managed wetlands are similar to unmanaged wetlands with some significant differences. These wetlands have been constructed to manage water levels and reduce infestations of weedy species. Managed wetlands have water structures which allow for control of the water levels, which are generally maintained at around 18 inches or less. The wetlands are usually drawn down during the summer months to mimic natural cycles and if necessary, they can be disked or plowed to reduce noxious plant infestations and to provide a good ratio of vegetative cover to open water. There are currently 13 managed wetlands sites on the mainland unit of the refuge (Figure 3.2).

Riparian forest sites in the project area are those areas that are too wet to manage as pasture lands or are in close proximity to sloughs, ditches and other waterways, excluding wetlands. Riparian sites identified in each field should be able to sustain a tree and shrub vegetation component. Most of the vegetation that presently exists in these locations is grasses, mostly reed canarygrass and scattered wetland plants, commonly *Juncus* species.

Restoration of native forested vegetation has been of ongoing concern since the establishment of the refuge. Both forested sites and passively managed fields (most often reed canarygrass fields and brush patches) are being managed to provide escape, resting and fawning cover for the deer. Initially the plan was to allow grass and brush fields that serve as cover units to eventually become reforested through natural plant succession. Unfortunately, this did not happen as the wet, mild climate encouraged a lush growth of reed canarygrass and *Juncus* that continually choked out woody seedlings. Heavy deer, elk, and rodent use also impacted tree regeneration. A limited planting area and small tree size may also have contributed to failure of the initial revegetation efforts.

In 1999 several larger scale plantings (less than 2 acres) were begun at three sites on the mainland. The trees were initially protected with a 12-foot tall hog wire fence (Figure 3.3). Individual tree protectors and weed mats were added a year later when it was discovered that meadow voles were chewing through the base of the newly planted trees killing many of them.

Figure 3.2 Wetland names and locations on the Mainland Unit of the Julia Butler Hansen Refuge.



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Imagery from 2009 NAIP

Figure 3.3 Refuge riparian planting from 2003 with protective fencing.

Interspersion of varied habitat (riparian forests, wetlands, and pastures) is an important component to successful management of the CWT deer population. Deer use is highest in sites with small pastures surrounded by trees and other forest cover. CWT deer will use dewatered wetlands during the summer to feed on plants. Since 1999, 16 wetland, pasture, riparian forest complexes totaling over 350 acres have been developed on the Mainland and Tenasillahe Island units. About 10 percent of the acreage in each unit is managed as wetlands, 10 is managed as pastures 20 is managed as riparian forest with the remaining 60 percent of the habitat consisting of unmanaged wetlands and fields.

Additional habitat restoration work has recently been completed on Crims Island. Numerous partners helped to make the Crims Island project a reality including the Bonneville Power Administration, which provided funding for acquisition of the island, the Columbia Land Trust, which completed the actual acquisition before transferring the land to the USFWS, and the U.S. Army Corps of Engineers, which provided technical planning, funding, and contractors for the habitat work.

The work on Crims Island between 2004 through 2006 help restore important tidal marsh and riparian forest habitat to an island in the lower Columbia River estuary. The island was mostly a reed canarygrass–infested island with limited riparian cover or tidal inundation before the work began. At completion, total of 76 acres of tidal marsh was restored to provide rearing and foraging habitat for fall Chinook, chum, and coho salmon. In addition in the spring of 2006, 115 acres of riparian forest was planted adjacent to the marsh. The riparian forest will provide habitat for bald eagles, neotropical migratory birds, and CWT deer.

3.7.1.1 Pasture Management

Haying and Grazing and Mowing

Haying and grazing are two methods used to control exotic plant species and provide short grass growth in pastures that are managed for the CWT deer. The two Julia Butler Hansen Refuge units that have managed pastures are the Mainland Unit and the Tenasillahe Island Unit. Suggested management tools include high intensity short duration grazing, mowing, and haying, as well as other restoration strategies, such as herbicide applications, disking and seeding. The primary objective of using haying and grazing is to manage vegetation to maintain or increase its value to wildlife at minimal cost to the government.

Under the preferred alternative of the proposed CCP/EIS, haying and grazing would occur on approximately 850 acres of pastures on the Mainland and Tennasillahe Island units of the refuge while under the other two alternatives haying and grazing would occur on approximately 650 acres of pastures at full implementation. Currently four local permittees graze and hay introduced reed canarygrass, native grasses, tame pasture grasses, sedges (*Carex* spp.) and rushes (*Juncus* spp., *Eleocharis* spp.) on refuge pastures. The haying program is rather minimal at this time and involves only 24 total acres all on the Mainland Unit. Although managed pastures acreage should remain relatively consistent, the number of individual permittees may vary from three or four to six or seven over time depending on the number of livestock in their operation. Also, depending on the ability and preferences of each permittee, at times, the number of acres grazed versus hayed may also change.

This refuge pasture management program using private individuals is conducted under a cooperative land management agreement (CLMA), which is established between the Refuge and the individual livestock operators (cooperator). The CLMA is an in-kind program, which means that both parties receive mutual benefits from the land without any funds being transferred. In this case, the cooperator receives grazing and haying privileges, and the Service receives habitat enhancement actions conducted primarily for the benefit of the CWT deer and Canada geese at the Julia Butler Hansen Refuge.

Pasture management actions contribute to achieving refuge purposes and goals as identified in the CCP/EIS and the National Wildlife Refuge System mission by providing valuable foraging areas for CWT deer and wintering and migrating Canada geese. It also contributes by economically providing weed control and other habitat maintenance functions which are not feasible for limited refuge staff to accomplish.

Grasses and forbs are the primary food sources for the CWT deer on the refuge. Browse is also used, but the deer prefer to feed in fields where the vegetation had been kept short by cattle grazing and mechanical cutting. The new actively growing plants are more succulent and digestible than mature plants, and deer naturally seek out the most nutritious food forages. The short grass pastures complement the marsh habitat on and around the refuge in providing forage and resting habitat for migrating and wintering Canada geese. Many off-refuge pastures are gradually being converted to other uses that exclude goose use. Refuge pastures also provide foraging habitat for ducks, raptors and elk. Grazing and haying are desirable means of maintaining this type of habitat because the climate is too wet for prescribe burning and repeated mowing of the pastures is beyond the capability of the refuge.

Negative impacts from grazing are mostly associated with difficulties in containing the cattle. Cattle are attracted to water and therefore can damage sensitive wetland areas if they gain access to those sites. They can also cause problems in riparian forest sites by trampling the understory and making the areas undesirable for other wildlife. By fencing off any sensitive areas and focusing the grazing on the pasturelands, negative impacts from grazing are minimized. Other negative impacts can result from soil compaction and poor water quality from livestock entering sensitive waterways. These impacts are significantly reduced by restricting livestock use to the spring through early fall time period and by development of site specific watering areas.

All three activities can cause some degree of disturbance to the CWT deer. The deer will generally avoid areas where cattle are concentrated and will not enter those pastures until after the cattle have moved. In addition, haying and silage activities may cause deer to move from the immediate area where the farming equipment is operating. However, since these disturbances are short term and localized, the deer can easily moved to an adjacent undisturbed location. Restricting the pasture management activities from spring thorough early fall provides the CWT deer and Canada geese optimum habitat conditions when they most need it, in the fall through winter seasons.

Because of the limited nature of this use (short term, small acres) it is not anticipated that these activities will have major adverse effects on native Refuge flora or fauna or other Refuge uses. Livestock excrement may increase the nutrient level of the area being grazed and could increase the levels of nitrogen, and phosphorus in the wetland basin after spring run-off. There will be short-term disturbance to wildlife caused by the presence of people, and livestock or haying machinery. Cover will be removed as livestock graze or haying is implemented. There is also potential for introduction of invasive plant species from private equipment used in haying. However, it is anticipated that removal of exotic grasses and weeds before they go to seed will reduce the spread of exotics.

Prior to the acquisition of the refuge, the native riparian habitat was altered from its original native condition by the creation of a dike to hold back the waters of the Columbia River followed by introduction of non-native grasses and intensive grazing practices. In order to maintain the biological integrity and diversity of the refuge, in a relatively small area, the threatened and endangered species component, mainly CWT deer, needs to be managed more intensively than was found historically in the area. The use of moderate grazing to reduce the build-up of annual introduced grassland biomass is viewed as beneficial to the CWT deer. By restricting the intensity and duration of grazing, and by adhering to the stipulations for this use, the environmental health of the rRefuge will be maintained.

Grazing and haying have been successfully used as a tool to manage pastures for the benefit of wildlife since the inception of the refuge in 1972. Mowing is another management method used to control exotic plant species and provide short grass growth in pastures that are managed for the CWT deer. As opposed to haying and grazing, mowing is generally conducted by refuge employees with the mowed vegetation chopped up and left on the field to decompose. Fields are mowed to a height of 4-6 inches at least twice per year, in July and then again from September through October. An early mowing in May is desirable if fields are dry enough. Mowing is planned for those fields that are not appropriate for grazing or haying activities such as those pastures with limited access and areas directly adjacent to visitor viewing facilities. Under the preferred alternative approximately 100 acres of pastures would be mowed each year while under the other two alternatives 140 acres of pastureland would be mowed.

Herbicide Applications

Canada thistle (*Cirsium arvense*), bull thistle (*Circisum vulgare*), tansy ragwort (*Senecio jacobaea*), tussock (*Juncus* spp.) and blackberry (*Rubus* spp.) are controlled to maintain pastures for targeted wildlife. Target plants, if left uncontrolled, eventually make pastures unusable to wintering geese and CWT Deer. Tansy is listed as a noxious weed by both the state and county, and Canada thistle is listed as a state noxious weed. Low densities and random distribution of tansy and Canada thistle render biological control impractical. Treatment sites are diked pastures totaling approximately 950 acres at refuges Mainland and Tenasillahe Island units.

Sensitive areas are ditches and channels within the treatment areas. These areas are avoided so that no herbicide enters the water. Waters bearing anadramous fish have buffer zones alongside either side within which no treatment with this herbicide will occur unless applied using a wicking device. Herbicide applications do not occur during periods of gusty winds or when wind is in excess of 15 miles per hour. Although CWT deer inhabit the area, there is no conflict since spraying is very limited, target plants are not major dietary plants of the deer, and this product is considered to be relatively nontoxic to ruminants.

Pasture Rehabilitation

As pastures age, they generally become more decadent with high percentages of weedy and invasive species that are less palatable to the CWT deer and Canada geese. Even with a grazing, haying and mowing program, pastures occasionally need to be rehabilitated through intensive efforts of plowing, disking and reseeding. Pastures that are grazed seem to require less rehabilitation while mowed pastures require more frequent rehab work. Pasture rehabilitation is rotated so no more than one or two fields are done in any one year. There is no set schedule for pasture rehabilitation with many field going 10 years or more before they are rehabbed. Field plowing and disking is generally done in the summer to help kill off dense reed canary grass stands while replanting is done in the early fall when there is increased soil moisture. Fields are replanted with various grasses and clover that are beneficial to target wildlife including orchard grass, timothy, perennial rye, annual rye, white clover, red clover and birdsfoot trefoil.

3.7.1.2 Riparian Establishment

Historically, much of the two diked units were once tidally influenced Sitka Spruce swamps that were flooded twice daily by ocean tides backing up the Columbia River. Once dikes were constructed and most of the old growth trees were cut, the drier sites were transformed into pastures and hayfields. Dikes, tide gates, natural sloughs, and drainage ditches now control flooding during periods of high tides.

The native forest of the area is classified as a tideland Sitka spruce community and consists of an over-story of black cottonwood, Sitka spruce, western red cedar, red alder, cascara, and big leaf maple and an under-story of shrubs such as snow berry, creek dogwood, vine maple, red elderberry, willow and salmonberry. Scattered openings in the over-story help maintain the under-story and permit growth of other desirable deer forage species such as blackberry, thimbleberry, hawthorn and wild rose. The condition of many of the non-tidal forested sites is declining with little or no understory regeneration.

Interspersion of habitat is an important component to successful management of the CWT deer population. Deer use is highest in sites with small pastures surrounded by trees and other forest cover. At present, approximately 20 to 25 percent of the two diked units, Mainland and Tenasillahe, are forested with the remaining 80 percent of the habitat consists of brush patches and grass fields. Restoration of native forested vegetation has been of ongoing concern since the establishment of the refuge.

Both forested sites and passively managed fields (most often reed canary grass fields and brush patches) are managed to provide escape, resting and fawning cover for the deer. The original plan was to allow grass and brush fields that serve as cover units to eventually become reforested through natural plant succession. Unfortunately, this has not happened in a reasonable time period, as the wet, mild climate encourages a lush growth of reed canarygrass and *Juncus* that continually choke out woody seedlings. Heavy deer, elk, and rodent use have also impacted tree regeneration. The limited planting area and small tree size may also have contributed to failure of the planting.

The planting rate is about 1,000 trees/acre, which allows for a success rate of around 60 percent in fenced tree lots. Riparian planting sites will be initially prepared in the summer when field conditions are capable of supporting the heavy equipment necessary for site preparation. Planting sites are prepared by discing in summer in anticipation for planting during the following spring. In selective situations, smaller sites may be tilled during March to give native trees additional competitive advantage against invasive reed canary grass. Riparian reforestation corridor sites are generally located along sloughs and other significant waterways. All plantings will consist of native bare root stock obtained from local (western Washington/Oregon) growers and nurseries.

Tree protectors are used in the planting sites to protect the base of each plant from meadow vole predation which can be significant. Tree protectors are a minimum of 18-24 inches in height mainly for the protection of the tree base from meadows voles or other rodents which tend to girdle the base of the plants. The tree protectors gradually break away from the base of the tree over the course of four to five years and eventually fall to the ground and degrade. Fences to protect the trees are usually constructed around the plantings on the mainland unit. Fences are 10 feet in height and capable of keeping large mammals such as deer and elk out of the planting sites. The fences generally remain in place until the plantings are of a sufficient height to be relatively safe from large mammals and beaver. Once the trees are large enough, depending on site conditions possibly between four and six years, the fencing are removed and materials reused when in good condition. Trees are planted in rows throughout each corridor site in random order to permit mowing between the rows during the first year of each planting. Since

2001, 26 separate riparian enhancement projects have been completed for the primary benefit of CWT deer. Through 2006, approximately 70 acres (21 woodlots) were planted on the 2,000-acre mainland unit of the refuge, and 22 acres (five woodlots) were planted on the 1,950-acre Tenasillahe Island Unit (Figures 3.4 and 3.5).

A habitat enhancement project begun in 2008 which is being funded in part by the U.S. Army Corps of Engineers is helping to significantly increase the riparian acreage as well as improve the slough conditions on the refuge's Mainland Unit. The project will benefit both anadramous fish as well as the CWT deer. In summary the project calls for replacing and modifying culverts and tidegates at eight slough locations along the perimeter mainland dike, recontouring about 1,000 linear feet of Risk Creek and development of approximately 210 acres of riparian forest habitat along approximately 84,000 feet of slough bank at the Mainland Unit. Because the riparian project requires so much fencing construction and riparian plantings will be staggered during the three-year planting effort in order to minimize disturbance impacts to wildlife. Corridors will generally be no longer than 100 yards in length with unfenced zones between each corridor so that movement of CWT deer and elk are not restricted.

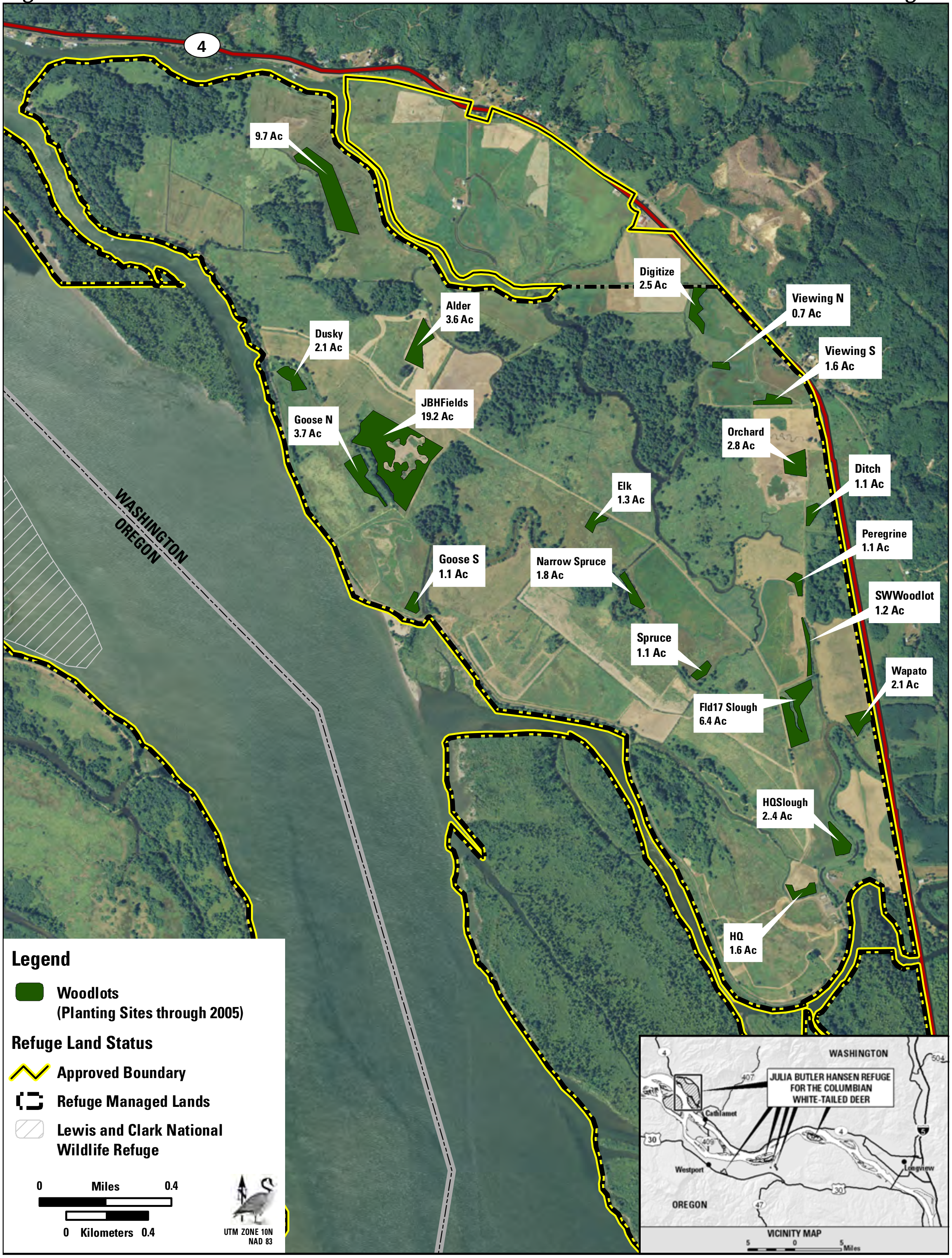
Once the native cover is reestablished it will provide shade conditions along sloughs and other waterways that will result in cooler peak summer water temperatures for out-migrating salmonids. It will also improve important cover and feeding opportunities for the federally endangered lower Columbia River population of CWT deer, along with improved habitat structure for a variety of neotropical migrating birds.

3.7.1.3 Non-tidal Wetland Enhancement

Wetland enhancement work has taken place in late spring through early fall, the driest portion of the year. Work begins as soon as soil conditions allow, with discing and plowing of the wetland sites and adjacent pastures occurring first. As the sites dry, more extensive dozer and scraper work is initiated. In the wetter locations some of the more extensive heavy equipment activity may be delayed until during the months of July and August. Since 1999, over 100 acres on the Mainland Unit and 25 acres on the Tenasillahe Island Unit have been modified to allow for managed wetlands.

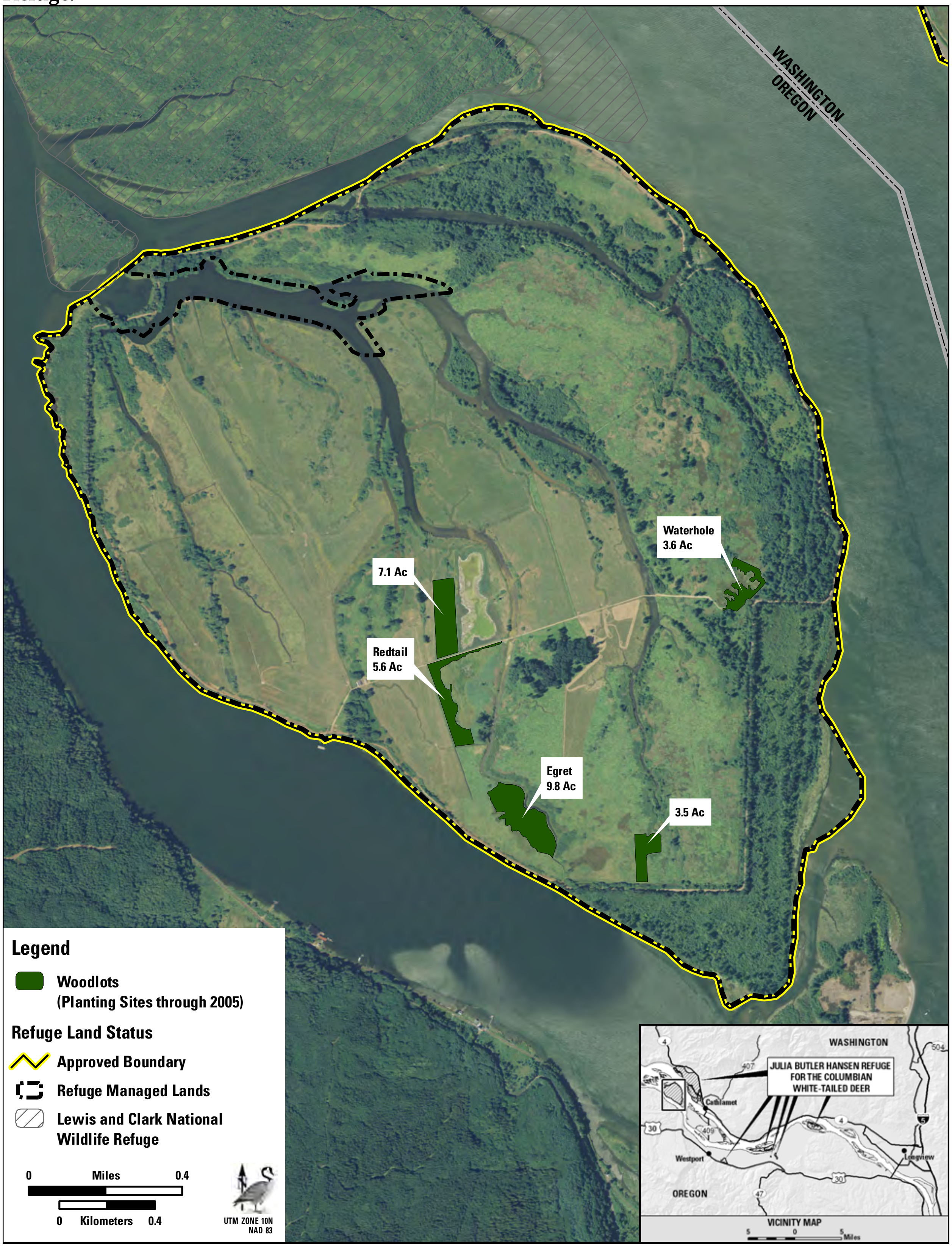
Wetlands are managed as summer feeding sites for the deer with the secondary goals of providing overwintering feeding and loafing sites for waterfowl and springtime breeding and larval rearing sites for pond-adapted amphibians. Water inflows at these sites will occur from precipitation and subsequent runoff into the wetland areas. Water levels will be maintained at relatively shallow depths (2-3 feet) to promote use by dabbling ducks. During periods of high precipitation, wetlands may serve as overflow areas, i.e., places that can be flooded instead of allowing the entire refuge to be inundated. These managed wetlands help to control invasive plant species by allowing the refuge to control water levels and to some degree the timing of the water inundation.

Figure 3.4. Woodlot names and locations on the Mainland Unit of the Julia Butler Hansen Refuge.



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Imagery from 2009 NAIP

Figure 3.5. Woodlot names and locations on the Tenasillahe Island Unit of the Julia Butler Hansen Refuge.



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Imagery from 2009 NAIP

Consideration is also given to management of water levels and management schemes for amphibian species. Species identified on the refuge include the long-toed salamander, northwestern salamander and Pacific tree frog and red-legged frog. Further survey work is planned to identify additional species as well as determine their relative population abundance. Particular emphasis will be placed on breeding water depth and larval use in wetlands. The expansion of bullfrog populations, which require water for two or more years to complete their life cycles, is limited by drying the wetlands during the summer.

Emergent wetland species such as smartweed and cattails benefit from the enhanced wetlands and provide valuable cover and food for waterfowl. Other wetland species such as manna grass provide a food source for the CWT deer when the wetlands dry summertime. Emergent plants are encouraged to develop through natural succession. During late spring, the water is removed from wetlands and the growth of species such as reed canarygrass, *Juncus* and sedges will likely accelerate. Management of the wetland bottoms depends on the type and amount of vegetation cover and involve periodic mowing and discing of the sites.

Enhanced wetland on the Mainland Unit of Julia Butler Hansen Refuge

3.7.2 Lewis and Clark National Wildlife Refuge

There is no active management taking place on the islands of the Lewis and Clark National Wildlife Refuge. The refuge islands are managed to permit natural processes to dominate such as tidal cycles and river flow. The only recent management actions to take place on the refuge islands have been in the form of limited biological weed controls. In the three units that are not on islands (Tongue Point, Emerald Heights and Browsmead) a few management actions have occurred.

Cleanup of toxic lead paint at Tongue Point occurred during in 2002. A contractor for the U.S. Coast Guard treated 170 cubic yards of contaminated sandblast grit and surrounding soils and then removed the materials. The piles were left from buoy cleaning activities performed by the U.S. Coast Guard prior to transfer to the USFWS. In all thirteen piles and grit were removed located along a 1,500-foot section of dirt road running along the west side of Tongue Point. Treatment took four days and was accomplished by spraying the grit piles with a phosphoric acid reagent. Treatment of the grit piles helps stabilize the heavy metals within the grit, rendering the material non-hazardous for disposal purposes.

Other management activities have included maintenance of the perimeter road at Tongue Point and grazing and riparian tree planting at the Browsmead Unit.

3.8 Topography and Bathymetry

The estuarine shoreline in both states consists of rocky, forested cliffs and low, wet floodplain areas that have been diked. A number of minor creeks and rivers with small drainage basins enter the estuary from both shores, but, because of their small size, they do not have much influence on the Columbia River. The topography of the riverine portion of the estuary does not vary significantly. The river's shoreline and adjacent lands have been diked and developed extensively for agricultural and industrial development as well as for commercial and residential uses. Only the Emerald Heights Unit and Tongue Point Unit of the Lewis and Clark Refuge along the south shoreline of the Columbia River have any significant slope. The Tongue Point Unit is essentially a hill, with steep to moderate slopes rising from the water to a crest. The west side has a steep (95 percent) slope, and there are tall cliffs in the northwest corner.

3.9 Geology

The estuary, formed over geologic time by the forces of volcanism, glaciation, hydrology, and the erosion and deposition of sediments, now has a surface area of approximately 41,200 hectares (101,750 acres). Circulation of sediments and cycling of nutrients within the estuary are driven by river hydrology and coastal oceanography. Sea levels have risen since the late Pleistocene epoch, resulting in coarse and fine sand deposits in submerged river channels. The region is also characterized by basalt flows of an age similar to the sedimentary bedrock units. These basalt flows are related to, and probably initiated from, Columbia River flood basalt flows originating from the Columbia Plateau (Niem and Niem 1985).

The Tongue Point and Emerald Heights units of the Lewis and Clark Refuge are located in the Astoria structural basin within the Coast Range physiographic province. The bedrock underlying this structural basin predominantly consists of marine deposited gray siltstone and claystone of the Astoria Formation, which is inferred to be on the order of 2,000 feet thick. Younger alluvium deposits are located throughout the Astoria Basin. These deposits consist of floodplain clay, silt, sand, and gravel, and estuarine laminated clay, silt, and fine sand (Niem and Niem 1985).

Periodic massive disturbances are an integral part of the natural environment that forms the basis for the ecology and evolution of anadromous fish in the Columbia River Basin. Additionally, natural events of large magnitude, such as the Mount St. Helens eruption, which impacted steelhead runs in Washington's Toutle River, have often occurred in localized regions over time.

3.10 Soils

3.10.1 Lewis and Clark Refuge

Soils on the Lewis and Clark Refuge vary significantly depending on the site. Except for Tenasillahe Island, the soils of the Columbia River islands have not been officially classified, but generally consist of soils found in a floodplain. Dredge spoil sites adjacent to some of the natural islands are well drained and generally consist of sandy soils dredged from the nearby river bottom sites.

3.10.1.1 Brownsmead Unit

At the Brownsmead Unit there are two soil types. One soil is termed Coquille-Clatsop Complex with a 0 to 1 percent slope. This soil complex generally has inadequate drainage, commonly floods, and is susceptible to upper layer compaction. Major uses of the soil are for croplands and wildlife habitat. The second soil is termed Brallier mucky peat with a 0 to 1 percent slope, and elevation of 5 to 25 feet, with very dark grayish brown to dark brown mucky peat. It is a deep very poorly drained soil with moderate permeability with common plants consisting of Sitka spruce, red alder, western red cedar, willow, salmonberry, skunk cabbage, sedges, rushes, and Douglas' spirea (USDA NRCS 1988).

3.10.1.2 Tongue Point Unit

At the Tongue Point Unit the soil types consist of the Klootchie-Necanicum Complex and the Necanicum-Ascar Complex. The Klootchie-Necanicum Complex consists of 30 to 60 percent slopes, with a good drainage, moderate permeability, and rapid runoff of precipitation, while the Necanicum-Ascar Complex consists of 60 to 90 percent slopes, good drainage, moderate permeability, and very rapid runoff (USDA NRCS 1988).

3.10.1.3 Emerald Heights Unit

On the Emerald Heights Unit two soil types are also present. The Templeton-Ecola silt loam has 30 to 60 percent slopes and is deep and well drained with moderate permeability and a severe erosion hazard. The major uses of this soil type, which has a dark grayish brown coloration, are for woodland management and for wildlife habitat. The second soil type is the Templeton silt loam, which is basically the same soil minus the Ecola loam characteristics. The main difference is the reduced slope percentage, which is from 3 to 30 percent (USDA NRCS 1988).

3.10.2 Julia Butler Hansen Refuge

Soil on most of the Julia Butler Hansen Refuge is classified as Ocosta silty clay loam with less than 10 percent slope. It is an alluvial bottomland soil associated with the Columbia River floodplain. Fertility is moderate to high. This fertility coupled with high available moisture contributes to heavy vegetative growth. In the event of a wildfire, high fuel loads could be expected. A smaller soil component of the Julia Butler Hansen Refuge is termed Fluvaquents, tidal. This is a very deep but poorly drained soil type that is typical of soils found on floodplains and deltas. The slope type is 0 to 1 percent with an elevation of sea level to 10 feet. No one single profile is representative of this soil type but one general characteristic is that it has a very dark olive gray and very fine sand surface layer about 6 inches thick. Runoff is very slow in this soil type and it is subject to frequent periods of flooding during high tides. A third small soil type found on portions of the river islands is udipsamments which are basically old dredge spoil disposal sites that are well drained with an elevation of 10 to 30 feet and a slope of 0 to 2 percent. Vegetation on this soil type can vary from none to moderate grass cover and shrub cover (USDA NRCS 1986).

Although no official soils mapping has been completed for Tenasillahe Island, a soil and water conservation plan completed in 1978 did identify certain soil types on the island. The soils identified were Clatsop silty clay loam, Coquille silt loam, Sauvies clay loam, tidal flats, made land pumped dikes, and unnamed silty clay loam. All of these soils are generally very poorly drained and were formed in fine textured alluvium consisting of a tidal mud (USDA NRCS 1986). These soils with minimal slope are used to support CWT deer and are managed as pasture for wildlife habitat.

3.11 Hydrology

3.11.1 Overview

The Columbia River estuary area is a drowned river valley, but, unlike most estuaries, it is primarily fresh water in nature, due to the tremendous influence of river flows. Approximately 26,550 hectares (about 71.2 percent) of the 37,289 hectares of this estuarine region are composed of shallow water habitats.

With the exception of the Willamette River, most of the Columbia River’s tributaries west of the Cascades drain relatively small watersheds. Tributaries originating in the Cascades include the Willamette and Sandy rivers in Oregon, and the Washougal, Lewis, Kalama, and Cowlitz rivers in Washington. Coast Range tributaries include the Elochoman and Grays rivers in Washington, and the Lewis and Clark, Young’s, and Clatskanie rivers in Oregon.

The flow of the lower Columbia River is strongly influenced by climatic variations as well as tides. The tidal influence on water surface elevation is evident all the way up river past the cities of Vancouver, Washington, and Portland, Oregon. During low flow periods, tides may cause river flow to reverse up to approximately river mile 80. Tidal salinity normally extends upstream to approximately river mile 23; historically it has reached river mile 46. The lowest river flows generally occur during September and October, when rainfall and snowmelt runoff are low. The highest flows occur from April to June, resulting from snowmelt runoff from the Cascade and Rocky Mountain Ranges to tributaries of the upper Columbia. High flows also occur between November and March, caused by heavy winter precipitation in the tributary basins of the lower river, primarily the Willamette River in Oregon and the Cowlitz River in Washington.

Construction of over 200 dams on the Columbia River and its tributaries has dramatically altered the historic hydrology. Dams now impose additional water level fluctuations to meet demands for hydroelectricity, agriculture, navigation, pool recharge, recreation, fisheries, and water quality priorities. Spring flood elevations on the lower Columbia River average 37 percent lower today than prior to dam construction. Regulated winter flows are typically less than 200,000 cubic feet per second (cfs). Peak flows in May and June have declined from about 600,000 cfs to 350,000 cfs. Prior to dam construction, average spring floods regularly inundated 170,000 acres of bottomland along the lower Columbia River for periods of up to 60 days. Major spring flood events inundated up to 300,000 acres of the lower Columbia River floodplain. Over half of the historic riverine wetlands in the lower Columbia River below Bonneville Dam have been lost or substantially degraded as a result of diking, draining, filling, dredging, and flow regulation.

3.11.2 Lewis and Clark Refuge

The hydrology of the lower Columbia River and its estuary are related to the daily rising and falling of the tides. As it nears the ocean, the slowing current deposits the river's silt load to form low, marshy islands and sandbars. Twice a day, many of the islands of the Lewis and Clark Refuge are part of the land, and twice they are reclaimed by the water, where rising ocean tides slow the river's current. These estuary islands form a chain that begins just above Tongue Point and follows the Oregon shore of the main channel upriver to Tenasillahe Island. Many of the river islands have large sloughs that cross through them that are directly connected to the Columbia River. A dike on Karlson Island was breached in 1976 but is still visible on aerial photos.

Two refuge units, Tongue Point and Emerald Heights, are on the Oregon side of the river close to the estuary, but high enough in elevation that they are not affected by daily tidal inundation. At Emerald Heights, several small unnamed drainages cross through the unit carrying water during heavy rainfall events. A third unit, Brownsmead, consists of low-lying pasture land that is at times inundated with sheet water during the winter months but is protected from tidal flooding by a river dike. Saspal Slough, which connects with the Columbia River via Blind Slough, borders the northern and western sections of the Brownsmead Unit.

3.11.3 Julia Butler Hansen Refuge

The Julia Butler Hansen Refuge consists of two large diked units (Mainland and Tenasillahe Island) as well as several undiked islands in the Columbia River (Hunting, Price, Wallace, and Crims) along with several small parcels near the town of Westport, Oregon. The two diked units are protected from daily tidal fluctuations by a system of flood control levees. The Mainland Unit contains 2,000 acres and is located along the Columbia River between the towns of Cathlamet and Skamokawa, Washington. The Elochoman River joins the Columbia River in the southeast part of the unit. The Mainland Unit also includes approximately 151 acres of forested intertidal Sitka spruce swamp and marsh on the east side of the Elochoman River that is not diked. Steamboat Slough and Brooks Slough dikes serve to protect Mainland Unit lands from daily tidal inundation from the Columbia River to the south, the Elochoman River to the west and southwest, and Brooks Slough to the northwest.

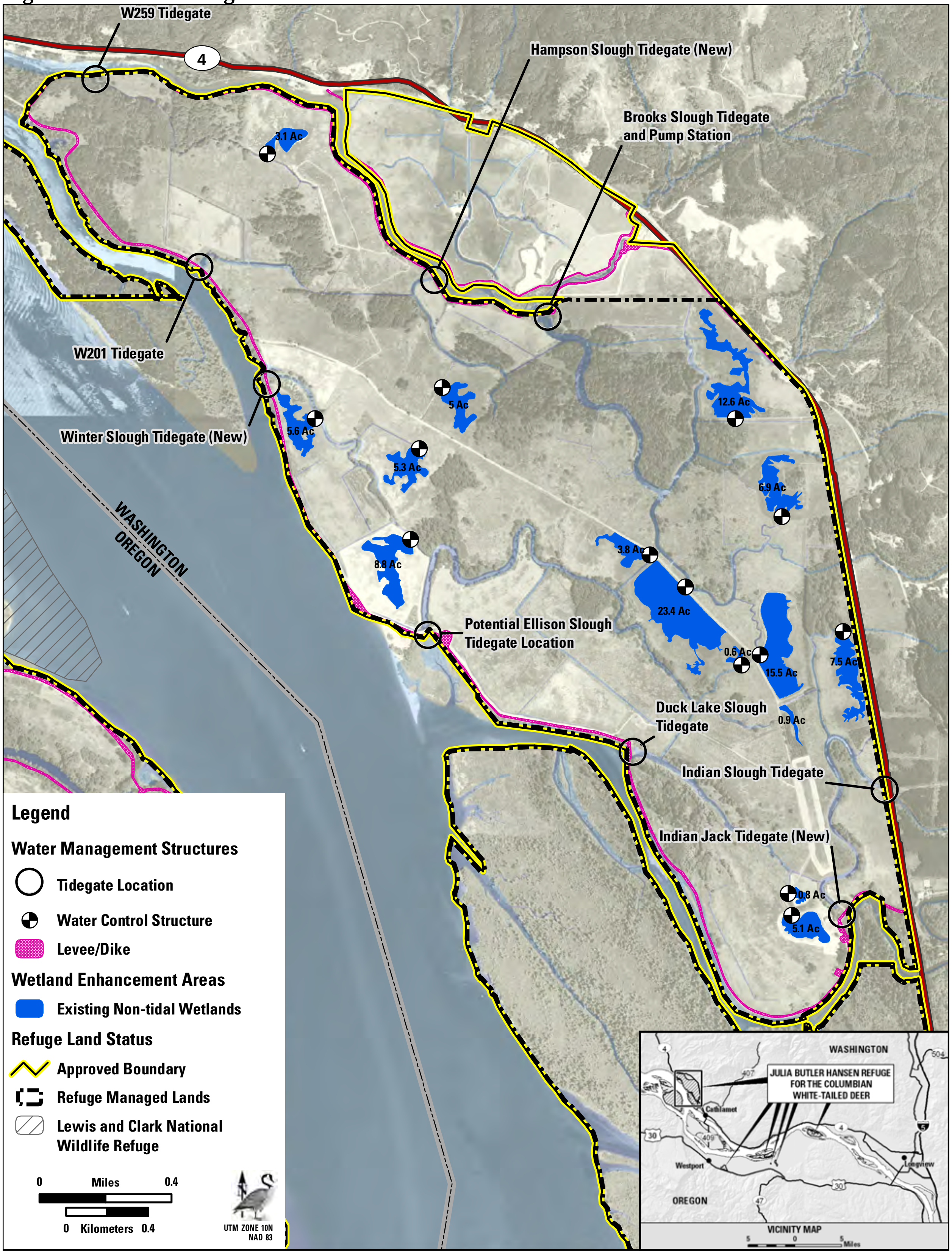
On the Mainland Unit, six tidegates are located under the refuge perimeter dike (under Steamboat Slough and Brooks Slough Roads) to allow water to drain from the area (Figure 3.6).

The 48-inch-diameter Indian Jack Slough tidegate (Figure 3.7) drains water from the eastern portion of the unit while the combined three adjacent tidegates located at the head of Brooks Slough drains water from the northwestern portion of the refuge. An expulsion pump located at the head of Brooks Slough also helps to drain excess water off of the refuge and is especially beneficial during periods of high river levels when the tidegates do not open. Two smaller tidegates, one located at the west end of Steamboat Slough Road and one located at the west end of Brooks Slough Road, also help to drain the northwest end of the refuge. The smaller northwest Steamboat Slough tidegate was replaced in 2003 to provide increased fish accessibility in that portion of the refuge. The smaller tidegate at the west end of Brooks Slough is extremely old (circa 1920), has a moderate leak, and is in need of replacement.

Figure 3.7 W201 tidegate replaced in 2003 across from Price Island.

Photo: USFWS

Figure 3.6 Water management structures – Mainland Unit.



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; Imagery from 2006 NAIP

The Mainland Unit is located within Wahkiakum County Diking Improvement District #4, which has an easement for the refuge dike and is responsible for maintenance of the refuge tidegates. Because the district has limited funding and resources, the refuge has shared the cost of the more recent tidegate and expulsion pump repairs and replacements.

Water flow into the unit occurs through precipitation and inflow from several different sloughs and creeks. Indian Jack Slough and Risk Creek are the two main sources of inflow. Nelson Creek, which is thought to have historically flowed into Indian Jack Slough, was diverted into the Elochoman River to reduce flooding potential on lands behind the dike. This diversion was likely around the time the dike was constructed in the 1920s. Several larger sloughs and numerous smaller sloughs and ditches bisect the unit channeling water throughout the refuge to the tidegates. Flows in the slough and ditches are generally very slow (less than 10 cfs) due to flat topography and exterior tidegates. One exception is Risk Creek, which is channelized as it runs to the east of the Wildlife Viewing Site flowing down towards Brooks Slough. During periods of heavy rainfall, Risk Creek water flows into the refuge at an estimated 250 cfs.

Another small unnamed drainage is diverted by a small dike to the west of the Wildlife Viewing Site adjacent to State Highway 4 flowing under Brooks Slough Road and into Brooks Slough. The diversion ditch has become filled with silt in recent years causing water to flow over the dike and into the northwest corner of the Mainland Unit. Two of the larger sloughs on the unit, Ellison and Indian Jack, have no direct outlet to the river although essentially all sloughs and ditches on the unit are interconnected, thus providing at least minimal water connectivity throughout the refuge.

During periods of heavy winter rainfall, when tidegates remain closed for long periods, the refuge dikes can act as dams holding back water inflow into the refuge. During periods of heavy rainfall, such as in February 1996 and November 2006, water levels inside the dike have covered 90 percent of the refuge lands for several weeks. Even during winters with average rainfall, water inside the dike can flood vast areas of the lower-lying lands.

Managed wetlands are generally filled through direct precipitation during the winter months, although during heavy rainfall events water will flow from adjacent sloughs and ditches through the water control structures and into the wetlands. Therefore, in addition to providing high-quality waterfowl and amphibian habitat, these wetlands serve as important water impoundment sites during periods of heavy rainfall. Non-managed wetland sites also serve as water impoundment reservoirs during heavy rainfall events, but there is no ability to control water levels during non-flood periods. During the summer months, managed refuge wetlands are generally dewatered, although many sites dry up naturally. The wetland adjacent to the shop facility is unique in that it has a sandy substrate and fills with ground water from the nearby Elochoman River.

Since 1999, 14 wetlands totaling 105 acres have been enhanced on the Mainland Unit. These sites were former low-lying reed canarygrass and tussock-infested fields that traditionally flooded from winter rainfall (November through April). Prior to enhancement they provided little benefit to most wildlife due to the inability to manage water levels and control invasive vegetation. These areas were enhanced by removal of non-native vegetation, contouring of wetland bottoms, and installation of water control structures to permit manipulation of water levels. Each water structure empties into a slough or ditch.

3.11.3.1 Tenasillahe Island Unit

The Tenasillahe Island Unit lies just across the main channel of the Columbia River and west of the Mainland Unit. The island is 1,950 acres in size, of which 1,700 acres are surrounded by a dike. The diked area is similar to the Mainland Unit in water drainage and land cover. An interior dike protects Multnomah Slough from the remainder of the island. Both dikes were built in the same time period that the mainland dikes were constructed, in the 1920s. There are a total of four tidegates on the Island. A set of three 84-inch tidegate structures are located on the main outflow channel to the island. The structures are concreted in place and have stop-log structures which allow for water level manipulation inside the dike. The gates themselves were recently replaced (2007) and are now aluminum side-hinged gates which should provide a somewhat better fish passage situation then the previous top hinged iron gates. All three gates have (24-by-24-inch) fish doors which can be opened to facilitate fish passage when interior water levels are low enough that flooding is not an issue. A fourth 48-inch tidegate is located at the head of Multnomah Slough and allows water to drain from the northern portions of the island.

Gravel roads are found on the top of the perimeter dike, which surrounds the majority of the refuge. An additional smaller dike separates Multnomah Slough and lands in the northwest section of the unit from the remainder of the island. The center road bisects the island crossing two large sloughs which help drain the interior of Tenasillahe Island. Both slough crossings have large culverts which are currently plugged, allowing no water flow between the upper and lower sloughs. Maintenance of the four tidegate structures, the dikes, culverts and the roads is the responsibility of the refuge. The southern tip of the island consists of a black cottonwood/Sitka spruce intertidal swamp that encompasses 250 acres and is not diked.

The hydrologic regime on the Tenasillahe Island Unit is similar to the Mainland Unit; the exception is that from the Columbia River, the sloughs or creeks which flow into this island are no longer naturally free flowing. Groundwater levels inside the dike while much lower than that of the surrounding river levels, are tied closely to the Columbia River level. Water control structures manage the water exchange and groundwater levels are maintained by the river. There are five newly constructed wetlands totaling 25 acres that have been developed on the Tenasillahe Island Unit since 2003.

3.11.3.2 Hunting and Price Islands

Hunting and Price Islands are located directly across the river from the Mainland Unit. Portions of Hunting Island are flooded twice by the daily tidal cycles of the Columbia and Elochoman rivers. Much of Price Island, which is mainly an old dredge spoil site, is slightly higher in elevation and is only minimally affected by the river’s tidal cycles. Hunting Island has several sloughs, which bisect through the unit and are directly connected to the hydraulic regime of the adjacent river system. Price Island does not have any sloughs that bisect the island.

3.11.3.3 Wallace and Crims Islands

The upriver islands, Wallace and Crims, are similar to the lower estuary islands in that they are undiked; however, they are slightly higher in elevation than the islands of the Lewis and Clark Refuge and are less susceptible to river flooding. A habitat restoration project, which began in 2004 on the Crims Island Unit, was implemented to improve the tidal flow to the interior of the island and replace non-native reed canarygrass with native plants. Numerous sloughs with a direct connection to the adjacent river meander through Crims Island. A total of 76 acres were restored from what was formally reed canarygrass infested fields and converted to productive tidal wetlands in 2004 and 2005 (Figures 3.8 and 3.9). Wallace Island is similar in hydrology to Hunting Island, with several smaller sloughs and one large slough bisecting the unit.

Figure 3.8 Crims Island before tidal restoration work.

Photo: USFWS

Figure 3.9 Crims Island after tidal restoration work.

Photo: USFWS

3.11.3.4 Westport Unit

The Westport Unit consists of several heavily vegetated parcels of land between Oregon Highway 30 and Westport Slough, just east of Westport, Oregon. This area during winter rainfall events gets saturated with water, but an old railroad dike along the outside of the property restricts flooding of the interior.

3.12 Water Quality

Rivers and streams are important commercial, recreational, and biological resources. They provide habitat for fish and wildlife and drinking water, and they are important for transportation as well as recreation such as fishing and kayaking. Rivers and streams in the Columbia River basin face many challenges from the introduction of toxic materials and bacteria from point source (identifiable sources of pollution from a single point or conveyance, such as a discharge pipe, that are regulated) as well as materials from nonpoint sources (sources of pollution that do not have a single point of origin; examples include air sheds, agricultural lands, cities and towns, construction sites, dams, mines, and other areas where runoff from the land may carry toxic contaminants to a stream and/or river) (ODEQ 1996). Currently, the estuary receives contaminants from more than 100 point source and numerous nonpoint sources, such as surface and stormwater runoff from urban and agricultural areas (Fresh et al. 2005). Agricultural, urban, industrial, and timber harvesting practices also affect water quality in the estuary (Lower Columbia Fish Recovery Board 2004). The release of toxic contaminants, nutrient loading, and reduced dissolved oxygen have altered the water quality in the Columbia River estuary. The available literature on water quality provides more information about the threats to water quality than it does about other water quality issues in the Columbia River estuary.

3.13 Environmental Contaminants

3.13.1 Lewis and Clark Refuge

The Lewis and Clark Refuge includes islands, mudflats, and tidal marshes, and the refuge was established in 1972 to preserve wintering and resting areas for an estimated 1,000 tundra swans, 5,000 geese, and 30,000 ducks. Bald eagles are present year-round with over 30 nest sites. The surrounding waters and channels provide food resources for shorebirds, and juvenile salmon. Other fish species include American shad, smelt, perch, starry flounder, bass, catfish, and Pacific lamprey. Harbor seals and California sea lions feed on fish in the estuary while beaver, raccoon, weasel, mink, muskrat, and river otter are found on the islands.

Refuge lands and associated fish and wildlife are located along the Columbia River, which is a major shipping corridor to six ports on the lower Columbia River and eastern Washington, and are, therefore, susceptible to spill events and other contaminant inputs from the surrounding river and waterways.

The current presence of contaminants on the refuge and in the lower Columbia River ecosystem directly impacts fish and wildlife species and their habitats, including reducing species' ability to successfully reproduce and flourish. This may be due to reduced quality or quantity of forage species or direct impacts of the contaminant on the individual listed species. Organochlorine contaminants in the Columbia River accumulate in prey of aquatic-dependent wildlife along the river, and these contaminants impact some top level predators such as bald eagle, osprey, mink, and river otter that use refuge lands (Anthony et al. 1993; Buck et al. 2005; USFWS 2004)

3.13.1.1 Lewis and Clark Islands Unit

The Lewis and Clark Islands have not been identified as having contaminants. The associated waters and wildlife in and around the Islands Unit are tested by various entities for contaminants in the environment. However, contaminants such as organochlorine compounds including DDE, polychlorinated biphenyls (PCBs), dioxins, and furans, and polybrominated diphenyl ethers, have been documented in fish and wildlife in the lower Columbia River in and around refuge lands (Buck et al. 2005; USFWS 1999).

3.13.1.2 Tongue Point Unit

Tongue Point is a 308-foot high, 79-acre peninsula, which protrudes 0.8 mile into the Columbia River at river mile 18 (Figure 3.10). There are a number of documented contaminant concerns at Tongue Point, a constructed peninsula, which is located on the south side of the Columbia River, just 3 miles to the east of Astoria, Oregon. The Service has no facilities located on this property. The vegetation is mature western hemlock/Sitka spruce/western red alder forest with some Douglas fir and bigleaf maple. The topography is essentially a hill, with steep to moderate slopes rising from the water to a crest. The west side has a steep (95 percent) slope, and there are tall cliffs in the northwest corner where an old rock pit and shooting range were once located. Former Navy munitions bunkers are still located on the crest of the hill. The Tongue Point area provides nesting and foraging habitat for several bald eagles and for large populations of shorebirds and waterfowl at the land base.

The Service completed a contaminants inventory of this area in 2005. The report identified contaminants at the Tongue Point site associated with former U.S. Navy activities. These consist of weathered petroleum compounds in fueling areas (above and below ground storage tanks) and pipelines, petroleum compounds, PCBs, and metals from a former landfill at south Tongue Point, which is currently undergoing remediation. Although underground and aboveground fuel storage tanks were removed from the site, an area where an underground tank was removed near the Job Corps facility still leaks petroleum into the Columbia River near the concrete piers (Woodward-Clyde 1998). There are currently no plans to remediate this tank area further.

Contaminants above background levels include some metals, semi-volatile organic compounds, organochlorines such as PCBs, petroleum compounds, and tributyltin (Buck et al. 2005; USFWS 2004). Environmental risk from the sediments has not been directly assessed, but it is likely that risk is low, based on the measured concentrations in this report unless the sediment is disturbed. In 2001, sediment between one of the piers was dredged to allow boat traffic and the dredged material was placed upland on the pavement at Tongue Point.

Figure 3.10 Aerial photo of Tongue Point, Oregon.

Photo: USGS

Another documented source of contaminants is the USCG facility on the west side of the peninsula. Large buoys were brought to the facility for painting and sandblasting, and the sandblast grit was dumped into the nearshore area on-site and into piles on the currently owned refuge land at north Tongue Point. The sandblast grit was contaminated with metals such as lead and tributyltin. Most of the paint chips and sandblast material in the piles on the refuge have been removed during a remedial action, but high concentrations of lead remain on the refuge area and it is likely that receptors such as worms, passerine birds, and small mammals are exposed to the metal (Buck et al. 2005; USFWS 2004).

3.13.2 Julia Butler Hansen Refuge

Organochlorine compounds; DDE, PCBs, dioxins, furans, and polybrominated diphenyl ethers have been documented in fish and wildlife in the lower Columbia River in and around refuge lands and waters. Concentrations have accumulated in top-level predators such as river otter, bald eagles, and osprey and are associated with reduced productivity of bald eagles nesting in and around Julia Butler Hanson Refuge (Buck et al. 2005; USFWS 1994, 2005). Corbicula clams collected from a county-owned beach at Elochoman Slough adjacent to the mainland of Julia Butler Hanson Refuge contained elevated levels of PCBs (Buck et al. 2005; USFWS 2005). People pass through the refuge in order to collect the clams at the slough and could be exposed to PCBs when eating the clams.

A potential for oil spills exists on the refuge islands as boat traffic on the Columbia River is common with both pleasure boats and large container ships and barges passing by the refuge islands on a daily basis.

Major fuel spills have been documented three times on the lower Columbia River since 1978 (Washington Department of Ecology 2007). On March 19, 1984, the oil tanker *Mobil Oil* ran aground near St. Helens, Oregon spilling an estimated 165,000-200,000 gallons of oil into the Columbia River. Over the next few days very high tides and strong winds pushed oil into the tidal marshes bays and shorelines on the Washington side of the river. The beach near the refuge shop received heavy accumulations of congealed oil “globs,” which washed up on shore. A bird cleaning/recovery center was set up in the refuge shop on March 23 and operated through April 23, 1984. A total of 450 birds were treated, primarily scoters, western grebes, and common murres. Of the birds treated, 288 (64 percent) survived and were released. Bald eagles on and near refuge lands experience poor reproductive success compared to eagles producing in other areas of Oregon and Washington, and the reduced productivity of the lower Columbia River eagles has been associated with organochlorine contaminants in eggs. In addition, these contaminants have been found in eggs of ospreys and great blue herons nesting near the refuge, and in river otter collected in the vicinity of the refuge (Buck et al. 2005; USFWS 2005). Fish and invertebrates from the lower Columbia River contain organochlorine body burdens that exceed protection levels for predators, although it is unknown if contaminant concentrations are harming the organisms themselves (LCREP 1999).

3.14 Surrounding Land Use

The Columbia River lies adjacent to and surrounds a large portion of the Lewis and Clark and Julia Butler Hansen refuges and provides a multitude of functions including fishing, hunting, cargo ship transportation, boating, recreation, and floating recreational cabin use. A variety of land uses occur in the vicinity of both Refuges. Surrounding land use involves mostly agricultural production, timber resources and water related recreational activities.

3.14.1 Lewis and Clark Refuge

On the Lewis and Clark Refuge both the Tongue Point Job Corps Center and the Coast Guard Facility are located just to the south and adjacent to the Tongue Point Unit. The Emerald Heights Unit is adjacent to a large apartment complex which borders the western boundary of the 89-acre unit. To the east of the Tongue Point Unit, portions of an old naval air station and a ship docking facility still exist. Currently, there is no industrial activity in this area although the ship docking facility is being promoted as a marine industrial facility called North Tongue Point. The Oregon Department of Environmental Quality (ODEQ) has listed several sites in the nearby vicinity of Tongue Point, including refuge lands that have potential for hazardous waste contamination. These sites as they relate to the refuge are discussed in Section 3.13, Environmental Contaminants.

Much of the lands and waters adjacent to the Lewis and Clark Refuge’s Islands Unit are made up of rural forests, small farms, and open waters. Commercial enterprises include forest products, farming, commercial fishing, and the transportation and shipment of products on the adjacent waterways. The major industrial shipping channel straddles the boundary of Oregon and Washington and varies from 0.25 mile to more than 1 mile from the nearest refuge islands.

The small town of Clatskanie, Oregon, and the larger community of Astoria, Oregon, can be found on the east and west ends of the refuge respectively. Skamokawa and Ilwaco, Washington, can be found on the other side of the river in Washington at the far ends of the refuge. Except for the apartments bordering the Emerald Heights Unit, little residential development borders the refuge. There are 32 float houses docked near the various refuge islands, which are used seasonally by the owners.

3.14.2 Julia Butler Hansen Refuge

Much of the land in the immediate vicinity of the Julia Butler Hansen Refuge is also agricultural and forest lands. However, residential and commercial uses can be found 3 miles to the east in the town of Cathlamet, Washington, and 2 miles to the west in Skamokawa, Washington. Adjacent to the town of Cathlamet is Puget Island with a large residential and agricultural community. The island can be reached through the town of Cathlamet via the Puget Island Bridge. The county operates a 12-passenger vehicle ferry on the Columbia River, which provides access from Puget Island, Washington, to Westport, Oregon.

At the Mainland Unit of the Julia Butler Hansen Refuge, Washington State Highway 4 borders the northwest boundary of the refuge. A 250-acre cottonwood plantation (Nelson Creek property) is located across the road from the refuge and has been purchased by the Columbia Land Trust for conservation and restoration of its habitat, wildlife, and fisheries values. To the northwest of the Mainland Unit are diked pasture lands, which are privately owned, and are being managed as a combination of enhanced wetlands and hayed/grazed pastures for waterfowl hunting opportunities. The Hunting Islands Unit is located directly across the Elochoman River from the Mainland Unit.

The land just east of the refuge's headquarters and west of the town of Cathlamet along Highway 4 is a timber sorting, storage, and shipping yard. Farther east along the upstream end of Hunting Islands is a new residential housing development and the Cathlamet Marina. Other lands adjacent to the refuge include farmlands, a small plant nursery, and the town of Skamokawa.

A large industrial area, Port Westward, is owned by the Port of Clatskanie in the Clatskanie flats across the channel from Crims Island. This area has a power-generating facility operated with natural gas, with construction of a second plant recently completed. A third power plant to process ethanol has recently begun construction. Ten miles downriver on a fourth facility, an LNG terminal just upriver from Tenasillahe Island is proposed for construction at Bradwood. The proposed facility, if constructed, would be approximately a half-mile from refuge lands. The proposed project also includes a 34-mile long pipeline that would run from the terminal along the Oregon side of the Columbia River to Port Westward near the tip of Crims Island and then under the Columbia River into Washington.

3.15 Effects to the Physical Environment

This section of Chapter 3 provides an analysis of the environmental consequences of implementing the alternatives described in Chapter 2, specifically as they relate to the physical environment. The various topics in this section will be separated by refuge and addressed individually as appropriate. The topics not covered in this section (climate, topography, geology, etc.) indicate areas not affected by management activities proposed in the alternatives. A summary of all environmental effects in chapters 3 through 5 will be presented in Chapter 6.

In describing the expected effects of particular management action(s), the terms *neutral*, *minor*, *intermediate*, and *significant* are frequently used to describe the environmental consequences of a particular action in an alternative. The thresholds and severity ratings are defined in Chapter 6.1 and were used to analyze the scope, scale, and intensity of effects on natural, cultural, and recreational resources. The no change in management practices alternative (Alternative 1) does not necessarily imply an insignificant effect over time. Chapters 4 and 5, will follow a similar format, focusing on the environmental effects (as they relate to the alternatives) of the topics identified in those chapters.

3.15.1 Lewis and Clark Refuge

3.15.1.1 Air Quality

Overall effects to the local air quality from alternatives 1 and 2 for the Lewis and Clark Refuge are expected to remain the same as current conditions. The number of managed acres and impacts to the air quality resulting from refuge management activities are all relatively minor when compared to the vast array of human actions that affect air quality in the lower Columbia River estuary. Other than the two shoreline-based units on the refuge, the refuge islands are outside the flood protection dikes. It is anticipated that the only use of mechanized equipment would happen on the Islands Unit in a very rare occasion under both alternatives.

Travel to and from the Islands Unit by refuge personnel would be conducted by gas powered motorboats or other related vessels. These vessels would be used to facilitate refuge management activities. The use of gas powered vessels has the potential to introduce various contaminants into the atmosphere. Replacing the engines with four-stroke engines has helped reduce the amount of pollutants introduced into the atmosphere but has not totally eliminated the problem. Use of motorized boats used by the general public to visit the Islands Unit is tough to quantify as visitors travel the Columbia River for a number of other reasons. However, motorized boating use in the estuary can be expected to remain relatively the same under either alternative. It is expected that nonmechanized watercraft such as kayaks and canoes in the estuary may increase with the advertised water trail. It is anticipated there would be an overall neutral effect to air quality.

3.15.1.2 Water Quality

The Lewis and Clark Refuge Islands Unit is particularly susceptible to water quality issues due to strong Columbia River tidal flows. It is not anticipated that any of the surrounding water sources would be affected by either alternative, making for a non-significant impact. Under both alternatives, non-native vegetation would be removed from the refuge through a combination of manual and chemical means. Herbicides would be used on a limited basis for invasive plant removal activities, and are not expected to impact the water quality of the lower Columbia River estuary. Herbicides will be applied by hand or mechanical means to target vegetation. There could be adverse impacts to nontarget vegetation from pesticide drift, but these effects are expected to be minimal due to the small quantities used and precautionary measures taken. Service-approved herbicides would be used with all action alternatives. The use of herbicides is highly regulated through the Service's Pesticide Use Proposal (PUP) process. This approach notes environmental hazards, efficacy, and costs.

Other than the shoreline units, overall impacts from mechanized refuge equipment should be extremely rare (only in the case of severe resource problems such as an extreme noxious weed invasion). Impacts to water quality should be non-significant from the limited proposed actions found in both alternatives.

Travel to and from refuge islands would be conducted by gas-powered motorboats or other related vessels under either alternative. These vessels would be used to facilitate refuge management, restoration, and public education activities. The use of gas-powered vessels would have the potential to introduce various contaminants to the surface waters, including fuel oils, grease, and other petroleum products. Contaminants would be similar to those used by surrounding vessels and may have an adverse effect on estuarine habitat. BMPs would be used to reduce the potential for spill occurrences, and proper vessel maintenance would reduce the likelihood that excess fuels and other contaminants would impact water quality in the estuary. Travel to the mainland-based units would be by automobile.

3.15.1.3 Soils

Soil erosion naturally occurs at the refuge's islands due to strong Columbia River tidal flows. Because of the logistics involved, mechanized equipment on the islands will not be used except in very select circumstances such as noxious weed control. No significant soil erosion is anticipated to result from activities occurring in any of the alternatives.

3.15.2 Julia Butler Hansen Refuge

3.15.2.1 Air Quality

Overall effects to the local air quality from alternatives 1, 2, and 3 for Julia Butler Hansen Refuge are expected to remain neutral. The number of managed acres and impacts to the air quality resulting from refuge management activities are all relatively insignificant when compared to the vast array of human actions that affect air quality in the lower Columbia River estuary. All alternatives would include general refuge management mechanized equipment use including mowing, disking, and tilling. These activities can cause periodic increases in dust and vehicular emissions during field operations.

Alternatives 2 and 3 may result in a slight increase in vehicular emissions due to a potential increase in refuge visitation. Alternative 3 would have the greatest increase because it provides the broadest spectrum of visitor activities. However, the anticipated increase in visitor use may be somewhat mitigated by the development of new public access trails, which may encourage more walking and bicycling and less driving and vehicle idling around the refuge. While the specific number of new visitors is not known, additional emissions as a result of visitor use of the refuge would not be expected to be significant.

The number of motorized boats used for specific refuge visits is hard to quantify as visitors travel the Columbia River for many reasons. Motorized boating can be expected to remain relatively the same under all three alternatives making for a limited or neutral effect on air quality.

3.15.2.2 Hydrology

The Columbia and Elochoman rivers would continue to be contained by dikes protecting the Mainland Unit of the refuge from tidal inundation under all three alternatives. The lower elevations of the other refuge units would continue to be affected by the daily tidal inundation of the Columbia River while the higher areas and the diked units would only be affected by extreme flood events.

The planned fish enhancement tidegate project common to all alternatives was initiated in the summer of 2009 and should allow for increased tidal flushing and improved water exchange on the interior Mainland Unit sloughs. This enhancement work is covered under a separate EA but is worth noting because the work will likely have a positive effect to the refuge hydrologic functions.

Some positive effects in water management would occur as a result of water control structure replacement/installation, and wetland enhancement projects under all three alternatives. Still the overall net hydrologic effect of each alternative would be neutral.

3.15.2.3 Soils

Soil erosion naturally occurs on many of the refuge islands due to the natural wind and water action surrounding the dynamic Columbia River. This natural occurrence can be observed on the river and along the shoreline areas. As one area erodes and disappears due to the wind, waves, and tidal action, another area builds up with sediment, expanding the islands or shorelines. Natural erosion is much less pronounced on the interior of both diked refuge units due to the vegetation and the lack of the river and tidal flow action.

Soil erosion is not anticipated as a result of activities occurring in any of the proposed alternatives. However, some wind erosion does occur during initial wetland, riparian, and pasture enhancement activities. Because the erosion is restricted to the time period during and immediately after soil disturbance, no negative long-term effects are anticipated. Once vegetation is reestablished during the growing season, the soil erosion is insignificant on the managed units. Overall, the alternatives will have a neutral effect on soils.

3.15.2.4 Water Quality

It is not anticipated that any of the surrounding water sources would be affected by implementing any of the alternatives. Under each alternative, non-native vegetation would be removed from the refuge through a combination of manual and chemical means. Herbicides would be used on a limited basis for invasive plant removal activities and are not expected to negatively impact the water quality of the lower Columbia River estuary. Herbicides would be applied by hand or mechanical means to target vegetation. There could be adverse impacts to nontarget vegetation from pesticide drift, but these effects are expected to be minimal due to the small quantities used and precautionary measures taken. Service approved herbicides would be used with all action alternatives. The use of herbicides is highly regulated through the Service's PUP process. This approach notes environmental hazards, effectiveness and costs.

Gas/diesel-powered machinery is expected to include heavy equipment (bulldozers, tractors, excavators) for habitat management and enhancement activities. Other tools include the use of chainsaws, disks, plows, mowers, etc. on the two diked units, with only hand-type tools on the undiked units. Overall impacts from mechanized refuge equipment to water quality should be neutral; however, positive effects may occur once habitat enhancement projects become fully established.

Travel to and from refuge islands would occur using gas-powered motorboats or other related vessels. These vessels would be used to facilitate refuge management, restoration, and public education activities. The use of gas-powered vessels would have the potential to introduce various contaminants to the surface waters, including fuel oils, grease and other petroleum products. Contaminants would be similar to those used by surrounding vessels and may have an adverse effect on estuarine habitat. BMPs would be used to reduce the potential for spill occurrences, and proper vessel maintenance would reduce the likelihood that excess fuels and other contaminants would impact water quality in the estuary. Overall, it is expected that the effects to water quality would be neutral for each of the alternatives.

Aerial photo of Lewis and Clark Refuge. Photo: USFWS

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Chapter 4. Biological Environment

Photos: Above, White-tailed deer doe and fawn. Right, tracking Columbian white-tailed deer / USFWS

Chapter 4. Biological Environment

4.1 Biological Integrity Analysis

The National Wildlife Refuges System Improvement Act of 1997 directs the Service to ensure that the biological integrity, diversity, and environmental health (BIDEH) of the Refuge System are maintained for the benefit of present and future generations of Americans. In simplistic terms, elements of BIDEH are represented by native fish, wildlife, plants, and their habitats as well as those ecological processes that support them. The Refuge System policy on BIDEH (601 FW 3) also provides guidance on consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and in associated ecosystems, that represents BIDEH on each refuge.

The BIDEH of the Columbia River estuary has been profoundly impacted by human activities. Land development for agriculture, industry, and housing, made possible by diking and draining, has disconnected large areas of the historical floodplain, marsh, and swamp habitat from the estuary (LCREP 1999). From Bonneville Dam to the river's mouth, an estimated 84,000 acres of floodplain have been lost from the construction of dikes (Marriott and McEwen 2005). In the lower estuary (the river mouth to the upstream end of Puget Island), where most refuge lands are located, Thomas (1983) estimated that more than 23,000 acres of forested and scrub-shrub tidal swamp and nearly 7,000 acres of tidal marsh, have been lost since 1870. These acreages represent 77 percent and 43 percent, respectively, of the historical total acreage. Further, much of the remaining floodplain, marsh, and swamp habitat either has been or is in the process of being degraded by the proliferation of non-native plants such as purple loosestrife, reed canarygrass, yellow iris, and Japanese knotweed (LCREP 1999).

As a consequence of habitat loss, many of the estuary's native wildlife species have declined. Other factors such as overutilization by humans and pollution have played a role in wildlife losses, but it is certain that wildlife cannot persist without suitable habitat. Twenty-four wildlife and plant species of the lower river and estuary are now federally listed as endangered or threatened, including 12 runs (evolutionarily significant units) of salmon and steelhead.

The habitat and wildlife losses have magnified the importance of the refuges' conservation and management activities. The Lewis and Clark Refuge's acquisition boundary encompasses 33,000 acres within the estuary, including 6,300 acres of tidal swamp and marsh. Julia Butler Hansen Refuge contains approximately 2,200 acres of tidal marsh and swamp and 3,800 acres of riparian habitat that includes forest, sloughs and nontidal marsh. These habitats represent vegetation communities important for the maintenance of BIDEH on the lower Columbia River. Together, the refuges protect a majority of the floodplain wetlands in a 30-mile stretch of the estuary. Thus, they are vital to preserving the natural environment as well as native species of fish, wildlife, and plants of the entire estuary.

Even though refuge lands are protected from development, the refuge habitats and its wildlife still face threats. Invasive plants and pest animals can displace and compete for resources with native species. Reed canarygrass is especially pervasive and monopolizes hundreds of acres of aquatic and upland habitat. Reed canarygrass has little value to wildlife compared to the native diversity of wetland plants it displaces. Purple loosestrife and yellow iris have spread rapidly in tidal and nontidal marsh. Japanese knotweed displaces native shrubs such as red-osier dogwood. Nutrias consume large amounts of marsh vegetation. New invasive species may appear in the future. Pollution is also a threat in that urban runoff washes chemicals and sewage into the river and through the refuges. Contaminants such as PCBs, dioxin, furans, polynuclear aromatic hydrocarbons (PAHs), pesticides, and heavy metals are found in the water, sediments, and organisms of the estuary (LCREP 1999). Organochlorine contaminants have impaired the reproduction of bald eagles (Buck et al. 2005), river otters (Henny et al. 1996), and possibly great blue herons (Thomas and Anthony 1997), among other species. Oil and chemical spills in the river have occurred in the past and almost certainly will occur again in the future.

These problems, while serious, are surmountable. Pollutant sources are being addressed and existing contaminants in the environment are being cleaned up. New methods of slowing or stopping the spread of invasive plants are being adopted. Overall, the refuge environment is still relatively healthy and the varied habitats support an abundance and diversity of wildlife.

4.2 Identification of Refuge Resources of Concern and Analysis

In preparing this plan, the Service reviewed other local, regional, and national plans that pertain to the wildlife and habitats of the Columbia River estuary. The Service also sought input from Washington and Oregon state conservation agencies, non-governmental organizations, and the general public. The refuge purposes, as stated in the various establishment documents for each refuge (see Chapter 1) were carefully reviewed as was the refuges' contribution to maintenance of BIDEH on the lower Columbia River. As a result of this information-gathering and review process, certain species and habitats were identified as resources of concern (Tables 4-1a and 4-1b). From this list of resources of concern, those species and habitats that are most representative of the refuges' purposes and habitats, BIDEH (Tables 4-2a and 4-2b), and other Service and ecosystem priorities were chosen as priority resources of concern. Examples include the CWT deer for Julia Butler Hansen Refuge, which represents refuge purposes, and the tundra swan, which represents species that utilize emergent wetlands for Lewis and Clark Refuge. A complete list of priority resources of concern (i.e., focal species and habitat types) for each refuge is contained in Tables 4-3a and 4-3b. These priority resources of concern are the species and habitats whose conservation and enhancement will guide refuge management into the future. Potential management actions will be evaluated on their effectiveness in achieving refuge goals and objectives for priority resources of concern.

Management of refuge focal species and habitats that support them will benefit many of the other native species that are present on the refuges and in lower Columbia River. Many of the species that will benefit from management of the refuges' focal species are identified in the "Other Benefiting Species" column in Tables 4-3a and 4-3b. Through the consideration of BIDEH, the refuges will provide for or maintain all appropriate native habitats and species. Refuge management priorities may change over time, and because the CCP is designed to be a living, flexible document, changes will be made at appropriate times.

Table 4-1a Comprehensive List of Resources of Concern for Julia Butler Hansen Refuge

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation Concern [c]	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Columbian White-tailed Deer	✓	✓	E[1]	E[1]	SS[1]				W,O				✓		S1[3]	S2[3]	Grassland, evergreen and deciduous forested wetland, scrub-shrub wetland, tidal and nontidal marsh, riparian forest and shrub.
Roosevelt Elk	✓																Grassland, riparian forest and shrub, tidal and nontidal marsh.
Steller Sea Lion			T[1]												S2[3]	S2[3]	Open water, sandbars for resting.
Fringed Myotis Bat			SoC[1]		SS[1]				O						S3[3]	S2[3]	Riparian forest, grasslands, snags for roosting.
Longeared Myotis Bat			SoC[1]		SS[1]										S4[3]	S4[3]	Riparian forest.
Yuma Myotis Bat			SoC[1]													S3[3]	Riparian forest.
White-footed vole			SoC[1]		SS[1]											S3[3]	Riparian forest.
Double-crested Cormorant								✓									Open water, sloughs, upland dredge spoil (nesting).
Great Blue Heron									W		✓						Tidal and nonmarsh, shallow open water, forested wetland and riparian forest (nesting).
Tundra Swan	✓											✓		✓			Tidal and nontidal marsh.
Cackling Goose	✓							✓				✓					Grassland, open water (roosting), tidal and nontidal marsh.
Dusky Canada Goose	✓							✓	O			✓	✓			S3[3]	Grassland, open water (roosting), tidal and nontidal marsh.
Western Canada Goose	✓							✓				✓					Grassland, open water (roosting), tidal and nontidal marsh.
Tule Greater White-fronted Goose	✓								W			✓					Grassland, open water (roosting), tidal and nontidal marsh.
Wood Duck	✓							✓							S4[3]		Forested wetland, riparian forest, tidal and nontidal marsh.

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation Concern [c]	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
American Wigeon	✓							✓									Grassland, tidal and nontidal marsh.
Mallard	✓							✓									Tidal and nontidal marsh.
Northern Pintail	✓							✓	W								Tidal and nontidal marsh.
Greater Scaup	✓							✓	W						S3[3]		Open water, sloughs.
Lesser Scaup	✓							✓							S3[3]		Open water, sloughs.
Bald Eagle			So c[1]	T[1]	T[1]				W,O				✓	✓	S4[3]	S4[3]	Forested wetland, riparian forest, open water, sloughs, tidal and nontidal marsh.
American Peregrine Falcon			So C[1]	SS[1]	E[1]		✓	✓	O					✓	S2[3]	S2[3]	Forested wetland, riparian forest, tidal and nontidal marsh, cliffs/man-made nesting structures.
Merlin				SC[1]											S3[3]		Grassland, forested wetland, riparian forest, tidal and nontidal marsh.
Northern Harrier						✓	✓								S4[3]		Grassland, tidal and nontidal marsh.
American Kestrel						✓											Grassland, riparian forest.
Red-shouldered Hawk						✓											Grassland, riparian forest.
Cooper's Hawk						✓								✓	S4[3]		Riparian forest.
Band-tailed Pigeon	✓		So C[1]			✓		✓	O			✓			S4[3]	S3[3]	Riparian forest and shrub.
Northern Saw-whet Owl								✓						✓	S4[3]		Riparian forest.
Short-eared Owl								✓	O						S4[3]		Grassland, tidal and nontidal marsh.
Western Screech Owl						✓									S4[3]		Riparian forest.
Dunlin							✓			4[2]							Tidal flats and sandbars.
Wilson's Snipe										4[2]							Grassland, tidal and nontidal marsh.
Greater Yellowlegs										4[2]							Tidal and nontidal marsh, tidal flats, sandbars.
Western Sandpiper										4[2]							Tidal flats and sandbars.
Killdeer										4[2]							Grassland, tidal and nontidal marsh.
Marbled Murrelet			T[1]	T[1]	T[1]			✓	W,O						S3[3]	S2[3]	Old growth forest for nesting.

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation Concern [c]	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Olive-sided Flycatcher			So C[1]		SS[1]	✓	✓	✓	O					✓	S4[3]	S3[3]	Forested wetland, riparian forest, tidal and nontidal marsh.
Little Willow Flycatcher			So C[1]		SS[1]	✓			O					✓		S3[3]	Riparian shrub.
Pacific-slope Flycatcher						✓											Forested wetland, riparian forest.
Hammond's Flycatcher						✓											Forested wetland, riparian forest.
Red-eyed Vireo						✓							✓		S3[3]		Forested wetland, riparian forest.
Swainson's Thrush						✓											Forested wetland, riparian forest.
Varied Thrush						✓											Forested wetland, riparian forest.
Rufous Hummingbird						✓	✓							✓			Forested wetland, riparian forest, scrub-shrub.
Horned Lark (*strigata*)			C[1]	E[1]		✓	✓		W,O						S1[3]	S2[3]	Grassland (sparse), dredge spoil.
Western Meadowlark						✓			O						S4[3]	S4[3]	Grassland with perch sites.
Western Bluebird									W,O						S3[3]	S4[3]	Riparian forest/grassland mosaic, snags.
Yellow Warbler						✓							✓				Forested wetlands, riparian forest, scrub-shrub.
Wilson's Warbler						✓											Forested wetlands, riparian forest, deciduous understory.
Hermit Warbler						✓									S4[3]		Riparian forest, forested wetland.
Winter Wren						✓											Riparian forest.
Purple Martin			So C[1]	SC[1]	SS[1]	✓			W						S3[3]	S2[3]	Forested wetlands, riparian forest, snags, open water.
Tree Swallow						✓											Forested wetlands, riparian forest – open water.
Vaux's Swift				SC[1]		✓			W						S3[3]		Forested wetland, riparian forest – hollow trees.
Pileated Wood-pecker				SC[1]	SS[1]	✓			W						S4[3]		Forested wetland, riparian forest – large snags.
Downy Woodpecker						✓											Forested wetland, riparian forest.

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation Concern [c]	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Brown Creeper						✓											Forested wetland, riparian forest.
Red Crossbill						✓			O						S4[3]		Riparian forest, forested wetland (Sitka spruce).
Chinook Salmon	✓	✓	T[1], E[1]	SC[1]	SS[1]				W,O				✓			S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Chum Salmon	✓	✓	T[1]	SC[1]	SS[1]				W,O				✓		S3[3]	S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Coho Salmon	✓	✓	T[1]		SS[1]				W,O				✓		S3[3]	S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Steelhead	✓	✓	T[1]	SC[1]	SS[1]				W,O				✓			S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Coastal Cutthroat Trout	✓		SoC[1]		SS[1]				W,O				✓			S2[3]	Open water and sloughs, tidal marsh.
Bull Trout			T[1]	SC[1]	SS[1]				W,O				✓			S2[3]	Open water and sloughs.
Red-legged Frog			SoC[1]		SS[1]				O						S4[3]	S4[3]	Tidal and nontidal marsh, forested wetland, riparian forest, scrub-shrub.
Western Toad				SC[1]	SS[1]				W,O						S3[3]	S3[3]	Riparian forest, grassland, marsh.
Western Painted Turtle					SS[1]				O						S4[3]	S2[3]	Sloughs, nontidal marsh, adjacent sparse grassland for nesting.
Western Pond Turtle			SoC[1]	E[1]	SS[1]				W						S1[3]	S2[3]	Sloughs, nontidal marsh, adjacent sparse grassland for nesting, riparian forest, forested wetlands, scrub-shrub.
Valley Silverspot Butterfly				SC[1]					W						S2[3]		Grasslands.
California Floater Mollusk			SoC[1]	SC[1]					W						S2[3]	S1[3]	Open water, sloughs.
Winged Floater Mollusk									W								Open water, sloughs.
Oregon Floater Mollusk									W						S3[3]	S3[3]	Open water, sloughs.
Sitka Spruce Swamp	✓	✓															

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation Concern [c]	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Cottonwood Tidal Swamp	✓	✓															
Scrub-shrub Tidal Swamp	✓	✓															
Riparian Forest	✓	✓															
Tidal Marsh	✓	✓															

[1] T = Threatened; E = Endangered; SoC = Species of Concern; SC = State Candidate; SS = State Sensitive
[2]Category 4 = species of high concern
[3]S1 = critically imperiled; S2 = imperiled; S3 = rare, uncommon or threatened; S4 = not rare, apparently secure, but with cause for long-term concern
[a]U.S. Fish and Wildlife Service 2001
[b]Altman 1999, 2000
[c]U.S. Fish and Wildlife Service 2002a
[d]U.S. Fish and Wildlife Service 2005a
[e]ODFW 2006; WDFW 2005
[f]Drut and Buchanan 2000
[g]Kushlan et al. 2002
[h]Pacific Flyway Council 1983, 1999, 2001; Subcommittee on Dusky Canada Geese 1992; Subcommittee on Pacific Population of Western Canada Geese 2000
[i]Northwest Power and Conservation Council 2004
[j]Oregon Habitat Joint Venture 1994
[k]WDNR 2005
[l]Oregon Natural Heritage Program 2004

Table 4-1b Comprehensive List of Resources of Concern for Lewis and Clark Refuge

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP[j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Columbian White-tailed Deer	✓		E[1]	E[1]	SS[1]				W,O				✓		S1[3]	S2[3]	Grassland, evergreen and deciduous forested wetland, scrub-shrub wetland, tidal and nontidal marsh, riparian forest and shrub.
Fringed Myotis Bat			SoC[1]		SS[1]				O						S3[3]	S2[3]	Riparian forest.
Long-eared Myotis			SoC[1]		SS[1]										S4[3]	S4[3]	Riparian forest.
Yuma Bat			SoC[1]													S3[3]	Riparian forest.
White-footed Vole			SoC[1]		SS[1]											S3[3]	Riparian forest.
Steller Sea Lion			T[1]												S2[3]	S2[3]	Open water, sandbars for resting.
Western Grebe				SC[1]					W		✓				S3[3]	S3[3]	Open water, tidal marsh.
Brown Pelican			T[1]	E[1]	E[1]			✓	W,O		✓				S3[3]	S2[3]	Open water (shallow for foraging).
Double-crested Cormorant								✓			✓						Open water for foraging.
Great Blue Heron									W		✓						Tidal and nonmarsh, shallow open water, forested wetland and riparian forest (nesting).
Tundra Swan	✓											✓		✓			Tidal and nontidal marsh.
Cackling Goose	✓							✓				✓					Grassland, open water (roosting), tidal/nontidal marsh.
Dusky Canada Goose	✓							✓	O			✓	✓			S3[3]	Grassland, open water (roosting), tidal and nontidal marsh.
Western Canada Goose	✓							✓				✓					Grassland, open water (roosting), tidal and nontidal marsh.
Tule Greater White-fronted Goose	✓								W			✓					Grassland, open water (roosting), tidal and nontidal marsh.
Wood Duck	✓							✓							S4[3]		Forested wetland, riparian forest, tidal and nontidal marsh.

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
American Wigeon	✓							✓									Grassland, tidal and nontidal marsh.
Mallard	✓							✓									Tidal and nontidal marsh.
Northern Pintail	✓							✓	W								Tidal and nontidal marsh.
Greater Scaup	✓							✓	W						S3[3]		Open water, sloughs.
Lesser Scaup	✓							✓							S3[3]		Open water, sloughs.
Bald Eagle			So C[1]	T[1]	T[1]				W,O				✓	✓	S4[3]	S4[3]	Forested wetland, riparian forest, open water, sloughs, tidal and nontidal marsh.
American Peregrine Falcon			So C[1]	SS[1]	E[1]		✓	✓	O					✓	S2[3]	S2[3]	Forested wetland, riparian forest, tidal and nontidal marsh.
Merlin				SC[1]											S3[3]		Grassland, forested wetland, riparian forest, tidal and nontidal marsh.
Northern Harrier						✓	✓								S4[3]		Grassland, tidal and nontidal marsh.
American Kestrel						✓											Grassland, riparian forest.
Red-shouldered Hawk						✓											Grassland, riparian forest.
Cooper's Hawk						✓								✓	S4[3]		Riparian forest.
Band-tailed Pigeon	✓		So C[1]			✓		✓	O			✓			S4[3]	S3[3]	Riparian forest and shrub.
Northern Saw-whet Owl								✓						✓	S4[3]		Riparian forest.
Short-eared Owl								✓	O						S4[3]		Grassland, tidal and nontidal marsh.
Western Screech Owl						✓									S4[3]		Riparian forest.
Dunlin							✓			4[2]							Tidal flats and sandbars.
Wilson's Snipe										4[2]							Grassland, tidal and nontidal marsh.
Greater Yellowlegs										4[2]							Tidal and nontidal marsh, tidal flats, sandbars.
Western Sandpiper										4[2]							Tidal flats and sandbars.
Killdeer										4[2]							Grassland, tidal and nontidal marsh.
Caspian Tern							✓	✓	O		✓		✓		S3[3]		Dredge-spoil islands for nesting.
Marbled Murrelet			T[1]	T[1]	T[1]			✓	W,O						S3[3]	S2[3]	Old growth forest for nesting.

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Olive-sided Flycatcher			So C[1]		SS[1]	✓	✓	✓	O					✓	S4[3]	S3[3]	Forested wetland, riparian forest, tidal and nontidal marsh.
Little Willow Flycatcher			So C[1]		SS[1]	✓			O					✓		S3[3]	Riparian shrub.
Pacific-slope Flycatcher						✓											Forested wetland, riparian forest.
Hammond's Flycatcher						✓											Forested wetland, riparian forest.
Red-eyed Vireo						✓							✓		S3[3]		Forested wetland, riparian forest.
Swainson's Thrush						✓											Forested wetland, riparian forest.
Varied Thrush						✓											Forested wetland, riparian forest.
Rufous Hummingbird						✓	✓							✓			Forested wetland, riparian forest, scrub-shrub
Horned Lark (*strigata*)			C[1]	E[1]		✓	✓		W,O						S1[3]	S2[3]	Grassland (sparse), dredge spoil.
Western Meadowlark						✓			O						S4[3]	S4[3]	Grassland.
Western Bluebird									W,O						S3[3]	S4[3]	Riparian forest/ grassland mosaic.
Yellow Warbler						✓							✓				Forested wetlands, riparian forest, scrub-shrub.
Wilson's Warbler						✓											Forested wetlands, riparian forest, deciduous understory.
Hermit Warbler						✓									S4[3]		Riparian forest, forested wetland.
Winter Wren						✓											Riparian forest.
Purple Martin			So C[1]	SC[1]	SS[1]	✓			W,O						S3[3]	S2[3]	Forested wetlands, riparian forest, snags, open water.
Tree Swallow						✓											Forested wetlands, riparian forest – open water.
Vaux's Swift				SC[1]		✓			W						S3[3]		Forested wetland, riparian forest – hollow trees.
Pileated Woodpecker				SC[1]	SS[1]	✓			W						S4[3]		Forested wetland, riparian forest – large snags.
Downy Woodpecker						✓											Forested wetland, riparian forest.
Brown Creeper						✓											Forested wetland, riparian forest.
Red Crossbill						✓			O						S4[3]		Riparian forest, forested wetland (Sitka spruce).

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Chinook Salmon	✓	✓	T[1], E[1]	SC[1]	SS[1]				W,O				✓			S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Chum Salmon	✓	✓	T[1]	SC[1]	SS[1]				W,O				✓		S3[3]	S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Coho Salmon	✓	✓	T[1]		SS[1]				W,O				✓		S3[3]	S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Steelhead	✓	✓	T[1]	SC[1]	SS[1]				W,O				✓			S2[3]	Open water and sloughs for migrating, tidal marsh for juvenile foraging.
Coastal Cutthroat Trout	✓		SoC[1]		SS[1]				W,O				✓			S2[3]	Open water and sloughs, tidal marsh.
Bull Trout			T[1]	SC[1]	SS[1]				W,O				✓			S2[3]	Open water and sloughs.
White Sturgeon		✓											✓		S4[3]		Open water.
Pacific Lamprey			SoC[1]		SS[1]				W,O				✓		S4[3]	S3[3]	Open water.
Red-legged Frog			SoC[1]		SS[1]				O						S4[3]	S4[3]	Tidal and nontidal marsh, forested wetland, riparian forest, scrub-shrub.
Western Toad				SC[1]	SS[1]				W,O						S3[3]	S3[3]	Riparian forest, grassland, marsh.
Painted Turtle					SS[1]				O						S4[3]	S2[3]	Sloughs, nontidal marsh.
Valley Silverspot Butterfly				SC[1]					W						S2[3]		Grassland.
California Floater Mollusk			SoC[1]	SC[1]					W						S2[3]	S1[3]	River bed.
Winged Floater Mollusk									W								River bed.
Oregon Floater Mollusk									W						S3[3]	S3[3]	River bed.
Sitka Spruce Swamp	✓	✓															
Cottonwood Tidal Swamp	✓	✓															
Scrub-shrub Tidal	✓	✓															

SPECIES	Refuge Purpose	BIDEH[a]	Federally Listed	Washington Listed	Oregon Listed	Partners in Flight[b]	Birds of Conservation	Service Migratory Bird Focal Species[d]	State Comp. Wildlife Plan[e] (WA, OR)	Shorebird Plan[f] (priority score 4,5)	N.A. Waterbird Conservation Plan[g]	Pacific Flyway Management Plan[h]	Subbasin Plan[i]	NAWMP [j]	WA NHP[k]	OR NHP[l]	HABITAT TYPE
Swamp																	
Riparian Forest	✓	✓															
Tidal Marsh	✓	✓															

[1] T = Threatened; E = Endangered; SoC = Species of Concern; SC = State Candidate; SS = State Sensitive
[2] Category 4 = species of high concern
[3] S1 = critically imperiled; S2 = imperiled; S3 = rare, uncommon or threatened; S4 = not rare, apparently secure, but with cause for long-term concern
[a] U.S. Fish and Wildlife Service 2001
[b] Altman 1999, 2000
[c] U.S. Fish and Wildlife Service 2002a
[d] U.S. Fish and Wildlife Service 2005a
[e] ODFW 2006; WDFW 2005,
[f] Drut and Buchanan 2000
[g] Kushlan et al. 2002
[h] Pacific Flyway Council 1983, 1999, 2001; Subcommittee on Dusky Canada Geese 1992; Subcommittee on Pacific Population of Western Canada Geese 2000
[i] Northwest Power and Conservation Council 2004
[j] Oregon Habitat Joint Venture 1994 (North American Waterfowl Management Plan)
[k] WDNR 2005
[l] Oregon Natural Heritage Program 2004

Table 4-2a Summary of Biological Integrity, Diversity, and Environmental Health (BIDEH) for Julia Butler Hansen Refuge

Species and Habitats (Plant Communities) that Represent Existing BIDEH	Population/Habitat Attributes (Age class, structure, seral stage, species composition)	Natural Processes Responsible for these Conditions	Landscape Limiting Factors
Columbian White-tailed Deer	Small population occupies habitat that is a mosaic of riparian forest, tidal forested wetland, tidal scrub-shrub, tidal and nontidal marsh, and upland grassland.	Flooding that maintained marsh, riparian forest and swamp habitat. Fire that maintained grassland openings in riparian forest.	Nonfunctioning flood plain: dike construction that led to industrial, agricultural and residential development, dam construction that reduced flooding, increased coyote numbers resulting from logging and land clearing, usurpation of former habitat by black-tailed deer.
Sitka Spruce Tidal Swamp (Palustrine Evergreen Forested Wetland)	Late succession forest, stand age greater than 95 years, with trees larger than 21 inches mean diameter at breast height (DBH). Western red cedar is also a common overstory tree. Abundant understory of native shrubs including willow, red-osier dogwood, Nootka rose, and service berry.	Functioning floodplain with tidal flooding.	Nonfunctioning flood plain: dike construction that led to land clearing for industrial, agricultural, and residential development, dam construction that reduced flooding, invasive species such as reed canarygrass that inhibit natural forest and shrub regrowth.
Cottonwood Tidal Swamp (Palustrine Deciduous Forested Wetland)	Mid to late succession forest with black cottonwood and Oregon ash as dominant canopy trees. Abundant understory of native shrubs including willow, red-osier dogwood, Nootka rose, and red alder.		
Scrub-shrub Tidal Swamp (Palustrine Scrub-shrub Wetland)	Climax scrub-shrub vegetation with the major dominant being Sitka willow. Other dominants include Pacific willow, red-osier dogwood, and hardhack. Other species include ninebark, crabapple, and rose. Scattered Sitka spruce may be present.	Prolonged tidal flooding: elevation too low to permit growth of large trees.	Dike construction that led to land clearing for industrial, agricultural, and residential development, dam construction that reduced flooding, invasive species such as reed canarygrass that inhibit natural forest and shrub regrowth.
Riparian Forest	Mid to late succession forest with the dominant trees being black cottonwood, red alder, Oregon ash, Sitka spruce, western red cedar, and bigleaf maple. Abundant understory of native shrubs including salmonberry, red-osier dogwood, willow, nine-bark, black hawthorn, snowberry, indian plum, and vine maple.	Natural forest growth and vegetation succession.	
Tidal Marsh (Palustrine and Estuarine Emergent Wetland)	Native emergent herbaceous marsh plants with a diversity of species including Lyngbye's sedge, pointed rush, tufted hairgrass, water parsnip, boltonia, water horsetail, wapato, spike rush, beggar-tick, soft stem bulrush, river bulrush, three-square bulrush, touch-me-not, and bird's-foot trefoil.	Prolonged tidal floods, elevation too low to permit woody plant growth, but there may be scattered willows.	Dike construction and drainage that prevent tidal flooding, invasive species such as reed canarygrass and purple loosestrife that displace native vegetation.
Salmon (Chinook, Coho, Chum, Steelhead)	River channels provide migration pathways for adults traveling to spawning grounds throughout the Columbia River and Snake River basins, and for juveniles traveling to the Pacific Ocean. Tidal marshes, swamps, mudflats, and shallow waters produce forage organisms for juveniles.	Functioning floodplain, free flowing river, abundant productive tidal marshes and swamps.	Dams impede salmon migration, dike construction results in loss of productive marshes and swamps, and degradation of spawning streams throughout the basin has reduced salmon numbers.

Table 4-2b Summary of Biological Integrity, Diversity, and Environmental Health (BIDEH) for Lewis and Clark Refuge

Species and Habitats (Plant Communities) that Represent Existing BIDEH	Population/Habitat Attributes (Age class, structure, seral stage, species composition)	Natural Processes Responsible for these Conditions	Landscape Limiting Factors
Salmon (Chinook, Coho, Chum, Steelhead)	River channels provide migration pathways for adults traveling to spawning grounds throughout the Columbia River and Snake River basins, and juveniles traveling to the Pacific. Tidal marshes, swamps, mudflats, and shallow waters produce forage organisms for juveniles.	Functioning floodplain, free flowing river, abundant productive tidal marshes, swamps, etc.	Dams impede salmon migration, dike construction results in loss of productive marshes and swamps; degradation of spawning streams throughout the basin has reduced salmon numbers.
Sitka Spruce Tidal Swamp (Palustrine Evergreen Forested Wetland)	Late succession forest, stand age greater than 95 years, with trees larger than 21 inches mean diameter at breast height (DBH). Western red cedar is also a common overstory tree. Abundant understory of native shrubs including willow, red-osier dogwood, Nootka rose, and service berry.	Functioning floodplain with tidal flooding.	Nonfunctioning flood plain: dike construction that led to land clearing for industrial, agricultural, and residential development, dam construction that reduced flooding, invasive species such as reed canarygrass that inhibit natural forest and shrub regrowth.
Cottonwood Tidal Swamp (Palustrine Deciduous Forested Wetland)	Mid to late succession forest with black cottonwood and Oregon ash as dominant canopy trees. Abundant understory of native shrubs including willow, red-osier dogwood, Nootka rose, and red alder.		
Scrub-shrub Tidal Swamp (Palustrine Scrub-shrub Wetland)	Climax scrub-shrub vegetation with the major dominant being Sitka willow. Other dominants include Pacific willow, red-osier dogwood, and hardhack. Other species include ninebark, crabapple, and rose. Scattered Sitka spruce may be present.	Prolonged tidal flooding: elevation too low to permit growth of large trees.	Dike construction that led to land clearing for industrial, agricultural, and residential development, dam construction that reduced flooding, invasive species such as reed canarygrass that inhibit natural forest and shrub regrowth.
Riparian Forest	Mid to late succession forest with the dominant trees being black cottonwood, red alder, Oregon ash, Sitka spruce, western red cedar, and bigleaf maple. Abundant understory of native shrubs including salmonberry, red-osier dogwood, willow, nine-bark, black hawthorn, snowberry, indian plum, and vine maple.	Natural forest growth and vegetation succession.	
Tidal Marsh (Palustrine and Estuarine Emergent Wetland)	Native emergent herbaceous marsh plants with a diversity of species including Lyngbye's sedge, pointed rush, tufted hairgrass, water parsnip, boltonia, water horsetail, wapato, spike rush, beggar-tick, soft stem bulrush, river bulrush, three-square bulrush, touch-me-not, and bird's-foot trefoil.	Prolonged tidal floods, elevation too low to permit woody plant growth, but there may be scattered willows.	Dike construction and drainage that prevent tidal flooding, invasive species such as reed canarygrass and purple loosestrife that displace native vegetation.

Table 4-3a Priority Resources of Concern for Julia Butler Hansen Refuge

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species[1]
Columbian White-tailed Deer	Grassland	Vegetation height of 4-6 inches during an average winter (Dec.-Feb.), field size smaller than 20 acres, with 20-40 percent clover, and 20 percent orchardgrass, within less than 820 feet of woodlots[2].	Foraging	Canada goose (other subspecies including western, lesser, and Vancouver), cackling goose, greater white-fronted goose, American wigeon, northern harrier, American kestrel, short-eared owl, western meadowlark, western bluebird, Wilson's snipe, killdeer, fringed myotis, long-eared myotis, and Yuma myotis.
Dusky Canada Goose		An average winter vegetation height of 4-6 inches, ryegrass preferred (greater than 30 percent), with small patch size (less than 100 acres)[3].	Wintering Foraging	
Swainson's Thrush Red-legged Frog Columbian White-tailed Deer*	Palustrine deciduous forested wetland – tidal cottonwood and/or willow swamp	Mid to late succession; abundant shrub layer cover (native species including red-osier dogwood, salmonberry, trailing blackberry and, willows), greater than 50percent tree canopy closure (native species including black cottonwood, Oregon ash and willows)[2,4,6].	Foraging, Breeding	Fringed myotis, long-eared myotis, Yuma myotis, wood duck, Cooper's hawk, red-shouldered hawk, band-tailed pigeon, olive-sided flycatcher (forest edge), Pacific-slope flycatcher, red-eyed vireo, yellow warbler, rufous hummingbird, purple martin (snags), tree swallow (snags), great blue heron (nesting), pileated woodpecker, downy woodpecker, and brown creeper.
Bald Eagle Columbian White-tailed Deer* Red-legged Frog		Late succession: mature trees, within 5,000 feet of water and with an unobstructed view of a large water body[2,6,8,9].		
Little Willow Flycatcher Red-legged Frog Columbian White-tailed Deer*	Palustrine scrub-shrub wetland–tidal swamp	Predominantly shrubs (native species include Pacific willow, Sitka willow, Pacific nine-bark, hardhack, red-osier dogwood), scattered larger trees (native species include Sitka spruce, black cotton-wood and willows) may be present[2,4,6].	Foraging, Breeding	Yellow warbler and rufous hummingbird.
Bald Eagle Red Crossbill Columbian White-tailed Deer* Red-legged Frog	Palustrine evergreen forested wetland – tidal Sitka spruce swamp	Late succession: mature trees, within 5,000 feet of water and with an unobstructed view of a large water body[2,8,9], with greater than 7 mature spruce trees per acre[2], typically with a dense understory of shrubs (Sitka willow, red-osier dogwood).	Breeding, Foraging	Fringed myotis, long-eared myotis, Yuma myotis, wood duck, Cooper's hawk, red-shouldered hawk, olive-sided flycatcher (forest edge), Pacific-slope flycatcher, red-eyed vireo, yellow warbler, rufous hummingbird, purple martin (snags), tree swallow (snags), great blue heron (nesting), pileated wood-pecker, downy woodpecker, brown creeper, and red-legged frog.
Northern Pintail Columbian White-tailed Deer*	Palustrine emergent wetland-tidal	Shallow tidal marsh (less than 4-18 inches depth at mean higher tide stages), 30-70 percent cover of emergent vegetation,	Foraging	Mallard, wood duck, American wigeon, northern harrier, great blue heron, Cackling goose, dusky Canada goose, western Canada goose, tule greater

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species[1]
	marsh	native seed bearing plants such as bulrushes, spike rush, Lyngbye's sedge and smartweeds[2,7].		white-fronted goose, tundra swan, Wilson's snipe, bald eagle, and peregrine falcon.
Northern Pintail Columbian White-tailed Deer*	Palustrine emergent wetland-nontidal freshwater marsh	Seasonally flooded shallow marsh, flooded to a depth of less than 4-18 inches from approximately October through June, with a 30-70 percent cover of emergent vegetation such as native seed bearing plants including spike rushes, bulrushes, manna grass, bur-reed, cattail and smartweeds [2,7].	Foraging (winter)	Mallard, wood duck, American wigeon, northern harrier, great blue heron, Cackling goose, dusky Canada goose, western Canada goose, tule greater white-fronted goose, tundra swan, Wilson's snipe, western painted turtle.
Red-legged Frog		Shallow water (1.5-6.5 feet) with emergent and/or submergent vegetation[6].	Breeding	
Columbian White-tailed Deer*Red-legged Frog Yellow Warbler Swainson's Thrush	Riparian forest and shrub	Mid succession multilayered, varied forest with abundant shrubs and subcanopy trees, in addition to larger canopy trees. Native species including red alder, black cottonwood, Sitka spruce, red cedar, red-osier dogwood, nine-bark, salmonberry, and willows [2,4,6].	Breeding, Foraging	Roosevelt elk, Yuma bat, fringed myotis, long-eared myotis, white-footed vole, wood duck, red-shouldered hawk, Cooper's hawk, band-tailed pigeon, northern saw-whet owl, western screech owl, olive-sided flycatcher (forest edge), red-eyed vireo, rufous hummingbird, purple martin (snags), tree swallow, pileated woodpecker, downy woodpecker, and brown creeper.
Little Willow Flycatcher Red-legged Frog Columbian White-tailed Deer*		Early succession; shrubs and young trees, native species including red-osier dogwood, salmonberry, trailing blackberry, willows, Sitka spruce, black cottonwood, red alder, red cedar[2,4,6], early-successional stands on the refuge are usually the result of planting trees and shrubs.	Breeding, Foraging	Roosevelt elk, yellow warbler, and rufous hummingbird.
Bald Eagle Swainson's Thrush Columbian White-tailed Deer* Red-legged Frog		Late succession: mature trees, abundant shrubs in openings, within 5,000 feet of water, with an unobstructed view of a large water body[2,4,6,8,9], native trees and shrubs including Sitka spruce, red cedar, red alder, black cottonwood, salmonberry, red-osier dogwood, trailing blackberry, and willows.	Breeding, Foraging	Roosevelt elk, fringed myotis, long-eared myotis, Yuma myotis, red-shouldered hawk, Cooper's hawk, Vaux's swift (snags), tree swallow, purple martin (snags), olive-sided flycatcher (forest edge), and rufous hummingbird.
Chinook salmon (juvenile)	Riverine open water sloughs (River back-waters either	Current less than 0.3 feet per second for refuge from strong currents, aquatic vegetation for shelter from predatory fish.[10]	Foraging, Resting	Red-legged frog, painted turtle, coho salmon, chum salmon, steelhead, coastal cutthroat trout, Oregon floater, winged floater, lesser scaup, greater scaup, bald eagle, purple martin, and tree swallow

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species[1]
	restricted by tidegates or not).			
California Floater	Riverine unconsolidated bottom	Sand or mud bottom substrate[11]	Breeding, Foraging	

*The CWT deer is a habitat generalist in its use of shrub, forest and marsh. A modest degree of canopy closure for cover; abundant shrubs for cover and forage; and tree lichens, grasses and forbs for forage satisfy its forest requirements. An abundance of marsh grasses and forbs provide forage. Therefore, the detailed habitat structures given for birds in this table would also benefit CWT deer. The ideal habitat for the deer is a mosaic of small forest stands, short-grass fields, and seasonal or tidal marsh.

[1]from Table 4-1.a, Comprehensive List of Resources of Concern
[2]Suring and Vohs 1979
[3]Bromley and Rothe 2003
[4]Altman 2000
[5]Altman 1999
[6]Corkran and Thoms 1996
[7]Fredrickson and Heitmeyer 1991
[8]Anthony et.al. 1982
[9]Buehler 2000
[10]Johnson et.al. 2003
[11]Nedeau et.al. *undated*

Table 4-3b Priority Resources of Concern for Lewis and Clark Refuge

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species[1]
Chinook Salmon	Riverine and estuarine open water and unconsolidated bottom	Medium to deep depths (elevations between 3 and greater than 18 feet below MLLW)[2,3]	Migrating	Steller sea lion, coho salmon, chum salmon, steelhead, coastal cutthroat trout, white sturgeon, and bull trout.
Greater Scaup Western Grebe		Shallow to medium depth (3-30 feet), fine soft bottom substrates of silt or sand[3,17]	Wintering, Foraging	Lesser scaup, double-crested cormorant, purple martin (foraging), tree swallow (foraging), California floater mollusk, winged floater mollusk, coho salmon, chum salmon, steelhead, coastal cutthroat trout, white sturgeon, and bull trout.
Oregon Floater			Breeding, Foraging	
Chinook Salmon (juvenile)		Shallows and flats (elevations between MLLW and about 6 feet below MLLW), vegetation is absent[2,3]	Foraging, Migrating	
Caspian Tern		Shallow depth (1-16 feet preferred, but sometimes deeper)[16]	Foraging	
Western Sandpiper	Riverine and estuarine unconsolidated shore-tidal flats (mud flats) and sandbars	Largely unvegetated flats with soft substrates and benthic invertebrates[5,6]	Migrating	Peregrine falcon, merlin, dunlin, killdeer, greater yellowlegs
Steller Sea Lion		Sand bars for haulout sites	Resting	
Mallard Northern Pintail	Estuarine and palustrine emergent wetland-tidal marsh	Water depth less than 10 inches, native emergent seed bearing vegetation including soft-stem bulrush, Lyngbye's sedge and smartweed[10,12]	Migrating, Wintering	Peregrine falcon, merlin, northern harrier, cackling goose, dusky Canada goose, western Canada goose, tule greater white-fronted goose, wood duck, American wigeon, purple martin (foraging), tree swallow (foraging), Wilson's snipe, greater yellowlegs, and CWT deer (foraging)
Tundra Swan		Water depth to 3 feet, native emergent and submergent vegetation (wapato, sedges, rushes) to provide seeds, stems, roots and tubers[13]	Wintering	
Chinook Salmon (juvenile)		Elevations between MLLW and slightly above MHHW dominated by herbaceous emergent vegetation and low shrubs, often includes tidal channels[2,3]	Foraging	
Little Willow Flycatcher	Palustrine scrub-shrub wetland–tidal swamp	Early succession; shrub layer (less than 13 feet) 30-80 percent cover (native species including red-osier dogwood, salmonberry, trailing blackberry, willows), canopy tree (greater than 13 feet tall) cover less than 20 percent (native species including sitka spruce, black cottonwood, willows)[4]	Nesting, Foraging	Yellow warbler and CWT deer.
Bald Eagle	Palustrine evergreen and deciduous forested	Late succession: mature trees with mean DBH greater than 41 inches, within 5,000 feet of water and with an unobstructed view of a large water body[7,11]	Nesting, Perching	CWT deer, Yuma bat, Townsend's big-eared bat, wood duck, red-shouldered hawk, Cooper's hawk, merlin, band-tailed pigeon, northern saw-whet owl,

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species[1]
Red Crossbill	wetland–tidal Sitka spruce or cottonwood/willow swamp	Late succession forest with more than 7 mature spruce trees per acre.[8]	Foraging	western screech owl, olive-sided flycatcher (forest edge), red-eyed vireo, Swainson's thrush rufous humming-bird, purple martin (snags), tree swallow, pileated woodpecker, downy woodpecker, brown creeper
Streaked Horned Lark	Upland dredge spoil islands with sparse vegetation	Sparsely vegetated (~35 percent of ground unvegetated) sandy areas, dominated by grasses and forbs with few or no trees or shrubs[9]	Foraging, Breeding	Double-crested cormorant (nesting), killdeer
Caspian Tern		Open, sparsely vegetated areas on islands or areas free of mammalian predators, sand substrate preferred[14,15,16]	Breeding	
Bald Eagle	Upland and riparian conifer and mixed forest	Late succession: mature trees with mean dbh greater than 41 inches, within 5,000 feet of water and with an unobstructed view of a large water body[7,11]	Breeding	Vaux's swift (snags), brown creeper, pileated woodpecker, downy woodpecker, hermit warbler, Pacific-slope flycatcher, Hammond's flycatcher, Wilson's warbler, winter wren, red-shouldered hawk, Cooper's hawk, northern saw-whet owl, western screech owl, Townsend's big-eared bat, Yuma bat
Varied Thrush		Late succession forest in blocks larger than 75 acres, canopy closure greater than 70 percent and deciduous vegetative cover greater than 30 percent in the subcanopy[8]	Breeding, Foraging	
Red Crossbill		Late succession forest with more than 7 conifer trees per acre larger than 18 inches dbh with more than 2 trees larger than 24 inches dbh.[8]	Foraging	

[1]from Table 4-1b, Comprehensive List of Resources of Concern
[2]Johnson et al. 2003
[3]Thomas 1983
[4]Altman 2000
[5]Wilson 1994
[6]Paulson 1993
[7]Anthony et al. 1982
[8]Altman 1999
[9]Pearson and Hopey 2005
[10]Laubhan and Fredrickson 1993
[11]Buehler 2000
[12]Fredrickson and Heitmeyer 1991
[13]Limpert and Earnst 1994
[14]Quinn and Sirdevan. 1998
[15]Penland 1976
[16]Cuthbert and Wires 1999
[17]Nedeau et al. *undated*

4.3 Habitats and Vegetation

The refuges are located within the Sitka spruce vegetation zone (Franklin and Dyrness 1988). Prior to settlement and development, the land was a mix of tidal marsh, Sitka spruce tidal swamp, black cottonwood tidal swamp, and willow scrub-shrub tidal swamp. These habitats remain, although their acreage has been reduced. Diking, drainage and land clearing has converted some former tidal marsh/swamp habitat to upland grassland and riparian forest.

The current refuge habitats were mapped using GIS based on the interpretation and analysis of 2003 color infrared and 2005 true color ortho-corrected aerial photography. These habitats are depicted in Maps 4a, 4b, and 6 and the acreages of each are shown in Table 4-4.

Table 4-4 Habitat Types and Acreages within Lewis and Clark and Julia Butler Hansen Refuges

Habitat	Number of Acres		
	Lewis and Clark Refuge	Julia Butler Hansen Refuge	Total
Riverine and Estuarine Open Water (sum of Unconsolidated Bottom and Ditches)	1,362	296	1,658
Riverine and Estuarine Unconsolidated Shore (Tidal Flats and Sandbars)*	4,825	63	4,888
Riverine and Estuarine Unconsolidated Bottom (River/Slough Bottom)*	1,362	249	1,611
Estuarine and Palustrine Emergent Wetland-Tidal Marsh	3,723	301	4,024
Palustrine Scrub-Shrub Tidal Wetland	2,165	847	3,012
Palustrine Evergreen Forested Wetland–Tidal Sitka Spruce Swamp	284	353	637
Palustrine Deciduous Forested Wetland–Tidal Cottonwood Willow Swamp	120	611	731
Palustrine Emergent Wetland–Nontidal Marsh	0	129	129
Riparian Forest and Shrub	469	924	1,393
Grassland	68	2,384	2,452
Barren Land-Upland Dredge Spoil with Sparse Vegetation	16	7	23
Upland Conifer and Mixed forest	89	0	89
Low Intensity Developed	0.32	74	74.32
Ditch	0	48	48

*Overlaps with open water, i.e., open water includes both unconsolidated bottom (river and slough bottoms) and ditches.

The following summaries of habitats and vegetative communities are based largely on descriptions by Christy (2004), Christy and Putera (1992), Cowardin et al. (1979), Tabor (1976), and Thomas (1980, 1983), along with the observations of refuge staff. The plant and animal species listed in this section are given as examples of the more common species present, not as a comprehensive list of all species present.

4.3.1 Riverine and Estuarine Open Water and Unconsolidated Bottom

Open water refers to those areas that are continuously submerged. The elevation is generally 6 feet or more below mean lower low water. These habitats are referred to as deepwater habitats by Cowardin et al. (1979). Only fully aquatic organisms reside in the open water.

The open water channels of the river are home to fish and a variety of invertebrate animals and aquatic plants. They serve as migration pathways for adult salmon, shad, eulachon, lamprey, and steelhead going upriver to spawn, as well as for the juveniles going downstream to the ocean. Deeper channels and holes are preferred habitat for white sturgeon. Clams, mussels, aquatic worms, and other small organisms are found on the bottom. Rooted aquatic plants are scarce in the main channels because of water depth and strong, erosive currents, but are found in backwaters.

Julia Butler Hansen Refuge has over 200 acres of Columbia River backwaters, or sloughs. The sloughs on the mainland and Tenasillahe Island were cut off from the river when the dikes were constructed. Some of the sloughs have tidegates that allow water to pass directly to the river. Other sloughs drain through ditches that connect to sloughs with tidegates. These diked sloughs have very slow current velocities because of the constricting effect of the tidegates. Water temperatures in the summer are much higher in the sloughs than water temperatures in the Columbia River. Partly because of these differences, non-native species of plants and fish are predominant. Parrotfeather milfoil covers the water surface in many areas. Introduced species of fish such as common carp, largemouth bass, yellow perch, and bluegill are abundant.

Sloughs on the undiked islands are usually open to the river at only one end (at least at normal water levels), so that current velocities are much lower than the river channels. Vegetation is generally scarce, due to the slough’s steep sides and depth. Invertebrate organisms are plentiful. Juvenile salmonids use the sloughs to forage and gain respite from strong currents.

4.3.2 Riverine and Estuarine Unconsolidated Shore (Tidal Flats and Sandbars)

Tidal flats and sandbars are those areas that are often submerged, but are exposed at lower tide levels. The elevation is less than 6 feet below mean lower low water. Typically, vegetation is scarce or absent. These areas support an abundance of invertebrates including clams, mussels, amphipods, polychaete and oligochaete worms, and nematodes. Foraging shorebirds follow the receding tide across the flats, and fish and scaup frequent the flats when they are flooded.

4.3.3 Estuarine and Palustrine Emergent Wetland – Tidal Marsh

Tidal marsh occurs in the estuary where the ground is high enough (not flooded too deeply for too long) to support emergent herbaceous plants, but too low and wet to support shrubs or trees. They are generally found from elevations of about mean lower low water to mean higher high water. There is no saltwater intrusion into the Julia Butler Hansen Refuge and relatively little into the Lewis and Clark Refuge, thus the refuge’s tidal marshes are characterized by freshwater marsh plants (Thomas 1980).

The lowest elevation marshes feature pioneering plants such as soft-stem bulrush, pointed rush, spike rush, river bulrush, and wapato. At medium elevations, Lyngbye's sedge, tufted hairgrass, water horsetail, water parsnip, boltonia, monkeyflower, marsh marigold, beggar-ticks, water plantain, and willow-herb appear. Plant diversity continues to increase as the elevation rises. Douglas' aster, reed canarygrass, tall fescue, sneezeweed, birds-foot trefoil, Pacific silverweed, skunk cabbage, forget-me-not, slough sedge, smartweed, rice cut-grass, scattered willows, and other species join the mix of plants at the higher elevations.

These marshes provide an abundance of food for the invertebrates, fish, birds, and mammals of the estuary. The vegetation filters pollutants from the water. The plant seeds, roots, tubers, and leaves feed many thousands of ducks and geese. Bits and decaying remains of plants are fed upon by small organisms called detritivores, which in turn are fed upon by larger organisms. Juvenile salmon and other fish find an abundance of food in the marshes, as well as shelter from strong currents and predators. Bald eagles, great blue herons, and other predators are attracted to the abundance of life. The productivity of the marshes is critical to the health of the estuary.

Over the past century, the extent of tidal marsh in the lower estuary declined from about 16,000 acres to about 9,000 acres. Most of this loss occurred in the first half of the twentieth century when extensive areas of former tidal wetlands were surrounded with dikes and converted to agricultural land.

4.3.4 Palustrine Tidal Scrub-Shrub Wetland

Scrub-shrub wetlands, or swamps, occur at elevations that are just high enough to support woody plants, but too low and too frequently submerged to support large trees. Scrub-shrub wetlands usually occur from about mean higher high water to slightly above. With an extent of 2,165 acres, scrub-shrub is the second most widespread terrestrial habitat type on the Lewis and Clark Refuge.

Scrub-shrub often forms nearly impenetrable thickets. Sitka willow is usually the dominant species, although spiraea (hardhack) is dominant in some areas. Other shrub species include Pacific willow, red-osier dogwood, nine-bark, crabapple, and Nootka rose. Twinberry and service berry occur in places. Herbaceous understory plants include skunk cabbage, jewelweed, water horsetail, and slough sedge. Scattered Sitka spruce and cottonwood trees may also be present. Scrub-shrub is often interspersed with Sitka spruce or black cottonwood tidal forested swamp. The spruce and/or cottonwood grow on the natural levees that form along the edges of islands and bisecting channels, and the scrub-shrub occupies the lower interior areas.

As with the marshes, the scrub-shrub provides nutrients for the estuary food chain. Dead leaves, branches, and shrubs feed detritivores, which in turn feed fish and other organisms. Juvenile salmon and other fish find food and shelter from strong currents in the web of narrow channels that wind through the shrubs. Passerine birds such as willow flycatchers and yellow warblers forage and nest in the willows. Ducks feed on invertebrates and herbaceous plant seeds during high tides. Beaver eat the bark of the willows.

Of all the estuary's habitats, the tidal swamps (scrub-shrub, cottonwood, and Sitka spruce) have sustained the greatest losses due to the construction of dikes. The acreage covered by swamps in the lower estuary declined from 30,000 in 1870 to 7,000 today (Thomas 1983).

4.3.5 Palustrine Evergreen Forested Tidal Wetland–Sitka Spruce Swamp

The Sitka spruce zone extends from about the Chinook River to Puget Island. The spruce swamps occur at elevations slightly higher than scrub-shrub swamps—generally above mean higher high water.

Sitka spruce is the dominant tree. There may also be scattered western red cedar, red alder, cottonwood, and Oregon ash. Scrub-shrub forms a dense understory. Shrub species include Sitka willow, Pacific willow, red-osier dogwood, crabapple, rose, snowberry, and salmonberry. Areas of pure scrub-shrub are often intermixed with the spruce stands. Herbaceous ground cover plants include skunk cabbage, slough sedge, maidenhair fern, and jewelweed.

CWT deer are often found in the spruce swamps. They can escape high water on the hummocks formed from large trees that fell long ago. The spruce swamp supports a high diversity of birds and small mammals. Red crossbills forage on the cones. Woodpeckers (hairy, downy, and pileated), Stellar's jay, tree swallow, black-capped chickadee, winter wren, hermit thrush, Swainson's thrush, golden-crowned kinglets, cedar waxwing, and song sparrow are common residents of the swamps. Colonies of great blue herons nest in the trees. Deer mice and vagrant shrews live in the branches. Otter and beaver cruise the channels. Fallen leaves, branches and trees provide nutrients that feed the estuary.

Spruce swamps originally covered about 19,000 acres of the estuary. Only about 2,200 acres remain (Christy and Putera 1992). The 637 acres of spruce swamps on the refuges are a significant contribution to the preservation of this rare habitat that is underrepresented in the Columbia River estuary.

4.3.6 Palustrine Deciduous Forested Tidal Wetland – Cottonwood/Willow Swamp

As the elevation rises, cottonwood swamps become prevalent. Black cottonwood becomes the dominant tree in the swamps near Cathlamet and upstream. Oregon ash is also commonly present and may be codominant. Other tree species may include Sitka spruce, red alder, and willow. Understory characteristics vary according to elevation, wetness, age of the stand, and other site factors. Old-growth stands with considerable tidal flooding often have a dense understory, similar to the spruce swamps, and may be intermixed with Sitka willow/Pacific willow/red-osier dogwood scrub-shrub. Younger, more vigorous stands in somewhat drier sites may achieve complete canopy closure. The resultant shading leads to a sparse understory of diverse shrubs including willows, red-osier dogwood, salmonberry, rose, and snowberry. Trailing blackberry often forms a ground cover in these stands. A wide variety of other herbaceous plants are typically present. At some sites, reed canarygrass is prevalent.

The cottonwood swamps, like the spruce swamps, host an abundance and diversity of wildlife. The wood of cottonwood is soft and rots quickly, creating ideal habitat for cavity-nesting birds. Hairy and downy woodpeckers and red-bellied sapsuckers bore nesting cavities in the soft wood. Wood ducks and hooded mergansers utilize natural cavities. Passerine birds, such as black-throated gray warblers and warbling vireos, are abundant. The uncommon red-eyed vireo frequents the swamps. Cottonwood bark is a favorite food of beavers. CWT deer, black-tailed deer, raccoons, river otters, mink, deer mice, vagrant shrews, and other mammals find food and cover. Great blue herons nest in colonies in the trees. Salmon and other fish benefit from the nutrients that flow from the swamps. Red-legged frogs and Pacific treefrogs forage on insects and breed in vernal pools.

The cottonwood swamps share with the spruce swamps the distinction of being one of the habitat types most impacted by dike construction, river flow regulation/alternation from dams, and land clearing for agriculture and development. It is safe to say that the remaining cottonwood swamps are a small fragment of what existed when Lewis and Clark journeyed here.

4.3.7 Palustrine Emergent Wetland–Nontidal Marsh

Nontidal marshes on the refuges have no direct connection to the Columbia River and thus are not affected, or are affected very little, by the tides. These marshes occur primarily on the diked areas of the Julia Butler Hansen Refuge (the Mainland and Tenasillahe Island units). They are seasonal in nature and form in depressions where winter rainfall creates pools.

The nontidal marshes tend to be small in size and vegetated with undesirable invasive plants such as reed canarygrass and common rush (tussock). Since 1999, the refuge has been enhancing some of these marshes by shallow excavation and the installation of water control structures. To date, 20 areas totaling 129 acres have been improved. The excavation and water control installations result in establishing more desirable wetland plants. Species include creeping spike rush, cattail, bur-reed, smartweed, beggars-tick, soft-stem bulrush, water purslane, tapered rush, water foxtail, wapato, mannagrass, and water plantain. Less desirable plants such as reed canarygrass and common rush also flourish and are periodically controlled by mowing and cultivating.

The nontidal marshes have many of the same biological functions as the tidal marshes that were present prior to the construction of dikes. The plants provide food for thousands of migratory ducks and geese. Bald eagles and peregrine falcons are attracted to the abundance of prey. Water draining from the marshes carries nutrients that reach the Columbia River and help feed the organisms of the estuary, including salmon. CWT deer feed on water foxtail and other marsh plants. The nontidal marshes also provide ideal breeding habitat for several species of amphibians, such as long-toed salamanders, red-legged frogs, and Pacific treefrogs.

4.3.8 Riparian Forest and Shrub

Riparian forest and shrub habitat is dominated by woody vegetation that lies adjacent to a stream, channel, seep, or other body of flowing water. It is typically within or very close to the flood plain of a stream and the vegetative composition is influenced by moist soils. For the purpose of this CCP, the term *riparian forest* refers to woodlands that are along the estuary; they are not swamps, and they are not flooded with consistent regularity. Riparian shrub is a transition habitat that will soon mature into riparian forest. These definitions include nearly all wooded habitats (other than swamps) on the refuges.

At the Julia Butler Hansen Refuge, riparian forest/shrub habitat is found primarily on the diked areas of the Mainland and Tenasillahe Island units, although a small amount occurs on the highest parts of Crims and Price islands. Within the Lewis and Clark Refuge, riparian forest occurs on the higher ground of old dredge spoil islands including Miller Sands, Lois, and Mott islands and on Tongue Point.

Riparian forest within the diked areas is characterized by a diverse mix of tree species. Cottonwood, red alder, Sitka spruce, western red cedar, bigleaf maple, Oregon ash, and tree-sized willows are prominent. Understory shrubs include salmonberry, red-osier dogwood, snowberry, red elderberry, trailing blackberry, and currant. Riparian forests on the undiked river islands tend be less diverse, with cottonwood (downstream islands) and cottonwood/willow/Oregon ash (upstream islands) being the dominant tree species.

Riparian forests typically support a diversity of plants and are structurally complex (Pollock et al. 1998). They also support a great diversity and abundance of wildlife. Red-eyed vireos, uncommon in Washington, nest and forage in the trees along with downy woodpeckers, Swainson's thrushes, and Cooper's hawks. The shrub understory is a favorite habitat of yellow warblers, among other species. Winter wrens, red-legged frogs, and northwestern salamanders forage on the forest floor. CWT deer find browse and cover. The trees shade waterways, thus improving water quality for salmon and other fish. A large amount of the organic matter produced by the forest finds it way to the estuary, where it nourishes the food chain.

4.3.9 Grassland

Grasslands occupy 2,384 acres on the Julia Butler Hansen Refuge and 68 acres on the Lewis and Clark Refuge. Grasslands are not native habitats of the refuges; rather, they were created when dikes were constructed and former marsh and swamp habitat was cleared and drained for agriculture. The grasslands are dominated by introduced varieties of grasses that were originally planted for livestock forage. Species include tall fescue, reed canarygrass, orchardgrass, velvetgrass, meadow foxtail, ryegrass, and bentgrasses. Other plants that are common in the grasslands include red and white clover, creeping buttercup, field horsetail, curly dock, and common rush (tussock).

Grassland management is a major activity at Julia Butler Hansen Refuge. Cattle grazing, mowing, and seeding are used to maintain about 700 acres in short, actively growing, nutritious grasses and clover that provide high-quality forage for CWT deer, Canada geese, and cackling geese. Unmanaged grasslands tend to be dominated by reed canarygrass, and to a lesser extent, tall fescue. In wetter areas, common rush (tussock) may form dense stands.

While the grasslands are managed primarily to benefit CWT deer and geese, other wildlife also utilize them. Townsend's voles flourish in the grass, and their presence attracts predators such as northern harriers, white-tailed kites, great horned owls, barn owls, coyotes, long-tailed weasels, and garter snakes. Other species that utilize the grasslands include Wilson's snipe, western meadowlark, American kestrel, tree swallow, barn swallow, purple martin, Virginia rail, yellowthroat, and American wigeon.

4.3.10 Barren Land – Upland Dredge Spoil Islands

The approved boundary of the Lewis and Clark Refuge includes six islands that were created by the deposition of sandy material dredged from the river's bottom during ship channel maintenance operations. The islands are Pillar Rock (Jim Crow Sands), Miller Sands, Miller Sands Spit, Rice, Mott, and Lois. Miller Sands, Mott, and Lois islands have not been used for spoil deposition for many years and are now heavily vegetated with riparian cottonwood forest and scrub-shrub.

Pillar Rock, Miller Sands Spit, and Rice islands are used regularly for spoil deposition and are characterized by large expanses of bare, sandy ground with areas of sparse grasses, forbs, and small shrubs. These islands are a unique, almost desert-like habitat in the estuary. The lack of vegetation and absence of mammalian predators make the islands an attractive nesting location for colonial waterbirds such as glaucous-winged and western gulls, Caspian terns, and double-crested cormorants. Canada geese also nest on the spoil islands. The rare streaked horned lark is fairly common here.

The off-channel edges of the spoil islands often slope into shrubby willows and cottonwoods near the water's edge, and then into tidal marsh and shallow flats. These shallows attract large numbers of wintering ducks, as well as migrating shorebirds and juvenile salmon.

4.3.11 Upland Conifer and Mixed Forest

The only upland forest habitat within the refuges occurs on the 89-acre Emerald Heights Unit of the Lewis and Clark Refuge. Upland forest occurs at elevations ranging from 50 to 266 feet. The Emerald Heights Unit is completely forested, with 120 year-old western hemlock being the dominant species. Sitka spruce are scattered throughout the stand. The southwest part of the unit contains a small amount of 65-year-old western hemlock, Sitka spruce, Douglas fir, and red alder. A bald eagle nest site is located within the forest. The forest also provides high-quality habitat for passerine birds, including pileated woodpeckers, varied thrushes, hermit warblers, Hammond's flycatchers, Wilson's warblers, and winter wrens.

4.4 Fish and Wildlife

4.4.1 Fish

The Columbia River estuary provides habitat for a relatively large number of freshwater and marine fish species. During February 1980 through July 1981, NOAA's Fisheries Service conducted monthly fish surveys throughout the estuary, from marine habitats near the Columbia River mouth to completely freshwater habitats 38 miles upstream. A total of 80 fish species were collected (Table 4-5) from three regions of the estuary. The regions were selected based on salinity, marine/estuarine mixing, and fresh water (Bottom et al. 1984). An additional five species have been collected in recent surveys at both refuges by the Service and USGS (Haskell et al. 2005a, 2005b; Johnson et al. 2009). Of the 80 fish species collected, approximately half were collected in the completely freshwater region in which the refuges occur.

Table 4-5 Species of Fish Collected in the Columbia River Estuary

Common Name	Scientific Name
River lamprey	*Lampetra ayresi*[1]
Western brook lamprey	*Lampetra richardsoni*[2]
Pacific lamprey	*Lampetra tridentata*[1]
Spiny dogfish	*Squalus acanthias*[1]
Big skate	*Raja binoculata*[1]
Green sturgeon	*Acipenser medirostris*[1]
White sturgeon	*Acipenser transmontanus*[1]
American shad	*Alosa sapidissima*[1]
Pacific herring	*Clupea pallasi*[1]
Northern anchovy	*Engraulis mordax*[1]
Common carp	*Cyprinus carpio*[1]
Peamouth	*Mylocheilus caurinus*[1]
Northern pikeminnow	*Ptychocheilus oregonensis*[1]
Largescale sucker	*Catostomus macrocheilus*[1]
Yellow bullhead	*Ameiurus natalis*[1]
Brown bullhead	*Ameiurus nebulosus*[1]
Whitebait smelt	*Allosmerus elongatus*[1]
Surf smelt	*Hypomesus pretiosus*[1]
Night smelt	*Spirinchus starksi*[1]
Longfin smelt	*Spirinchus thaleichthys*[1]
Eulachon	*Thaleichthys pacificus*[1]
Cutthroat trout	*Oncorhynchus clarki*[1]
Chum salmon	*Oncorhynchus keta*[1]
Coho salmon	*Oncorhynchus kisutch*[1]
Steelhead	*Oncorhynchus mykiss*[1]
Sockeye salmon	*Oncorhynchus nerka*[1]
Chinook salmon	*Oncorhynchus tshawytscha*[1]
Mountain whitefish	*Prosopium williamsoni*[1]
Pacific hake	*Merluccius productus*[1]
Pacific tomcod	*Microgadus proximus*[1]
Walleye Pollock	*Theragra chalcogramma*[1]
Banded killifish	*Fundulus diaphanus*[2]
Western mosquitofish	*Gambusia affinis*[3]
Threespine stickleback	*Gasterosteus aculeatus*[1]
Bay pipefish	*Syngnathus leptorhynchus*[1]
Black rockfish	*Sebastes melanops*[1]
Kelp greenling	*Hexagrammos decagrammus*[1]
Lingcod	*Ophiodon elongatus*[1]
Padded sculpin	*Artedius fenestralis*[1]
Coastrange sculpin	*Cottus aleuticus*[1]
Prickly sculpin	*Cottus asper*[1]
Mottled sculpin	*Cottus bairdi*[3]
Buffalo sculpin	*Enophyrs bison*[1]
Red Irish lord	*Hemilcpidotus hemilepidotus*[1]
Pacific staghorn sculpin	*Leptocottus armatus*[1]
Cabezon	*Scorpaenichthys marmoratus*[1]
Warty poacher	*Ocella varrucosa*[1]
Tubenose poacher	*Pallasina barbata*[1]

Common Name	Scientific Name
Pricklebreast poacher	*Stellerina xyosterna*[1]
Slipskin snailfish	*Liparis fucensis*[1]
Showy snailfish	*Liparis pulchellus*[1]
Ringtail snailfish	*Liparis rutteri*[1]
Pumpkinseed	*Lepomis gibbosus*[1]
Warmouth	*Lepomis gulosus*[1]
Bluegill	*Lepomis macrochirus*[1]
Smallmouth bass	*Micropterus dolomieu*[2]
Largemouth bass	*Micropterus salmoides*[1]
White crappie	*Pomoxis annularis*[1]
Black crappie	*Pomoxis nigromaculatus*[1]
Yellow perch	*Perca flavescens*[1]
Redtail surfperch	*Amphistichus rhodoterus*[1]
Shiner perch	*Cymatogaster aggregata*[1]
Striped seaperch	*Embiotoca lateralis*[1]
Spotfin surfperch	*Hyperprosopon anale*[1]
Walleye surfperch	*Hyperprosopon argenteum*[1]
Silver surfperch	*Hyperprosopon ellipticum*[1]
White seaperch	*Phanerodon furcatus*[1]
Pile perch	*Rhacochilus vacca*[1]
Snake prickleback	*Lumpenus sagitta*[1]
Saddleback gunnel	*Pholis ornata*[1]
Pacific sand lance	*Ammodytes hexapterus*[1]
Pacific sandfish	*Trichodon trichodon*[1]
Bay goby	*Lepidogobius lepidus*[1]
Pacific sanddab	*Citharichthys sordidus*[1]
Speckled sanddab	*Citharichthys stigmaeus*[1]
Starry flounder	*Platichthys stellatus*[1]
Butter sole	*Pleuronectes isolepis*[1]
English sole	*Pleuronectes vetulus*[1]
C-O sole	*Pleuronichthys coenosus*[1]
Sand sole	*Psettichthys melanostic*[1]

[1] Bottom et al. 1984
[2] Johnson et al. 2009
[3] Haskell et al. 2005a, 2005b; not reported in Bottom et al. 1984 or Johnson et al. 2009

4.4.1.1 Salmon

Fish most identified with the Columbia River are anadromous salmonids. Salmonids found in the lower Columbia River include Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), chum salmon (*O. keta*), sockeye salmon (*O. nerka*), steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarki clarki*), and pink salmon (*O. gorbuscha*), although pink salmon rarely spawn in the Columbia River basin (Wydoski and Whitney 2003). Although life histories vary considerably among and within these species of Pacific salmon (Groot and Margolis 1991), the general life cycle for Pacific salmon consists of adults spawning in fresh water and subsequently dying, egg development, juvenile rearing, juvenile migration to salt water, growth and maturation in salt water, and adult migration to freshwater spawning habitats (NRC 1996). Adult salmon primarily spawn in the fall. However, the season that Chinook salmon return to fresh water prior to spawning is used to describe specific runs—fall-, spring-, and summer-runs. Two life histories of Chinook salmon, stream- and ocean-type, are also distinguished by the residency of juveniles in fresh water (Bottom et al. 2005; Fresh et al. 2005; Healey 1991; NRC 1996).

Stream-type fish spend one to two years in streams and rivers prior to migrating to saltwater, whereas ocean-type fish migrate in their first year after up to a few months in streams or rivers. Ocean-type fish also rear in lower reaches of rivers and estuaries much more than stream-type fish. The other species of Pacific salmon (juvenile chum and pink salmon) migrate to salt water either immediately or within a few weeks after emergence. Coho salmon generally spend a year rearing in fresh water before migrating, and sockeye salmon typically spend a year rearing in a lake before migrating (NRC 1996).

Steelhead and coastal cutthroat trout exhibit substantial variability in their life histories (Behnke 1992; Burgner et al. 1992; Hall et al. 1997). Both species spawn from late winter through the spring. Adult steelhead that return to fresh water fully mature from late fall through spring are considered winter-run fish, whereas those that are sexually undeveloped and return from late spring through early fall are considered summer-run fish (Withler 1966). Anadromous individuals of both species may spend one to six years in fresh water with most migrating after at least two years (Burgner et al. 1992; Trotter 1997). Steelhead migrate to the open ocean and spend one to four years before returning to spawn, whereas coastal cutthroat trout migrate to estuaries and nearshore areas for a matter of months before returning to fresh water. Unlike salmon, steelhead and coastal cutthroat trout may survive after spawning and return to salt water to forage and make multiple spawning runs. In addition, coastal cutthroat trout exhibiting resident, fluvial (i.e., migrating to larger rivers only), and anadromous life histories are thought to occur in some streams.

The Columbia River basin historically produced some of the world’s largest runs of Pacific salmon. Predevelopment estimates of historical abundance for adult salmon of all species returning to the basin range from 7.5 million to 16 million fish annually (NRC 1996). Overfishing and habitat degradation reduced abundance of naturally produced salmon to about one-eighth of their predevelopment abundance by 1900. Habitat loss and degradation, dam operations, and some hatchery practices further reduced abundance of naturally produced, wild salmon. Minimum in-river run estimates for adult Chinook and coho salmon are currently about 1 million fish (1991-2005 mean 1.09 million, range 0.41-2.26 million [PFMC 2007]). With over 80 million hatchery produced salmon and steelhead annually released in the Columbia River basin (1979-2005 mean 82.16 million, range 66.34-95.09 million for Chinook, coho, and sockeye salmon and steelhead combined [FPC 2006]); the majority of adults returning to the basin are artificially produced for most salmon and steelhead stocks (NRC 1996). The status of and threats to anadromous salmonids in the Columbia River basin have resulted in listing 13 ESUs and DPSs of salmon and steelhead as threatened or endangered under the Endangered Species Act (ESA).

Although the presence of salmonids in the Columbia River estuary has seasonal patterns (e.g., peak juvenile abundance in spring and early summer), adults and juveniles consisting of various species, runs, and life-history strategies may be present throughout the year. No salmonid spawning habitat occurs within the boundaries of the refuges. However, opportunities exist to provide access for fish through Julia Butler Hansen Refuge to potential spawning habitat in Risk Creek and alternate access to spawning habitat presently used by coho salmon, steelhead, and coastal cutthroat trout in Nelson Creek (Johnson et al. 2009; Yoshinaka and Lohr 2009). Therefore, habitats used directly by salmonids at the two refuges primarily consist of tidally influenced sloughs, marshes, and floodplains for juvenile rearing. These habitats also indirectly provide benefits to salmonids through production and export of nutrients, organic matter, and invertebrates, which contribute to the food web in the estuary.

4.4.1.2 Sturgeon

For anadromous nonsalmonid fish, the largest population of white sturgeon (*Acipenser transmontanus*) in Washington occurs in the Columbia River estuary downstream of Bonneville Dam (Wydoski and Whitney 2003). The abundance of fish 21.3 inches or greater in length was estimated at 895,500 individuals (range 678,000 to 1,058,300) from 1986 through 1990. White sturgeon feed primarily on bottom organisms such as mollusks, crustaceans, and fish and can live more than 100 years. A commercial and popular sport fishery exists for white sturgeon. Other anadromous fish in the Columbia River estuary include Pacific lamprey (*Lampetra tridentate*), green sturgeon (*Acipenser medirostris*), American shad (*Alosa sapidissima*), and eulachon (*Thaleichthys pacificus*).

4.4.1.3 Warm Water Fish

Non-native warm water fish species are found in sloughs within the dikes at Julia Butler Hansen Refuge. These include such species as common carp (*Cyprinus carpio*), brown bullhead (*Ameiurus nebulosus*), pumpkinseed (*Lepomis gibbosus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and white crappie (*Pomoxis annularis*) (Johnson et al. 2009). These species were introduced to the Pacific Northwest from other regions to provide a sport fishery and have become established. Most of these species are predators and likely prey on native fish, amphibians, and aquatic invertebrates. Densities of these introduced species are relatively low outside of diked sloughs at the refuge.

4.4.2 Birds

More than 175 species of birds occur along the lower Columbia River and estuary (LCREP 1999). The habitat mosaic of sand islands, sandbars, tidal mud flats, marshes, swamps, scrub-shrub, and riparian forest attracts an abundance of neotropical migrant songbirds, as well as waterfowl, marsh birds, waterbirds, and raptors.

4.4.2.1 Waterbirds

The refuges provide important wetland habitat that sustains the migratory birds of the Pacific Coast. The refuges are both a wintering area and a migrational stopping area for waterfowl that nest in Alaska and winter in Oregon, Washington, and California. Up to 50,000 ducks are often present during November through April. The most common species are mallard, American wigeon, pintail, green-winged teal, bufflehead, northern shoveler, and greater scaup. In addition, a few thousand resident mallards, cinnamon teal, gadwalls, and wood ducks nest on the refuges during the spring and summer. The tidal and nontidal marshes attract the greatest numbers of ducks, although shallow open water is preferred by scaup, mergansers, western grebes, common loons, scoters, and ruddy ducks.

Six subspecies of wintering Canada geese (*Branta canadensis*) are found at the estuary—lesser (*B. c. parvipes*), Taverner (*B. c. taverneri*), dusky (*B. c. occidentalis*), western (*B. c. moffitti*), Vancouver (*B. c. fulva*), and Aleutian (*B. c. leucopareia*). Cackling geese are the most numerous of the wintering geese. Geese forage in the fields on Julia Butler Hansen Refuge's Mainland and Tenasillahe units. They also roost, loaf, and forage in the Estuary Islands Unit of the Lewis and Clark Refuge. There are a total of 10,000 to 15,000 Canada and cackling geese present on the estuary during the winter months. A flock of 300 to 500 lesser snow geese typically winter in the lower reaches of the Lewis and Clark Refuge. A resident population of approximately 2,000 western Canada geese nest throughout the estuary. The dredge spoil islands (Miller Sands, Pillar Rock, Fitzpatrick) within the Lewis and Clark Refuge are especially important goose nesting areas.

Approximately 500 to 1,000 tundra swans winter at the estuary, especially in the Lewis and Clark Refuge. Their preferred habitat is tidal marsh, where they feed on the roots and tubers of wapato and other marsh plants.

American bitterns and great blue herons are abundant. There are heron nesting rookeries at both refuges. These colonies are not surveyed regularly, but it is apparent that the number of nesting herons has declined in recent years. This may be due in part to the increase in nesting bald eagles, which prey on heron chicks and eggs. Other factors such as human disturbance and contamination may also be involved. Bitterns nest in fields at the Julia Butler Hansen Refuge. Great egrets are common during winter. The refuges provide wintering habitat for western and pied-billed grebes, and common loons. Red-throated loons visit during spring migration. Virginia and sora rails nest in the marshes and grasslands.

Eight thousand pairs of Caspian terns formerly nested on Rice Island, along with a few hundred pairs of double-crested cormorants. Because the terns were consuming large numbers of juvenile salmon, the colony was moved downriver to East Sand Island in Baker Bay (USFWS 2005b). The cormorants also moved to East Sand Island and joined a larger nesting colony there. A few pairs of cormorants still nest within the Lewis and Clark Refuge on navigation markers. Several hundred pairs of glaucous-winged/western hybrid gulls presently nest at Rice Island and Miller Sands Spit.

4.4.2.2 Shorebirds

Migrating shorebirds feed and rest on intertidal mud flats during the spring, summer and fall. They feed on a variety of invertebrate organisms, including annelid and nematode worms and amphipods. The estuary has been recognized by the Western Hemisphere Shorebird Reserve Network as an internationally important area because more than 100,000 shorebirds are sometimes present. Principal species are dunlin, western sandpiper, short-billed dowitcher, and greater yellowlegs.

4.4.2.3 Raptors

Raptors include bald eagle, peregrine falcon, white-tailed kite, northern harrier, kestrel, merlin, red-tailed hawk, red-shouldered hawk, rough-legged hawk, Cooper's hawk, sharp-shinned hawk, and osprey, as well as barn, great horned, short-eared, barred, screech, saw-whet, and pygmy owls.

Bald Eagle

The bald eagle was removed from the federal threatened and endangered species list in 2007. It is still listed as threatened by the states of Oregon and Washington. The species will continue to be closely monitored by Federal and state agencies. Bald eagles are a common resident of the refuges. In 2005, there were six nesting pairs on the Julia Butler Hansen Refuge that produced a total of eight young, and eight nesting pairs on the Lewis and Clark Refuge that produced a total of five young. Eagles on the refuges nest in large cottonwood and Sitka spruce trees. In addition, 27 pairs nested on mainland areas adjacent to the refuges (Isaacs and Anthony 2005).

Environmental contaminants may be reducing the nesting success of bald eagles along the lower Columbia River. Buck et al. (2005) found thin eggshells and elevated levels of DDE, PCBs, and dioxins in eggs taken from nests. Eagle productivity, however, appears to be increasing. The number of young produced per occupied site in the Columbia River Recovery Zone for the period 2001 to 2005 was 0.994, compared to 0.814 for the preceding five years (1996-2000) (Isaacs and Anthony 2005). The productivity goal in the Pacific Bald Eagle Recovery Plan is a minimum of 1.00 young per occupied site (USFWS 1986).

Eagle numbers in the estuary peak in late winter/early spring, when more than 150 may be present. They perch along the water and forage over shallows and tidal flats at low tide and at first light. They feed primarily on fish, although waterfowl, seabirds, carrion, and small mammals are also taken. Favored fish species are largescale sucker, American shad, common carp, and salmonids (Watson et al. 1991).

The shallow waters, abundant fish and waterfowl, large cottonwood and spruce trees, and relatively low human presence that characterize the refuges make ideal bald eagle habitat. Toxic contaminants in the Columbia River will continue to be an issue for years to come, but national and regionwide cleanup efforts are making progress. The habitat within the refuges is expected to remain suitable. Eagles are susceptible, however, to human-caused disturbance. The presence of people can disrupt an eagle’s feeding, resting, and nesting activities. While some eagle populations are fairly tolerant of human presence, other populations are not. Eagles of the Columbia River estuary avoid boats, especially stationary boats, within a distance of about 1,300 to 2,600 feet (McGarigal et al. 1991). The presence of large numbers of recreational boats has the potential to seriously disrupt eagle foraging. Recreational use of the estuary, including the refuges, is increasing and may in the future have negative impacts on eagles.

4.4.2.4 Landbirds

Virtually all landbirds that occur in the region use the refuges for nesting and foraging. Particularly abundant species include song sparrow, savannah sparrow, red-winged blackbird, tree swallow, common yellowthroat, American robin, yellow warbler, golden-crowned kinglet, marsh wren, Steller’s jay, and black-capped chickadee. Less common species found at the refuges include red-eyed vireo and streaked horned lark.

4.4.3 Mammals

The CWT deer is the principal focal species at the Julia Butler Hansen Refuge and may be found in small numbers on the Lewis and Clark Refuge. See the Section 4.5.3.2 for information on CWT deer numbers and ecology.

4.4.3.1 Coyote

The coyote is one of the most widely distributed carnivores in North America. Despite more than 100 years of intensive efforts to control coyotes and reduce coyote depredation on livestock, coyotes are abundant and have expanded their range (Litvaitis and Mautz 1980). Human activities have often unintentionally benefited coyotes. For example, coyotes thrived in the Cascades, but only after their habitat was altered by clear cutting and wolves—their primary competitors—were extirpated (Toweill and Anthony 1988).

The coyote's social organization revolves around the mated pair. Each pair occupies a home range that it defends against other coyotes. However, pairs often accept the presence of one or more "associates." These are nonbreeding adults that share the home range and assist in pup rearing duties (Andelt 1985; Ryden 1989). Home range size and coyote density vary according to prey abundance, topography, and vegetative characteristics (Gese et al. 1988). Home ranges often occupy 10 to more than 40 square miles or more (Andelt and Gipson 1979; Gese et al. 1988; Litvaitis and Shaw 1980; Springer 1982), but it may be considerably smaller when conditions are favorable. Gese et al. (1988) and Windberg and Knowlton (1988) reported home ranges as small as 1 square mile. Densities may be higher than home range size would indicate (Hein and Andelt 1995). Ranges of adjacent pairs may overlap, at least at the peripheries (Litvaitis and Shaw 1980), and transient (unmated) individuals whose home ranges overlap those of mated pairs are usually present (Andelt 1985; Gese et al. 1989).

Densities and home ranges on the refuge are unknown, but coyotes are observably common throughout the year. Townsend voles (*Microtus townsendi*) and other small mammals thrive in the fields and provide an abundant, year-round, prey base. The Mainland and Tenasillahe Island units are each about 3 square miles in size. The frequency with which coyotes are observed and heard by refuge staff suggests that two or three mated pairs are typically occupying each refuge unit.

In accordance with Julia Butler Hansen Refuge's PMP/EA (USFWS 1997), periodic coyote control has been conducted in recent years on some units of Julia Butler Hansen Refuge during the late winter and early spring (late December to April 15). The objective of control efforts was to remove all coyotes from the refuge during the early CWT deer fawning season, but that objective was not always achieved. The number of coyotes removed from the Mainland Unit was 12 in 1997, one in 1998, four in 2005, 11 in 2006, and eight in 2007. At Tenasillahe Island, the number removed was 12 in 2004, six in 2005, four in 2006, and five in 2007. The lethal coyote control used on the refuge likely had little effect upon the local population.

Coyote mating on the Julia Butler Hansen Refuge typically occurs during January or February and five to 10 pups for each breeding pair typically are born during April or May (Burt and Grossenheider 1964). Pups are fed by the adults for several months then disperse from their parents' home range before reaching one year of age, but they may remain longer (Andelt 1985; Bowen 1982; Nellis and Kieth 1976). Mortality of pups often exceeds 50 percent during their first year (Andelt 1985; Nellis and Kieth 1976). If each coyote pair on Julia Butler Hansen Refuge were to have pups in the spring, there would likely be at least 20 coyotes on the Mainland Unit and a similar number on Tenasillahe Island Unit during the summer months.

The typical adult coyote weighs 25 to 30 pounds, although there is some geographic variation and occasionally individuals may be larger (Berg and Chesness 1978). Coyotes are opportunistic, omnivorous foragers; their diet is flexible based upon prey that is available. Diets can include large and small mammals such as mice, rats, rabbits, and hares; deer and other wild ungulates; livestock and domestic pets; and carrion; as well as reptiles; amphibians; fish; insects; fruits; and even farm crops such as corn (Bailey 1936; Gier 1957). Deer, especially fawns, are often a major food item for coyotes (Andelt 1985; MacCracken 1984; Toweill and Anthony 1988). During the breeding season, coyotes seek larger prey (e.g., deer fawns) to feed their young (Till and Knowlton 1983). Harrison and Harrison (1984) found that pups at a site in Maine were fed deer fawns almost exclusively during June and July.

A medium-sized coyote requires about 4,800 mice or eight adult deer per year to meet its basic resting energy needs (Litvaitis and Mautz 1980); however, coyote predation on deer older than 120 days is low on the Julia Butler Hansen Refuge (A. Clark, unpublished data). This does not include the energy needed for hunting, keeping warm, growth, nursing, etc., which could triple the energy requirements. The coyotes on Julia Butler Hansen Refuge would be capable of consuming hundreds of fawns annually if that were their only food, but meadow voles are likely a major part of the coyotes diet (Reichel 1991).

4.4.3.2 Other Mammals

Mammals that inhabit the forested and pasture areas of the refuges include bobcat, coyote, Virginia opossum, raccoon, porcupine, striped skunk, snowshoe hare, northern flying squirrel, long-tailed weasel, and a variety of small mammals such as bats, mice, voles, moles, and shrews. Black bear and mountain lion occupy the adjacent hills and pass through the refuges occasionally; however, there are no recorded sightings for these large mammals on Julia Butler Hansen Refuge. Columbian black-tailed deer, the most abundant deer species in western Washington and Oregon, have a minimal presence on the refuges. A few occupy Lewis and Clark Refuge's Lois, Mott, and Karlson islands; and individual black-tails often pass through the Julia Butler Hansen Refuge.

Roosevelt elk are a management concern on the Julia Butler Hansen Refuge. They compete with CWT deer for browse and cover (USFWS 2004). As many as 110 elk occupied the Mainland Unit in 1983. Since the early 1980s, a combination of trapping, transplanting (USFWS 1997), and more recently controlled public hunting, have reduced herd numbers to 20, the refuge's maximum population objective.

Although population estimates (or densities) are not available, small mammals are relatively common on the refuges. Townsend's voles, Townsend's moles, and deer mice are abundant on the refuges. Bushy-tailed wood rats and Norway rats have also been documented. Shrews are commonly observed, but species have not been identified. Shrews that occur in the general vicinity of the refuges include vagrant, Bendire's, and Trowbridge's shrews (WDFW 1999).

Mammals that inhabit the streams, rivers, swamps, and associated riparian habitats within the refuges include mink, beaver, nutria, muskrat, harbor seal, California sea lion, and river otter. The Steller sea lion, a threatened species, follows salmon runs through the estuary.

No bat surveys have been conducted on the refuges. Species that may be present include little brown myotis, big brown bat, Yuma myotis, long-legged myotis, western long-eared myotis, California myotis, silver-haired bat, Townsend's big-eared bat, and hoary bat (WDFW 1999). Many bat species roost and forage in forested areas and use snags and downed logs as day roosts.

4.4.4 Reptiles and Amphibians

Reptiles and amphibians are most abundant in the nontidal habitats of the refuges. This seeming avoidance of tidal areas may be due to the cold waters of the Columbia River, the abundance of predatory fish, and the large tidal fluctuations in water depth.

Refuge staff have conducted surveys of amphibians breeding in ditches and managed wetlands at the Julia Butler Hansen Refuge. The species identified are Pacific treefrog, red-legged frog, American bullfrog, northwestern salamander, and long-toed salamander. All are present in large numbers. Western red-backed salamanders and ensatinas may also be present (neither are aquatic breeders). Bullfrogs breed in ditches and sloughs, but not the managed seasonal wetlands (these typically are dry by late summer and bullfrog tadpoles require two years to mature). Treefrogs, red-legged frogs, and long-toed salamanders breed in greatest numbers in the managed seasonal wetlands, although they also utilize ditches and vernal pools.

Garter snakes are abundant on the diked portions of the Julia Butler Hansen Refuge. Most are either common or western terrestrial garter snakes, although the northwestern garter snake may also be present. Painted turtles are often seen sunning on logs in the sloughs. Northern alligator lizards have been observed a few times but are considered rare on the refuges.

4.4.5 Invertebrates

Mosquito sampling was conducted on the Mainland Unit in 2005 and 2006, as part of the Washington Department of Health's statewide West Nile virus surveillance. Nine species were identified, including 7 not previously documented in Wahkiakum County. At least 3 of the species found on the refuge are potential vectors of West Nile virus. However, the virus itself has not been detected in the local area. No surveys of other insects have been conducted.

Native freshwater mussels have been declining in North America to the point that nearly three-quarters of the 297 known species are imperiled (Nedeau et al. *undated*). Little information is available concerning mussels on the refuges. Mussels have been seen but only collected at one site on Tenasillahe Island. Oregon floaters have been confirmed to be present, while winged floaters are likely. California floaters may also be present. The California floater is a candidate for listing as a threatened or endangered species in the state of Washington, and the Oregon floater is considered a vulnerable species by the Washington Natural Heritage Program.

The tidal flats and shallows support abundant populations of invertebrates that are an important part of the estuary's food chain. Surveys conducted during the early 1980s found a minimum of 64 species in the river bottom sediments (Holton 1984). The amphipod *Corophium salmonis* is a major food item of juvenile salmon and other small fish (Bottom et al. 1984). Other amphipods, including *Cororphium*, along with a wide variety of benthic worms and other invertebrates, are an essential food source for migrating western sandpipers and other shorebirds (Wilson 1994).

4.5 Federally Threatened and Endangered Species

4.5.1 Fish

The definition of "species" under the ESA includes any distinct population segment of vertebrate fish or wildlife. In implementing the ESA, NOAA's Fisheries Service identified ESUs for Pacific salmon and DPSs for steelhead, and considers both as species under the ESA. Thirteen species of salmon and steelhead are listed in the Columbia River basin (Table 4-6), two of which are endangered and the remaining 11 are threatened. Even though spawning habitat for the salmon and steelhead occurs throughout various watersheds in the basin, all 13 species use the Columbia River estuary as a migratory corridor, and to varying degrees, rearing habitat. The Columbia River estuary has been designated critical habitat as a rearing/migration corridor for 12 of these species, with critical habitat currently being identified for coho salmon. Because the lateral extent of designated critical habitat in estuaries is "extreme high water," much of both refuges are included. The Service has supported habitat restoration actions with partners to improve rearing habitat for juvenile salmonids at the Crims Island Unit and is presently conducting work on sloughs and wetlands at the Tenasillahe Island and Mainland units.

Table 4-6 Federally Listed Pacific Salmon and Steelhead in the Columbia River Basin

Species	Species (ESU or DPS)	Listing status
Sockeye salmon	Snake river	Endangered
Chinook salmon	Upper Columbia River Spring-run	Endangered
	Snake River Spring/Summer-run	Threatened
	Snake River Fall-run	Threatened
	Lower Columbia River	Threatened
	Upper Willamette River	Threatened
Coho salmon	Lower Columbia River	Threatened
Chum salmon	Columbia River	Threatened
Steelhead	Upper Columbia River	Threatened
	Snake River Basin	Threatened
	Lower Columbia River	Threatened
	Upper Willamette River	Threatened
	Middle Columbia River	Threatened

Bull trout (*Salvelinus confluentus*) is a salmonid federally listed as threatened. It is native to the Pacific Northwest, including the Columbia River basin, and is closely related to the Dolly Varden (*S. malma*). Bull trout are especially dependent on cold, clean streams and rivers for spawning, and may exist as resident or migratory individuals (i.e., reside solely in the stream in which they were spawned versus fish that migrate from spawning streams to larger rivers, lakes, or the ocean). The closest known spawning habitat to the Columbia River estuary is in the upper Lewis River basin, which is part of the lower Columbia River recovery unit for bull trout (USFWS 2002b). Although the estuary was not designated as critical habitat for bull trout, the role of the lower Columbia River in bull trout recovery has been identified as a primary research need in the draft Bull Trout Recovery Plan.

4.5.2 Birds

4.5.2.1 Brown Pelican

Endangered brown pelicans are common during spring, summer, and fall in the lower estuary. Most are immature and nonbreeding adult birds. The number of pelicans in the estuary has soared since the 1980s. East Sand Island in Baker Bay is a primary night roost. Approximately 11,000 pelicans were counted there in 2002 (Wright et al. 2003). Pelicans utilize the brackish water from Tongue Point downstream in the estuary and the offshore waters, and only occasionally venture into the downstream portion of the Lewis and Clark Refuge.

Brown pelicans feed on fish, especially herrings and anchovies. They typically feed by plunging into the water when fish are spotted, although they also catch fish by swimming into surfacing schools of baitfish (Shields 2002). There is an abundance of anchovies and other schooling marine forage fishes near East Sand Island (Emmett et al. 2006). These fish species likely make up the majority of the diet of brown pelicans that roost on East Sand Island (Roby 2007).

4.5.2.2 Northern Spotted Owl and Marbled Murrelet

Threatened northern spotted owls and marbled murrelets occur in western Washington and Oregon, but they are not known to utilize the refuges.

4.5.2.3 Streaked Horned Lark

The coastal strain of the streaked horned lark is a candidate for protection under the ESA. In the Columbia River estuary, streaked horned larks are found in sparsely vegetated sandy areas that are dominated by grasses and forbs with few or no trees or shrubs (Pearson and Hopey 2005). This type of habitat occurs mainly on the dredge spoil islands. Islands within the approved boundaries of Lewis and Clark and Julia Butler Hansen Refuges that support breeding pairs of horned larks are Rice, Miller Sands Spit, Pillar Rock, and Crims. Streaked horned larks have also been seen on Welch, Tenasillahe, and Wallace islands but have not been confirmed as breeding there. As the vegetation develops on the dredge spoils, these areas will likely support breeding birds as well. While the dredge spoil areas are not presently part of the refuge, one or more of them may become so if an agreement is reached with the ODSL. Currently, streaked horned larks are not known to occur on either refuge.

4.5.3 Mammals

4.5.3.1 Steller Sea Lion

An estimated 25,000 Steller sea lions (threatened), also known as northern sea lions, frequent the Washington and Oregon coasts. As many as 1,000 Steller sea lions use the south jetty at the mouth of the Columbia River as a haul-out site (NOAA 2006). Some of these animals follow runs of smelt (eulachon) and/or salmon up the river, through waters that are within or adjacent to the refuges. Steller sea lions have been observed upstream in the Columbia River as far as Bonneville Dam. It is likely that some individuals occasionally haul out on sand bars within the Lewis and Clark Refuge. There is increasing controversy over sea lions and harbor seals eating salmon in the river. Harassment and even lethal take are being discussed as means of reducing marine mammal predation on threatened and endangered salmon runs. Much remains to be learned about the interactions between marine mammals and salmon in the estuary.

4.5.3.2 Columbian White-tailed Deer

Distribution

The endangered CWT deer likely was abundant within its historic range, which likely encompassed floodplain and riverside habitats in the lowlands from southwestern Oregon (Roseburg) to the south end of Puget Sound (Bailey 1936; Smith 1985). In 1806, Lewis and Clark observed and harvested white-tailed deer along the Columbia River from approximately The Dalles, Oregon, to Astoria, Oregon (Thwaites 1905). By the early 1900s, the CWT deer had been extirpated throughout much of its historic range (Bailey 1936; Jewett 1914) as a result of habitat loss and degradation primarily from agriculture conversions and logging as well as industrial and urban development (Brookshier 2004; Gavin et al. 1984). Scheffer (1940) documented the presence of CWT deer along the lower Columbia River in 1939, where an estimated 500 to 700 animals inhabited diked floodplain areas near Cathlamet, Washington, and Westport, Oregon. Small numbers of white-tails (presumably CWT deer) were also known to exist along the Umpqua River in the vicinity of Roseburg, Oregon, in Douglas County.

Recovery Criteria

The CWT deer was federally listed under the Endangered Species Preservation Act (P.L. 89-669, 80 Stat. 926) during 1968 when only a small population (300-400 deer) was known to exist along the lower Columbia River as one minor and four main subpopulations in southwest Washington and northwest Oregon (USFWS 1983). During 1978, a population of approximately 2,000-2,500 CWT deer was found in Douglas County, Oregon, that was then federally listed as endangered.

The recovery plan for CWT deer addressing both geographically isolated, distinct populations was released during the early 1980s (USFWS 1983). In southwest Oregon, land use planning and zoning ordinances were implemented along with other conservation actions specified in the recovery plan. As a result, this population has increased to approximately 6,000 deer with subsequent delisting during summer 2003. In the lower Columbia River area, conservation activities from the recovery plan focused on securing and managing lowland habitats, including establishment of the Julia Butler Hansen Refuge. To down-list the lower Columbia River population to threatened, the recovery plan specified a population of more than 400 CWT deer must be maintained in three or more viable subpopulations of 50 deer or more, with two of the subpopulations located in secure habitat. Three or more viable subpopulations located in suitable and secure habitat would be required to federally delist the CWT deer. As described in the recovery plan, secure habitat is free from adverse human activities such as clearing woody plants and unregulated heavy grazing by domestic animals. The Mainland and Tenasillahe Island units provide secure habitat for two of the four subpopulations of CWT deer in the lower Columbia River. Presently, there are four established, viable subpopulations along the Columbia River in Washington and Oregon on the Mainland Unit, Tenasillahe Island Unit, Puget Island, and Westport/Wallace Island.

All of the subpopulations in the lower Columbia River are viable (more than 50 deer), where the total population was more than 500 deer during 2009 (Table 4-7). However, only two of the established subpopulations (Mainland and Tenasillahe Island units) are in secure habitat. Therefore, the recovery criteria can be met only by securing habitat for a third subpopulation or establishing a new subpopulation in secure habitat. The Service attempted to secure approximately 1,700 acres of habitat for the Westport/Wallace Island subpopulation, but only 800 acres have been acquired to date (including 579-acre Wallace Island). This area is insufficient to support a viable subpopulation of more than 50 deer. Subsequently, efforts have focused on establishing a new subpopulation on public lands.

Table 4-7 Estimated Number of CWT Deer in the Lower Columbia River Population, by Subpopulation, in 2009

Subpopulation	Number of Deer
Mainland Unit	61[1]
Tenasillahe Island Unit	112[1]
Puget Island	156
Westport/Wallace Island	161
Upper Estuary Islands	97
Population Total	587

[1]Numbers reflect the effects of a severe flood on the Mainland Unit in 2009 and the subsequent translocation of 20 deer from Tenasillahe Island to the Mainland Unit.

Beginning in 1999, the Service, WDFW, and ODFW transplanted CWT deer to a group of undeveloped river islands (collectively referred to as the Upper Estuary Islands) located immediately upstream of the existing population. The combined land area of these islands is about 1,730 acres; most is publicly owned (Table 4-8). From 1999 to 2006, 191 CWT deer were translocated to the Upper Estuary Islands from Puget Island, Westport, and the Mainland Unit.

Table 4-8 Upper Estuary Islands Acreage and Land Ownership

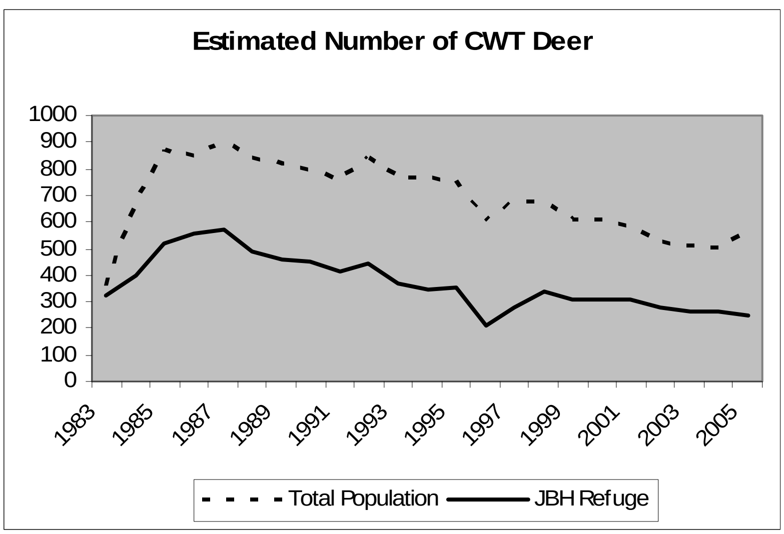
Island	Approx. Acres	Land Ownership
Crims	720	Julia Butler Hansen Refuge 473 acres; privately owned land 130 acres; ODSL 117 acres
Fisher	255	Washington Department of Fish and Wildlife
Hump	150	Washington Department of Natural Resources
Lord	500	Oregon Department of State Lands
Walker	109	Private, Columbia Land Trust has a 50-year conservation lease

Population Demographics

Population Trends in the Lower Columbia River

The lower Columbia River population has experienced considerable fluctuations with a long-term declining trend (Meyers 2008, 2009). Based upon ground and aerial classification surveys (fawns, does, and bucks) as well as monitoring of reproductive success, the total estimated population has ranged from 900 (1988) to 350 (1983) with the 2009 level at approximately 593 deer. On Julia Butler Hansen Refuge, the CWT deer population has ranged from 575 (1988) to less than 200 (1996) (Figure 4.1), where the lowest estimate occurred after extensive river flooding caused substantial mortality. In February 2009, there were an estimated 235 CWT deer on Julia Butler Hansen Refuge and 358 animals on nonrefuge lands (Meyers 2009). Severe flooding on the Mainland Unit during 2006 and 2009 caused short-term, substantial population declines within this unit. This decline was offset by a recent increase on Tenasillahe Island. However, long-term declines are more substantial. From 1988 to present, the CWT deer in the lower Columbia River population and on Julia Butler Hansen Refuge have exhibited long-term declines of 34 percent and 59 percent respectively.

Figure 4.1 The estimated number of CWT deer in the lower Columbia River population and the estimated number on the Julia Butler Hansen Refuge, by year from ground and aerial classification surveys.



Survival Rates

Using CWT deer classification data from aerial and ground surveys conducted during winter months over the past three decades, a deterministic projection matrix model with an optimization routine (Phillips and White 2003; White 2000; White and Lubow 2002) was used to estimate average annual survival rates of adult bucks, adult does, and fawns for the Mainland and Tenasillahe Island units.

> Note to readers: Symbols used in this section include the following:
> $\hat{S}_B$—survival rates of adult bucks older than 18 months;
> $\hat{S}_D$—survival rates of adult does older than 18 months; and
> $\hat{S}_J$—survival rates of fawns/juveniles 6-18 months old.

Optimized values for model parameters (survival rates) were estimated through iteration. The deterministic model also included other factors (e.g., weather severity index) in order to make it site-specific for CWT deer on Julia Butler Hansen Refuge. A set of explicit assumptions (e.g., juveniles were recruited into the herd during the winter survey of their second year at 1.5 years old) was identified before the modeling was conducted. Deterministic model fit was adequate for the Mainland and Tenasillahe Island units because estimated population size was generally either close to ground counts (adjusted for sighting probability) or between observed and adjusted ground counts. Data from early mark-resight surveys (Mainland Unit only) and from aerial surveys also indicated fitness of the deterministic models.

All CWT deer survival rates were slightly higher for Tenasillahe Island Unit compared with the Mainland Unit's survival rates of: $\hat{S}_J = 0.814$, $\hat{S}_D = 0.839$, and $\hat{S}_B = 0.685$ derived from deterministic modeling. For the Tenasillahe Island Unit, survival estimates from modeling were: $\hat{S}_J = 0.849$, $\hat{S}_D = 0.875$, and $\hat{S}_B = 0.773$.

Population Trends of the Mainland and Tenasillahe Island units

The historical population trends of the Mainland and Tenasillahe Island units for the deterministic models were then evaluated by calculating the annual rate of population change (λ) using the following formula.

$$\lambda = \left\{ \prod_{t=1}^{k} \left[N(t+1) / N(t) \right] \right\}^{1/k}$$

Where N is population size, t is incremented year, and k was total number of years. A λ value equal to 1 implies a stable population trend. Population rates of change indicated a long-term decline in deer numbers for the Mainland Unit (λ = 0.956) and relative stability for Tenasillahe Island Unit (λ = 1.004). The long-term population trend derived through deterministic modeling was consistent with long-term classification survey data (Figure 4.1) from Julia Butler Hansen Refuge.

Deer Densities

Estimated deer densities on Julia Butler Hansen Refuge from herd classification data have varied considerably over time. Gavin et al. (1984) estimated the density on the Mainland Unit ranged from 52 to 74 deer per square mile (164 to 230 total deer) from 1972 to 1977. Densities have been as high as 160 deer per square mile during the mid 1980s and as low as 19 deer per square mile following floods during 1996 and 2006. At the Tenasillahe Island Unit, estimated densities have ranged from less than 15 deer to 64 deer per square mile. Both Tenasillahe Island and the Mainland units are intensively managed to provide habitat for CWT deer, and they support higher densities compared with other natural, unmanaged units of Julia Butler Hansen Refuge with lower average densities of deer. For example, in recent years, estimated densities (based on Forward Looking InfraRed (FLIR) surveys, a method of surveying wildlife populations using a camera-equipped aircraft) on Wallace and Hunting islands have been about 30 deer and 10 deer per square mile, respectively. In 1940, Scheffer (1940) estimated the total lower Columbia River population was 500-700 deer in an area of about 42.6 square miles (with a density of 12 to 16 deer per square mile).

In other parts of the U.S. with unhunted deer populations, researchers have examined various aspects of white-tailed deer density and carrying capacity. In a long-term study, the carrying capacity of the George Reserve in Michigan was estimated at 98 deer per square mile (McCullough 1984). However, deCalesta and Stout (1997) postulated that at this density biodiversity and forest regeneration would be severely impacted. They recommended using the concept of relative deer density (RDD), where the desired density would be a proportion of the carrying capacity. The exact proportion would depend on management objectives. For example, the RDD for maintaining maximum biodiversity at the George Reserve was less than 20 deer per square mile. The RDD for maximum production of deer (the maximum sustained yield) was about 55 deer per square mile. Densities at the George Reserve reached 122 deer per square mile during some years. In contrast, white-tailed deer densities in an unhunted population on the Huntington Wildlife Forest in upstate New York ranged from about 16 to 31 deer per square mile during a 30-year period (McNulty et al. 1997). There are many other examples in the literature of white-tailed deer densities; however, those previously discussed represent a reasonable range of densities for largely unhunted populations in natural habitats, which is similar to the Julia Butler Hansen Refuge setting.

Population Objectives

The Mainland and Tenasillahe Island units are managed to maintain healthy and sustainable populations of CWT deer at relatively higher densities. Forty deer per square mile is a reasonable density for Tenasillahe Island, which is less vulnerable to flooding. Because the Mainland Unit is more susceptible to flooding, a density of 35 deer per square mile is appropriate for this unit. Unmanaged islands (Wallace, Hunting, Price, and Kinnunen Cut) are more likely to support densities of 20 deer per square mile while still maintaining biodiversity. Crims Island (presently a mix of riparian forest, old fields, and tidal swamp) is likely to support 30 deer per square mile until forest replaces the old fields during the next 10 to 20 years. Therefore, the total estimated population on Julia Butler Hansen Refuge would be more than 330 deer (Table 4-9). Other lands in public or conservation ownership (e.g., Fisher Island, Lord Island, Hump Island, White Island, Willow Grove wetlands) would be expected to support CWT deer numbers to significantly contribute toward the recovery goal of 400 deer on secure habitat.

Table 4-9 Population Estimates, by Refuge Unit, for CWT Deer on the Julia Butler Hansen Refuge in Southwest Washington and Northwest Oregon

Refuge Unit	Area (square miles)	Population Estimate	
		Deer per square mile	Total Deer
Mainland	3.5	35	123
Tenasillahe Island	3.1	40	124
Wallace Island	0.9	20	18
Hunting Island*	1.2	20	24
Price Island*	0.2	20	4
Crims Island*	1.1	30	33
Kinnunen Cut Island	0.1	20	2
Westport Wetlands	0.2	20	4
Total Deer			332

*Not all of the acreage is part of the refuge, but habitats on the nonrefuge lands are expected to remain intact for at least the next 15 years.

Diet and Nutrition

White-tailed deer are considered browsers, consuming leaves and twigs of woody plants. However, they are generalist herbivores readily grazing on available forbs, grass, fruits, nuts, and fungi. Physiologically, they could be classified as grazing animals (Nagy et al. 1967).

Based on observations of feeding deer during the period 1972 to 1976, Suring and Vohs (1979) and Gavin et al. (1984) reported that CWT deer on the Mainland Unit were primarily grazers, feeding mostly on grasses and forbs. A quantitative food habits analysis, based on microhistological examination of deer feces conducted on the Mainland Unit in 1978 and 1979 (Dublin 1980), found that browse was more important than previously thought for this herd. Browse made up 23 percent of the annual diet. Browse consumption peaked during fall and winter at 30 percent and 35 percent, respectively. The principal browse species was evergreen blackberry (*Rubus laciniatus*). Based upon subsequent knowledge of food habits on the refuge, it is likely that the blackberry was actually a mix of evergreen, Himalayan (*R. discolor*), and trailing blackberry (*R. ursinus*). Grasses made up 39 percent and forbs 38 percent of the annual diet of CWT deer. Grass consumption peaked at 51 percent of the CWT deer’s diet during spring, whereas forb consumption peaked at 51 percent during summer.

A more intensive diet and nutrition study, which used microhistological techniques, was conducted by refuge staff during the period 1996 to 1998. The study area was expanded to include Tenasillahe Island and off-refuge habitat near Westport, Oregon, along with the refuge’s Mainland Unit. Ten to 15 fresh fecal samples were collected monthly from each area for two years. Samples were collected throughout each area for representation of deer from the entire area. Monthly samples for each area were combined and analyzed for plant composition, fecal nitrogen (FN), and fecal diaminopimelic acid (DAPA). Fecal nitrogen and DAPA are indicators of diet quality in terms of protein and energy, respectively. During the second year of the study, samples of the principal plants in the diet, as determined from the first year’s fecal analysis, were collected by hand seasonally (spring is March, April, and May; summer is June, July, and August; fall is September, October, and November; winter is December, January, and February), dried and ground, mixed in proportion to their occurrence in the diet, and analyzed for digestibility, protein, fat, and fiber. All analyses were conducted by the Wildlife Habitat and Nutrition Lab at Washington State University.

There were some dietary differences among the three sites (Table 4-10). At the refuge's Mainland Unit, the content of the annual diet was 19 percent browse, 44 percent grasses and sedges, 33 percent forbs, and 4 percent others (lichens, mushrooms, berries, ferns, seeds). In contrast, deer at Tenasillahe Island Unit and Westport consumed more browse and less grass. Annual diet content at Tenasillahe Unit was 36 percent browse, 30 percent grasses and sedges, 28 percent forbs, and 6 percent others. At Westport, the annual diet content was 38 percent browse, 29 percent grasses and sedges, 32 percent forbs, and 1 percent others. Blackberry (*Rubus* spp.) was the major browse consumed at all three areas. Grasses were heavily utilized during winter at all three areas, whereas forbs characterized the diet during spring and summer. Although reed canarygrass was the most abundant and available grass species at all three locations, it was underrepresented in the diet. In contrast, the deer consumed grasses from improved pastures including orchardgrass (*Dactylis* spp.), foxtail (*Alopecurus* spp.), bentgrass (*Agrostis* spp.), brome grass (*Bromus* spp.), and timothy (*Phleum* spp.). The most heavily utilized forbs were creeping buttercup (*Ranunculus repens*), horsetail (*Equisetum* spp.), birdsfoot-trefoil (*Lotus corniculatus*), and cut-leaved geranium (*Geranium dissectum*). These forbs also were abundant in improved pastures.

Table 4-10 Seasonal and Annual Food Consumption, by Forage Class, Expressed as a Percentage of the Total Diet of CWT Deer at Three Locations in Southwest Washington and Northwest Oregon, 1996-1998

	FORAGE CLASS (percent)								
	Browse			Grasses			Forbs		
Season[1]	M[2]	T[2]	W[2]	M[2]	T[2]	W[2]	M[2]	T[2]	W[2]
Fall	10.77	48.72	49.28	50.65	36.77	32.77	36.00	12.62	17.10
Winter	17.03	30.32	31.90	69.58	52.78	47.42	6.52	1.83	19.07
Spring	23.78	30.42	26.08	38.10	28.00	24.88	35.57	40.07	46.32
Summer	24.65	36.23	44.98	19.05	4.13	9.72	55.10	58.90	44.27
Annual	19.06	36.42	38.06	44.35	30.42	28.70	33.30	28.35	31.69

[1] The sum of the seasonal percentages for each area is less than 100 percent because of the presence in the diet of small amounts of other items, such as lichens, mushrooms, ferns, and berries.
[2] Location codes are M = Mainland Unit, T = Tenasillahe Island Unit, and W = Westport.

The differences in diets among the three areas was likely related to differences in forage availability. High-quality short-grass/clover fields were available on the Mainland Unit as a result of intensive habitat management. In contrast, the Tenasillahe Island Unit had fewer short-grass fields that were not well distributed through the island. Because the Westport area was a hybrid cottonwood plantation at the time of the study, grass availability was limited to tree stand edges. Although blackberry, the principal browse plant, was readily available at all three areas, CWT deer at the Mainland Unit consumed less browse and more grasses than at Tenasillahe Unit or Westport. It is likely CWT deer on the Mainland Unit selectively foraged on grasses and forbs characteristic of managed, improved pastures compared with naturally available blackberry.

Along with forage availability, it is also important to know the nutritional quality of the deer's forage. Insufficient forage quantity and/or quality can be a limiting factor for ungulate populations. Because of the difficulty of determining the nutritional status of free-ranging wild animals, fecal indices of dietary quality are often used to assess forage quality. Droppings are collected and analyzed for various compounds. FN and DAPA are two widely used indices for deer and elk (Cook et al. 1994; Hodgman et al. 1996; Irwin et al. 1993; Leslie et al. 1989; Osborn and Ginnett 2001). High tannin content in the forage can confound forage quality (Osborn and Ginnett 2001; Robbins 1983; Robbins et al. 1987), but the plants consumed by CWT deer are generally not high in tannins.

FN values for CWT deer at the Mainland Unit, Tenasillahe Island, and Westport indicate considerable seasonal variation (Figure 4.2), which is likely related to seasonal differences in diet. Values were lowest during late summer, fall, and early winter and highest during spring and early summer. Percent FN at Westport tended to be lower than that at the Mainland and Tenasillahe Island units, indicating a diet low in protein. However, all of the values are relatively high when compared to reported values for deer in other areas. The mean annual FN for the Mainland and Tenasillahe Island units and Westport was 3.93 percent, 4.17 percent, and 3.54 percent, respectively. The lowest monthly value was 2.49 percent at Tenasillahe Island Unit during January 1997, but values less than 3.00 percent occurred rarely. Examples of FN values from other areas include the following: 2.16 percent for captive deer fed a high protein diet from October through December in Texas (Brown et al. 1995); 2.17 percent and 1.44 percent for pregnant females fed high protein and low protein diets in Texas (Howery and Pfister 1990); 1.99 percent to 2.15 percent for free-ranging white-tails in Oklahoma in February (Jenks et al. 1989); and a low of 1.24 percent and a high of 3.72 percent in March and July, respectively, for free-ranging white-tailed deer in Maine (Leslie et al. 1989). In summary, the FN values for CWT deer indicate a dietary protein content that is more than adequate for growth and reproduction.

Fecal DAPA values followed seasonal trends of FN (Figure 4.3), where values were highest during spring and early summer and steadily declining through late summer and fall. The DAPA values were similar for all three areas. The mean annual fecal DAPA for the refuge Mainland Unit, Tenasillahe Island, and Westport was 1.13 percent, 1.18 percent, and 1.11 percent, respectively. Fecal DAPA reached a low point during fall, and then in winter began to increase and continued to increase until late spring/early summer. This corresponds to the cycle of vegetative growth in this mild climate: Many plants begin growing during February; there is a flush of vegetative growth during spring and early summer; then plants flower and mature during summer, becoming more fibrous and less digestible. Seasonal peaks in fecal DAPA ranged from about 1.3 percent to 1.8 percent. Seasonal lows ranged from about 0.7 percent to 0.9 percent. As with FN, these values are higher, when compared with values from other areas. Values for white-tailed deer in Maine ranged from about 0.5 percent (March) to 1.4 percent (September) (Leslie et al. 1989). Values for captive white-tails fed a high energy diet in Texas averaged about 0.6 percent (Brown et al. 1995).

Figure 4.2 Monthly mean fecal nitrogen values (percent) for three subpopulations of CWT deer in southwest Washington and northwest Oregon, August 1996–July 1998.

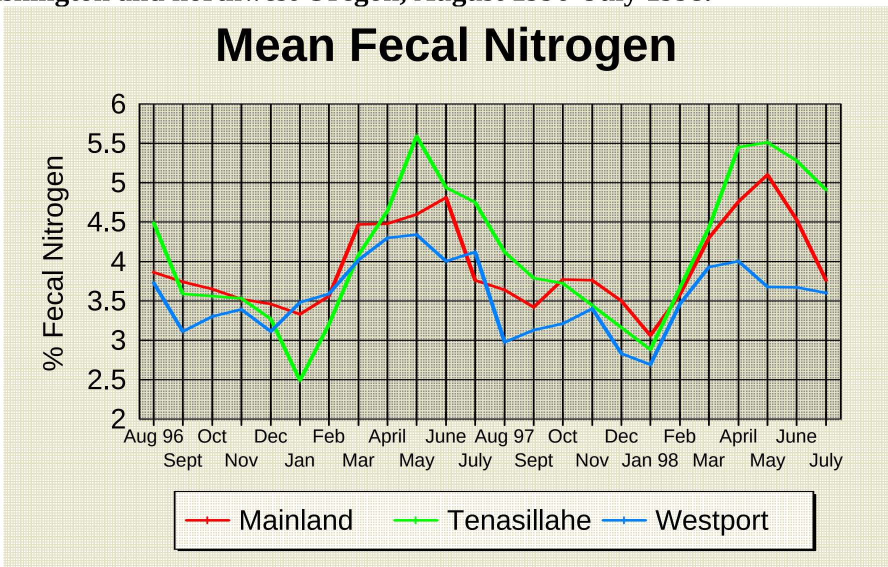
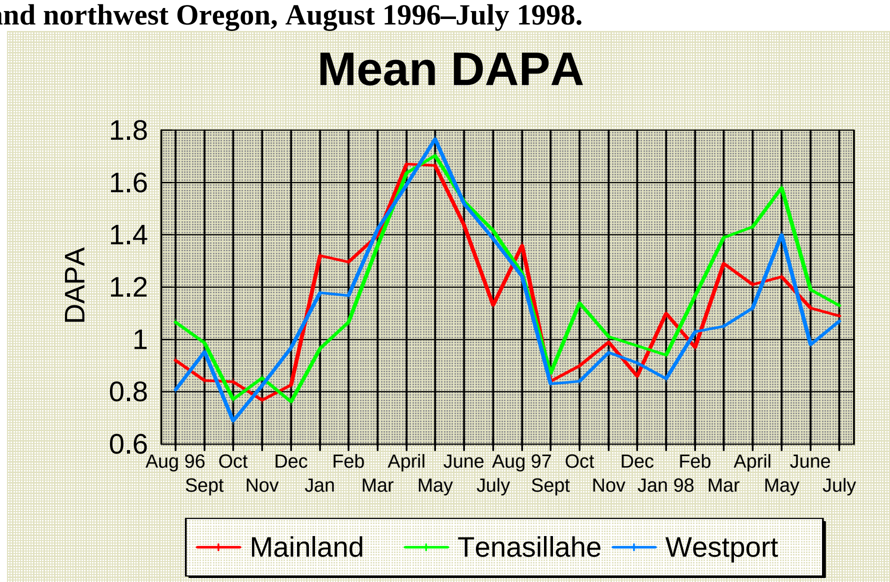


Figure 4.3 Mean monthly fecal DAPA values (mg/g) for 3 subpopulations of CWT deer in southwest Washington and northwest Oregon, August 1996–July 1998.



Analysis of CWT deer seasonal diets (plant samples mixed in proportion to their occurrence in the diet) verified that Julia Butler Hansen Refuge deer are consuming a quality diet with respect to protein and energy (Table 4-11). Crude protein (CP) values ranged from 15 percent to 22 percent (dry-matter basis). The protein requirement for growth of weaned fawns is 14 percent to 22 percent (Ullrey et al. 1967). Yearlings apparently require about 11 percent (Holter et al. 1979) and adults require as little as 6 percent to 10 percent (French et al. 1955). The availability of protein, energy, and other nutrients in forage is dependent on digestibility. The dry matter digestibility of the diets of CWT deer ranged from about 59 percent to 71 percent (Table 4-11).

All of the seasonal values were more than 60 percent, except for Westport during the fall. Dry matter digestibility greater than 50 percent is considered adequate for deer, assuming the forage has adequate nutrient content (Verme and Ullrey 1984).

Table 4-11 Seasonal Crude Protein (CP) and In Vitro Dry Matter Digestibility (IVDMD) for Diets of Three Subpopulations of CWT Deer in Southwest Washington and Northwest Oregon

Season	CP (percent)			IVDMD (percent)		
	M[1]	T	W	M	T	W
Fall	18.68	17.18	17.22	70.13	64.02	59.46
Winter	20.74	20.22	20.15	69.60	62.33	67.99
Spring	22.37	17.33	17.79	69.84	61.46	71.05
Summer	15.56	15.38	17.25	61.10	63.36	60.09

[1]Locations are M = Mainland Unit, T = Tenasillahe Island Unit, and W = Westport.

The CWT deer's diets were also analyzed for calcium (Ca) and phosphorus (P) content. Both are major constituents of bone and are essential for many other metabolic functions. White-tailed deer require about 0.45 percent Ca and 0.28 percent P in their diet on a dry matter basis (Ullrey et al. 1973; Ullrey et al. 1975), although 0.64 percent Ca is needed for maximum antler growth (Magruder et al. 1957). The diets of the deer at the Mainland Unit, Tenasillahe Island Unit, and Westport contained adequate amounts of Ca and P (Table 4-12). The P content tended to be slightly low in summer and fall at all three locations; whereas, the Ca content was generally lowest, but still adequate, in spring. The P content dropped slightly below the requirement of about 0.28 percent in summer at the Mainland Unit, in summer and fall at Tenasillahe, and in fall at Westport. A P deficiency on Julia Butler Hansen Refuge is unlikely because Ca levels were adequate during these seasons and a modest deficiency of P can be tolerated if Ca is adequate (Magruder et al. 1957).

Table 4-12 Seasonal Calcium and Phosphorus Content of the Diets of Three Subpopulations of CWT Deer in Southwest Washington and Northwest Oregon

Season	Calcium (percent)			Phosphorus (percent)		
	M[1]	T	W	M	T	W
Fall	0.79	0.78	0.89	0.30	0.24	0.26
Winter	0.45	0.64	0.70	0.35	0.30	0.31
Spring	0.44	0.51	0.54	0.35	0.32	0.34
Summer	0.77	0.82	0.64	0.26	0.24	0.28

[1] Locations are M = Mainland Unit, T = Tenasillahe Island Unit, and W = Westport.

The CWT deer's diets were also analyzed for selenium (Se). The soils are low in Se (Hansen et al. 1993) and previous research (Creekmore and Glaser 1999) (see also Population Objectives above) found low serum Se levels in CWT deer on the Mainland and Tenasillahe Island units. A Se deficiency in CWT deer can inhibit reproduction as well as lead to tissue breakdown (Hansen et al. 1993; Maynard and Loosli 1969; Robbins 1983,). The Se requirement for white-tailed deer is not known. The Se requirement for sheep is approximately 0.3 parts per million (ppm) in the forage (Merck 2006). The situation is further complicated by the fact that Se and vitamin E are interrelated, and a deficiency of one may be ameliorated by a sufficiency of the other (Robbins 1983). The Se content of the monthly deer diets from the Mainland Unit ranged from 0.23-0.86 ppm with a yearly average of 0.43 ppm. At Tenasillahe, monthly values ranged from 0.01 to 0.60 ppm with a yearly average of 0.19 ppm. The Se content at Westport was lowest with monthly values ranging from 0.01 to 0.24 ppm and a yearly average of 0.09 ppm. Allaway and

Hodgson (1964) found that Se deficiency symptoms sometimes occurred in sheep and cattle when forages contained less than 0.1 ppm. Brady et al. (1978) found no signs of Se deficiency in white-tailed deer fed a diet containing 0.04 ppm Se. Free-ranging female black-tailed deer in an area of California where the Se content of forage averaged 0.01 ppm produced more fawns when given Se supplementation (Flueck 1994).

The Se content in forages from the Mainland and Tenasillahe Island units is apparently adequate. The lowest monthly values at Tenasillahe Unit are borderline deficient, but it is unlikely that short-term deficiency would cause any symptoms, especially when the vitamin E interaction is considered. Vitamin E is relatively abundant in green forages, particularly immature green forages (Maynard and Loosli 1969). Green forages are available year-round to deer in this area. The form of the Se in the CWT deer forages is unknown. Some forms are readily available to animals, but others are not. Thus, Se deficiency cannot be ruled out completely. The Se content from Westport forages is quite low and Se deficiency there is more of a possibility. It is unknown why there are differences in Se levels among the three areas. The Mainland Unit, Tenasillahe Island Unit, and Westport are physically close together within the Columbia River floodplain and they share similar sedimentary soils.

In summary, analyses of the deer's diet and the nutritional content of the forages on Julia Butler Hansen Refuge over a two-year period indicates that deer are generally well nourished based upon macronutrients, protein, energy, calcium, and phosphorus. The Se content of the Julia Butler Hansen Refuge diets also seems adequate although dietary levels of deer on private lands at Westport were lower. Deficiencies of other trace elements such as iodine, copper, zinc, and cobalt are possible, but would be difficult to assess because the requirements of deer for these elements are not known. The concentrations of trace elements in forage plants are usually related to concentrations in the soil, thus animals living on those soils for sustained periods are obviously able to cope with any shortages.

Fecundity and Natality

The CWT deer does give birth to 1 to 4 fawns annually, with an average of 2 fawns annually. The mean number of fetuses per doe (two years old or older) is 1.8 (DelGiudice et al. 2007; Roseberry and Klimstra 1970; Verme and Ullrey 1984). Although female fawns breed in some populations, Gavin (1979) found fawns on the Mainland Unit did not breed, where does gave birth for the first time at two years of age. He also found that 70 percent of two-year-old does and 100 percent of does older than three years were pregnant. Thus, the reproductive potential of deer on Julia Butler Hansen Refuge is quite high. If all fawns born on Julia Butler Hansen Refuge survived, the fawn to doe (F:D) ratios in November would be greater than or equal to 150:100. However, the observed F:D ratios during November have been considerably lower than expected based upon reproductive potential of the herd (Table 4-13). The F:D ratio averages during 1986-2006 were 25:100 and 34:100 for the Mainland and Tenasillahe Island units, respectively. Mean recruitment ($\hat{R}$) and its process standard deviation (SD) were estimated using F:D ratio data during years with no coyote control, with methods described in Burnham et al. (1987), Phillips and White (2003), and White (2000). Mean recruitment was 0.307 (SD was 0.163) and 0.345 (SD was 0.171) for the Mainland and Tenasillahe Island units, respectively.

The F:D ratio averages during 1986 to 2006 for the off-refuge subpopulations at Puget Island and Westport were 44:100 and 35:100, respectively. The F:D ratios on Julia Butler Hansen Refuge ranged from 0:100 on Tenasillahe Island Unit during 2002 and 2003, to 68:100 on the Mainland Unit during 1984. The highest F:D ratio recorded for any Columbia River subpopulation was 70:100 on Puget Island during 2000. Only limited data are available for the newly established Upper Estuary Islands subpopulation because thick vegetation growth precludes complete herd composition counts. Counts conducted at Willow Grove diked lands near Longview, Washington, and the Diblee Point Flats near Rainier, Oregon, found an average F:D ratio of 28:100 from 2004 to 2006. Considering the large difference between observed and potential F:D ratios, all of the subpopulations are subject to considerable losses of fawns during their first summer.

Table 4-13 Fawn:doe Ratios for Subpopulations along the Lower Columbia River during 1986-2006

Year	Subpopulation				
	Mainland Unit	Tenasillahe Island Unit	Puget Island	Westport	Upper Estuary Islands[1]
1986	43:100	27:100	40:100	40:100	
1987	34:100	43:100	58:100	56:100	
1988	14:100	53:100	53:100	66:100	
1989	29:100	43:100	40:100	29:100	
1990	30:100	63:100	55:100	56:100	
1991	21:100	55:100	38:100	30:100	
1992	28:100	67:100	58:100	58:100	
1993	11:100	47:100	48:100	41:100	
1994	1:100	52:100	55:100	57:100	
1995	14:100	53:100	47:100	23:100	
1996	15:100	35:100	27:100	45:100	
1997	61:100	39:100	39:100	16:100	
1998	43:100	12:100	45:100	30:100	
1999	16:100	7:100	52:100	10:100	
2000	34:100	8:100	70:100	23:100	
2001	49:100	18:100	49:100	40:100	
2002	25:100	0:100	40:100	29:100	
2003	21:100	0:100	27:100	24:100	
2004	12:100	32:100	36:100	33:100	42:100
2005	4:100	24:100	22:100	14:100	28:100
2006	24:100	39:100	22:100	18:100	15:100
Average	25:100	34:100	44:100	35:100	28:100

[1]Subpopulation was established during 1999 by translocating deer from other areas.

Mortality factors

Neonatal (14 days old or younger) CWT deer were captured on Julia Butler Hansen Refuge during late May and early June for 10 years from 1978 to 2000. A total of 137 fawns were fitted with breakaway radio-collars and monitored daily for survival during the first 30 days, then four times or more per week thereafter, until the breakaway collars fell off (usually at 180 days or more). Survival of radio-marked fawns was periodically confirmed with visual observations. Dead fawns were recovered as quickly as possible and then shipped to the National Wildlife Health Center (Madison, Wisconsin) for necropsy. The causes of mortality were determined using necropsy results in combination with evidence collected at mortality sites. The causes of mortality were classified as predation, disease, starvation, exposure, or unknown.

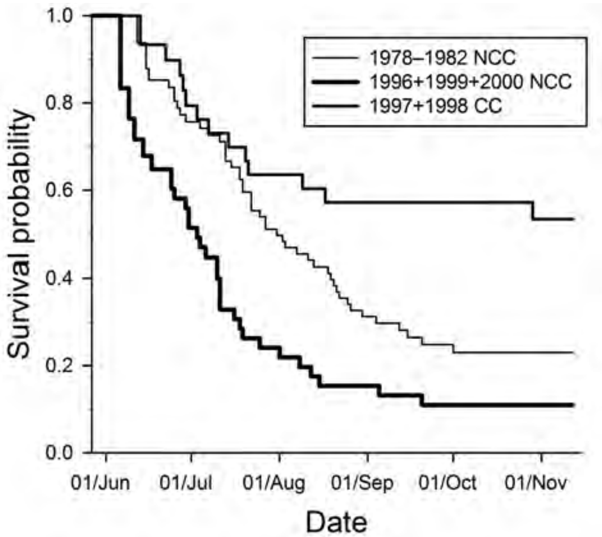
Predation was identified primarily based upon the condition of remains including bite marks, wounds, and copious bleeding (Garner et al. 1976; Steigers and Flinders 1980; White 1973). The identification of predator species followed methods described by O'Gara (1978) as well as Wade and Bourks (1984). Where necropsy revealed no evidence of trauma, disease was diagnosed by presence of bacteria or parasites, and starvation if the stomach was empty and the carcass was emaciated. Exposure was identified when other mortality factors were excluded and death was associated with one to two days of precipitation combined with cold temperatures. Fawn mortalities with insufficient pathological information from the necropsy and lack of evidence at the mortality site were classified as unknown.

Of the 131 CWT deer fawns radio-marked during our 10-year study, only 27 survived throughout the fawning period (June to November), and were monitored beyond 180 days (range is 194-1,000 days). There were 88 fawn mortalities (Table 4-14), where all of these deaths occurred by approximately four months of age. Predation was the primary cause of fawn mortality, where 69 percent of the deaths were attributed to coyotes. In addition, many of the unknown mortalities were likely caused by coyotes, but there was insufficient evidence to definitively classify them as predation. The average age of fawns killed by coyotes was 40 days. Moreover, about 95 percent of predation mortalities occurred during June, July, and August. In contrast, disease and starvation (combined) caused only 14 deaths during the fawning season. No fawn deaths were caused by exposure. For animals monitored beyond the fawning season, only five of 29 died before dropping their radio collars, two of these CWT deer were killed by coyotes and three died of other causes.

The survival rates (95 percent confidence intervals in parentheses) at the end of fawning season (more than 150 radio-tracked days) for all mortality factors combined were 0.11 (0.01-0.21), 0.23 (0.12-0.34), and 0.53 (0.35-0.72) for 1996, 1999, and 2000 (recent years without coyote control), 1978-1982 (past years without coyote control), and 1997-1998 (recent years with coyote control), respectively (Figure 4.4). The survival rate (all mortality factors combined) was significantly higher (χ^2=11.16, P≤0.001) for recent years with coyote control (1997-1998) compared to recent years without coyote control (1996, 1999, and 2000). Although slightly greater, there was no significant difference (χ^2=3.58, P=0.058) between survival rates for recent and past year groupings without coyote control.

Note to readers: Symbols used in this section include the following:
χ2—Chi-squared value (a number derived from a statistical test designed to look for deviation from randomness or a difference between two groups).
P—Probability that the results achieved would occur at random (P<0.05 is generally considered a non-random result; that is, the difference is valid and did not occur by chance sampling).
≥—greater than or equal to
≤—less than or equal to

Figure 4.4 Survival rates of radio-marked, CWT deer from 28 May through 31 October at Julia Butler Hansen Refuge for the Columbian White-tailed Deer, southwestern Washington, 1978–1982 and 1996–2000.



Years with and without coyote control on the Refuge are indicated by CC and NCC, respectively.

Coyote predation was the only mortality-specific factor where the survival rate was significantly higher (χ^2=9.33, P=0.002) for recent years with coyote control compared to recent years without coyote control. For the other cause-specific mortality factors (starvation, disease, and unknown causes), there were no differences (χ^2≤3.48, P≥0.062) between recent years with coyote control compared to recent years without coyote control. The mortality rates from coyote predation were higher compared with rates associated with other causes of death throughout the fawning season (Table 4-14). Mortality rates associated with coyote predation ranged from 0.26 to 0.81, where they were generally lower for years with coyote control. Predation by coyotes was the primary source (most important) of mortality during all study years. After predation, disease and starvation varied in importance as mortality factors depending upon the year grouping.

Table 4-14 Causes of Mortality for Radio-marked CWT Deer Fawns at Julia Butler Hansen Refuge, in Southwest Washington, 1978-2000

Year	Number Radio-tracked	Predation	Disease	Starvation	Exposure	Unknown[3]
1978	19	9	4	0	0	4
1979	15	6	1	1	0	2
1980	7	3	0	0	0	3
1981	19	8	1	1	0	2
1982	4	1	0	0	0	0
1996	13	9	1	1	0	1
1997[1]	18	3	0	1	0	0
1998[1]	14	8	1	0	0	0
1999	8	6	0	1	0	1
2000	14	8	0	1	0	0
Total	131[2]	61	8	6	0	13

[1]Years with coyote control conducted prior to the fawning season on the Mainland Unit.
[2]A total of 131 neonates were radio-marked during all study years, where 27 were known to survive to the end of the fawning season.
[3]Unknown fate because telemetry signal was lost.

Survival for neonates has been low since Julia Butler Hansen Refuge was established. The apparent survival rate for radio-marked fawns throughout the Julia Butler Hansen Refuge study (1978-2000) was 21 percent. Similarly, neonatal survival was low on Julia Butler Hansen Refuge from 1972 to 1977 (prior to the study) because fawns only comprised approximately 21-33 percent of late fall (November) population. We found survival rates of 24-54 percent and 15-34 percent during the first 60 and 90 days after capture, respectively, for fawns during years without coyote control. Cook et al. (1971) also found low rates of fawn mortality (28 percent) from birth to 90 days in a non-hunted population of white-tailed deer in Texas. Vreeland et al. (2004) found 43 percent and 28 percent survival rates for white-tailed deer fawns to 63 days after capture in agricultural and forested habitats in Pennsylvania, respectively.

Radio-marked CWT deer fawns were apparently healthy. Only 9 percent and 7 percent of the radio-marked fawns died of disease and starvation, respectively. Similarly, Gavin et al. (1984) found that 4 percent of the CWT deer moralities during 1974-1977 were disease caused, where all deaths were attributable to necrobacillosis. They also found no fawns died from nutritional stress. A health assessment conducted on CWT deer (n=20) from Julia Butler Hansen Refuge during February 1998 found no indication of infectious diseases (bovine viral diarrhea [BVD], bovine coronavirus, infectious bovine rhinotracheitis [IBR], bovine enterovirus, and *Pasteurella multocida*) and low parasite loads (Creekmore and Glaser 1999). All deer had serum Se values below the reference range and 17 percent had vitamin E levels that were deficient. However, the overall evaluation found CWT deer on Julia Butler Hansen Refuge were healthy despite the Se-vitamin E deficiency.

Coyote predation was the most important mortality factor impacting survival of CWT deer fawns on Julia Butler Hansen Refuge, where coyotes caused 69 percent of the radio-marked fawn mortalities. This percentage likely was higher because many unknown deaths (13 of 88) were probably due to coyote predation but lacked conclusive evidence. In contrast, Gavin et al. (1984) found only 17 percent of the fawn mortalities on Julia Butler Hansen Refuge during 1974-1977 were attributable to coyotes; however, 74 percent (40 of 54) of the fawns died of unknown causes that likely included coyote predation. Although coyotes were the only predator identified for CWT deer fawns on Julia Butler Hansen Refuge, other mammalian predators (bobcat, domestic dogs, and fox) killed neonatal deer in the southwestern Oregon population (Ricca et al. 2002). High losses of white-tailed deer fawns to coyotes also were reported by Cook et al. (1971), Beasom (1974), Garner et al. (1976), and Bartush and Lewis (1981).

Considering that coyote predation was identified as the primary cause of fawn mortality, there is scientific evidence indicating coyote likely are limiting recruitment on Julia Butler Hansen Refuge. The mean F:D ratio during November on the Mainland Unit was 26:100 (ranged from 1:100 to 61:100) from 1986-2000, where the highest ratios occurred during years with coyote control (1997-1998). Potential fawn survival is considerably greater because F:D ratios greater than 60:100 have been recorded on Julia Butler Hansen Refuge (1990 and 1992 on the Tenasillahe Island Unit) since the 1980s (USFWS, unpublished data, Julia Butler Hansen Refuge). The highest F:D ratio recorded for any subpopulation in the lower Columbia River was 70:100. Fawn to doe ratios of 100:100 or more are typical for white-tailed deer (McCullough 1984). Gavin (1979) concluded that fawn mortality was controlling recruitment rate and the subpopulation size on the Mainland Unit.

The CWT deer population on Julia Butler Hansen Refuge is believed to be reasonably healthy at the present time. Diseases causing short-term declines in deer numbers elsewhere in the U.S., such as epizootic hemorrhagic disease (Matschke et al. 1984), have not occurred in western Washington and Oregon. Of the diseases deer are susceptible to, necrobacillosis is the only one known to afflict more than just an occasional animal on Julia Butler Hansen Refuge (Gavin et al. 1984, Gavin 1979). This bacterial disease is difficult to diagnose positively, but one of the more obvious symptoms is foot rot (Rosen 1970). Deer with foot rot limp noticeably from swollen and ulcerous feet. Gavin (1979) examined 155 mortalities on Julia Butler Hansen Refuge from 1974 to 1977, where 32 percent (49) were systematic for necrobacillosis. The disease is often chronic; deer can be infected for years and succumb only during old age. Deer with foot rot are observed fairly regularly on Julia Butler Hansen Refuge (A. Clark, pers. comm.), although they are a relatively small proportion of the population. Most appear to be older animals. Based upon available information, it does not appear that necrobacillosis is limiting the population on Julia Butler Hansen Refuge.

Hair loss syndrome is a recent pathological condition of black-tailed deer in parts of western Washington and Oregon (Bender and Hall 2004; Bildfell et al. 2004). The condition is characterized by the loss of hair from substantial areas of the body. The effects on survival are not clear. Mild hair loss has been observed in a few CWT deer fawns and yearlings, but there has been no documented mortality on Julia Butler Hansen Refuge.

A herd health assessment was conducted on Julia Butler Hansen Refuge during February 1998 (Creekmore and Glaser 1999). Nine deer from the Mainland Unit and 11 deer from Tenasillahe Island Unit were captured by drive-netting. Each deer was visually examined for obvious parasites and lesions and tail fat (tail fat is an indicator of body condition). Blood samples were taken for analysis of complete blood count, plasma protein levels, trace minerals, vitamin E, serology, serum progesterone, and serum chemistry. The serologic screen included testing for agents of BVD, IBR, Johne’s disease, parainfluenza (P13), bovine respiratory syncytial virus (BRSV), bluetongue (BT), epizootic hemorrhagic disease virus (EHD) strains 1 and 2, and various other pathogens. Fecal samples were analyzed for DAPA, fecal nitrogen, crude protein, and parasites. Nasal swabs were tested for disease, including BVD, bovine coronavirus, IBR, bovine enterovirus, and *Pasteurella multocida* culture. No evidence of disease was found.

Three of 11 adult females and four of six adult males were in poor physical condition based on palpation of tail fat. This result is not surprising given that the assessment was done in February. Deer in northern areas typically lose substantial amounts of body fat during winter, in part because they voluntarily reduce their food intake (Fowler et al. 1967, French et al. 1955). Fecal DAPA and nitrogen values indicated that the diet just prior to capture was of good quality. All 20 deer from this study had serum selenium values below the reference range (for domestic animals) and two of 12 deer tested had vitamin E levels that were deficient. Selenium-vitamin E deficiency may cause problems such as abortions and reduced fertility. Soils in western Washington and Oregon are selenium deficient. Nevertheless, the deer have existed here for thousands of years. Wild animals may adapt to trace mineral deficiencies and have lower requirements than domestic animals, or they may meet their needs through selective foraging (Verme and Ullrey 1984).

Fifty-one percent of the radio-marked fawns on Julia Butler Hansen Refuge were females. This likely represents the sex ratio at birth because only very young (mostly one to seven days old) fawns were captured for radio-marking. A sex ratio favoring females may indicate the population is not nutritionally stressed, where fecundity is fairly high. As a result, it is assumed that the population on Julia Butler Hansen Refuge is below carrying capacity. In contrast, a population at or above carrying capacity would be nutritionally stressed, fecundity would be lower, and the sex ratio at birth would favor males (McCullough 1979; Verme 1965, 1969, 1983).

Table 4-15 Cause-specific Mortality Rates[a] for Radio-marked CWT Deer Fawns from 28 May through 31 October at Julia Butler Hansen Refuge for the Columbian White-Tailed Deer, Southwestern Washington, 1978–1982 and 1996–2000.

	1978–82 NCC[b]			1996+1999+2000 NCC			1997+1998 CC[b]		
Cause of Death	**60d**	**90d**	**157d**	**60d**	**90d**	**157d**	**60d**	**90d**	**157d**
Predation	0.26 (46)[c]	0.50 (59)	0.55 (49)	0.65 (66)	0.78 (70)	0.81 (62)	0.29 (73)	0.36 (77)	0.41 (79)
Disease	0.13 (23)	0.13 (15)	0.13 (12)	0.04 (4)	0.04 (4)	0.04 (3)	0.07 (18)	0.07 (15)	0.07 (13)
Starvation	0.09 (16)	0.09 (11)	0.09 (8)	0.26 (26)	0.26 (23)	0.26 (20)	0.04 (10)	0.04 (9)	0.04 (8)
Unknown	0.08 (14)	0.13 (15)	0.35 (31)	0.04 (4)	0.04 (4)	0.20 (15)	0.00	0.00	0.00

[a]Mortality rates ($1-\hat{S}$) at 60, 90, and 157 days, where survival rates ($\hat{S}$) were estimated using the Kaplan-Meier method modified for staggered entry (Pollock et al. 1989; White and Garrott 1990).
[b]NCC and CC represent years with no coyote control and coyote control, respectively.
[c]Relative importance (%) of a mortality factor for each year-day combination.

Table 4-16 Fawn:doe Ratios Pre- and Post-coyote Removal for the Mainland and Tenasillahe Island Units in Southwest Washington and Northwest Oregon

Year	**Mainland Unit**			**Tenasillahe Island Unit**		
	Coyotes Removed[1]	**Number Removed**	**Fawn:doe Ratio**	**Coyotes Removed[1]**	**Number Removed**	**Fawn:doe Ratio**
1994	No		1:100			
1995	No		14:100			
1996	No		15:100			
1997	Yes	9	61:100			
1998	Yes	1	43:100			
1999	No		16:100			
2000	No		34:100			
2001	No		49:100	No		18:100
2002	No		25:100	No		0:100
2003	No		21:100	No		0:100
2004	No		12:100	Yes	12	32:100
2005	Yes[2]	4	4:100	Yes	6	24:100
2006	Yes	11	24:100	Yes	4	39:100
2007	Yes	8	3:100[3]	Yes	5	50:100
2008	Yes	13	30:100	Yes	4	39:100

[1]Ratios are provided for three years before coyote control as a basis for comparison.
[2]Control actions were ineffective in substantially reducing coyote numbers on the Mainland Unit.
[3]Severe flooding during the previous breeding season may have affected the production of fawns.

4.6 Special Designation Areas

- The Columbia River estuary is part of the National Estuary Program (NEP). The NEP was established by Congress in 1987 in amendments to the Clean Water Act. Its primary objective is to protect estuaries of national significance that are threatened by degradation caused by human activity. The program is administered by the EPA which provides funding and technical support to local NEPs, including the LCREP.

- The estuary has been recognized by the Western Hemisphere Shorebird Reserve Network as an internationally important area because more than 100,000 shorebirds are sometimes present.

- The Columbia River was designated as one of the nation's great water bodies by the EPA.

4.7 Effects to Species and Habitats

4.7.1 Effects Common to All Alternatives (Integrated Pest Management)

Potential effects to the biological and physical environment associated with the proposed site-, time-, and target-specific use of pesticides (PUPs) on the refuges would be evaluated using scientific information and analyses documented in Chemical Profiles (see Appendix D). These profiles provide quantitative assessment/screening tools and threshold values to evaluate potential effects to species groups (birds, mammals, and fish) and environmental quality (water, soil, and air). The PUPs (including appropriate BMPs) would be approved where the Chemical Profiles provide scientific evidence that potential impacts to refuge biological resources and its physical environment are likely to be only minor, temporary, or localized in nature. Along with the selective use of pesticides, PUPs would also describe other appropriate IPM strategies (biological, physical, mechanical, and cultural methods) to eradicate, control, or contain pest species in order to achieve resource management objectives.

The effects of using nonpesticide IPM strategies (e.g., mowing) to address pest species on the refuges would be similar to those effects described elsewhere within this chapter, where they are discussed specifically as habitat management techniques to achieve resource management objectives on the refuges. For example, the effects of mowing to control invasive plants in an improved pasture would be similar to those effects summarized for mowing, where it would be specifically used to provide short-grass foraging habitat for wintering geese.

Based on scientific information and analyses documented in Chemical Profiles (see Appendix D), pesticides allowed for use on the refuges would be of relatively low risk to nontarget organisms as a result of low toxicity or short persistence in the environment. Thus, potential impacts to refuge resources and neighboring natural resources from pesticide applications would be expected to be minor, temporary, or localized in nature.

4.7.2 Julia Butler Hansen Refuge

4.7.2.1 Effects to Fish

All three alternatives include installing new tidegates at some sloughs that are presently isolated from the Columbia River, and modifying existing tidegates at others to improve connectivity between the sloughs enclosed by dikes (on Tenasillahe Island and Mainland units) and the Columbia River. The new tidegates will enhance water exchange, thereby improving water quality (e.g., dissolved oxygen) in the sloughs and their connecting drainage ditches. Approximately 180 acres of native trees and shrubs would be planted to establish riparian forest along the sloughs. The trees would eventually provide shade and detritus for the sloughs. Improved water quality and access are expected to benefit fish in the sloughs, especially native species such as juvenile salmon, threespine stickleback, and peamouth. Non-native invasive species, such as carp, may find the slough habitat less favorable because of lower water temperatures resulting from increased water exchange with the Columbia River. Fish in the estuary would also benefit because the improved connectivity would result in increased export of plant detritus from the Mainland Unit and Tenasillahe Island. Detritus forms the base of the estuary food web.

Alternative 1 proposes no changes in Julia Butler Hansen Refuge's habitat management, public use, and CWT deer management programs. This alternative would be neither more positive nor more negative than the existing situation, including tidegate activities common to all alternatives, thus its effects on fish would be neutral.

Alternative 2 proposes establishing an additional 110 acres of short-grass fields, 100 acres of riparian forest, and 40 acres of nontidal wetlands. The additional riparian forest would improve water quality in the sloughs and drainage ditches by providing shade and detritus, thus benefiting juvenile salmon and other native fish. The additional nontidal wetlands would provide habitat for native fish, such as threespine sticklebacks, that thrive in shallow water. The habitat enhancements we propose in Alternative 2 would benefit native fish, but these benefits would not be substantially different than those expected for Alternative 1.

Alternative 2 also proposes changes to the public use and CWT deer population management programs. The shorelines of Crims and Price islands would be opened to hunting for waterfowl and snipe. The predator control program would be expanded, and establishing an experimental population of CWT deer would be emphasized. These activities occur mostly on land and would have no effect on fish or fish habitat. Opening Crims and Price islands to waterfowl hunting could result in a slight increase in motorized boat use and the resultant water pollution in those areas. However, there would not likely be an increase in the number of hunters using the area; rather, the distribution of hunters may change somewhat. The effects, if any, on fish would be temporary and localized in nature.

Alternative 3 is similar to Alternative 1; it proposes no changes in the refuge habitat management program, and there would be no effects fish. The area open to waterfowl hunting would be increased under Alternative 3, similar to Alternative 2. Opening Crims and Price islands to waterfowl hunting could result in a slight increase in motorized boat use and the resultant water pollution in those areas. However, there would not likely be an increase in the number of hunters using the area; rather, the distribution of hunters may change. The effects, if any, on fish would be neutral. The predator control program would be expanded under Alternative 3; however, predator control occurs on land and would have a neutral effect on fish.

4.7.2.2 Effects to Birds

Waterbirds

Alternative 1 would result in no change in current refuge management programs. The existing habitats and habitat management practices would be maintained. No additional nontidal wetlands, short-grass fields or forests would be restored. The refuge would continue to manage 680 acres of short-grass fields that provide food for wintering geese and American wigeon. The existing 130 acres of nontidal wetlands would be managed to benefit wintering ducks, geese and other waterbirds. No additional wetlands would be restored. The existing forested (riparian and swamp) areas that provide nest sites for wood ducks, hooded and common mergansers, and great blue herons would be maintained. An additional 180 acres of grassland would be converted to riparian forest. Management would emphasize maintaining all habitats in their existing state and continuing existing management practices relating to waterbirds. Waterfowl hunting (ducks, geese, coots and snipe only) would continue at present levels. Thus, under Alternative 1 there would be a neutral effect to waterbirds.

Alternative 2, which emphasizes enhanced habitat management, CWT deer population management, and wildlife-dependent public use, proposes establishing an additional 110 acres of short-grass fields, 100 acres of riparian forest, and 40 acres of nontidal wetlands. This alternative would also open the shorelines of Price and Crims islands to waterfowl hunting during state open seasons.

Short-grass fields would increase from 680 acres to 790 acres under Alternative 2. The added acreage would provide additional foraging area for Canada geese, cackling geese, and American wigeon. This increase would likely have minor positive effects on waterfowl populations, because there is no shortage of short-grass fields in the lower Columbia River area. The short-grass fields would replace existing tall-grass fields that are vegetated primarily by weedy species such as reed canarygrass and Canada thistle. Alternative 2 would also result in the creation of an additional 40 acres of nontidal wetlands, which represents an increase of 36 percent for this habitat type. These wetlands provide foraging and resting areas for geese, ducks, great blue herons and other waterbirds. The effect on local waterbird populations would be a minor positive effect. The planting of 100 acres of riparian forest (in addition to the 180 acres proposed in Alternative 1) in existing weedy fields would be expected to have a neutral effect on waterbird populations during the life of this CCP, although this forest will eventually reach maturity and likely provide nesting sites for great blue herons, wood ducks, and hooded and common mergansers.

The area open to waterfowl and snipe hunting would be increased under Alternative 2. Crims Island and Price Island would be opened to hunting along the shorelines. For all practical purposes, hunting occurs in most of this area now because the refuge doesn't own the intertidal and subtidal zones immediately adjacent to the shoreline. The exception is the 94-acre interior marsh at Crims Island, which the refuge does own. Opening the marsh would represent an actual increase in hunting opportunity. We do not believe opening the marsh would result in any increase in either hunter numbers or the number of waterfowl and snipe harvested in the Columbia River estuary. Opportunities for waterfowl hunting are plentiful in the estuary and the number of waterfowl hunters is declining in both Oregon and Washington. Thus, any negative effects on waterfowl and snipe would be minor to nonexistent. Similarly, hunter-caused disturbance to other waterbirds would be minor and temporary in nature. The refuge would close approximately 1 mile of shoreline along the Lower Elochoman Slough. The shoreline would be closed both on the refuge mainland shoreline and the Hunting Island Shoreline. All private lands, non-refuge tidelands and navigable waters would remain open to waterfowl hunting. This closure would be expected to have an overall neutral effect on waterfowl and snipe harvests in the estuary and would result in a minor reduction in hunter-caused disturbance to other waterbirds.

Alternative 3, like Alternative 1, proposes no change in habitat types. No additional short-grass fields and nontidal wetlands would be created. Therefore, there would be no effects on waterbirds as a result of habitat changes. The area open to waterfowl hunting would be increased, identical to what is proposed in Alternative 2. As in Alternative 2, no increase in the waterfowl harvest in the estuary is expected. There would be minor and temporary hunter-caused disturbance to other waterbirds, such as great blue herons, grebes, and double-crested cormorants. Overall there would be a neutral effect on waterbirds.

Shorebirds

The refuge is not a major foraging or resting area for shorebirds. While up to 100,000 birds are present in the estuary during spring migration, most use sandbars and mudflats located downstream of the refuge. On the refuge, a few hundred shorebirds, mostly dunlin and western sandpipers and a few greater yellowlegs, occasionally forage in the managed wetlands and intertidal zones during spring migration. Wilson's snipes are common in short-grass fields during spring.

Alternative 1 proposes no change in current refuge management practices. The existing 130 acres of nontidal wetlands and 63 acres of intertidal flats and sandbars, which provide foraging areas for shorebirds, would be maintained. Approximately 180 acres of the existing 2,384 acres of grassland would be converted to early-successional riparian forest. This would result in a minor loss of habitat for migrating Wilson's snipe, although the 680 acres of short-grass fields, which are preferred by snipe, would remain unchanged. Snipe numbers on the refuge probably never exceed a few hundred individuals; therefore, we expect this minor loss of habitat to have no effect on snipe populations. Alternative 1 would be neutral in its effects on shorebirds.

Alternative 2 would provide the most benefits to shorebirds and their habitats. The creation of an additional 40 acres of nontidal wetlands would provide foraging habitat for dunlins, western sandpipers, and greater yellowlegs. Foraging habitat for Wilson's snipe would be increased by the addition of 110 acres of short-grass fields. The existing nontidal wetlands, tidal flats, and sandbars would be maintained. A total of 280 acres of fields would be planted to early successional riparian forest. This acreage would primarily be taken from tall-grass fields, which provide habitat for Wilson's snipe. However, given the abundance of grassland habitat on the refuge and the relatively low numbers of snipe (a few hundred at most), there should be a neutral effect on snipe.

Crims and Price islands would be opened to waterfowl and snipe hunting under Alternative 2. This could result in disturbance to foraging shorebirds. However, most fall-migrating shorebirds (except snipe) have already passed through the estuary prior to the start of hunting season. Waterfowl hunters space themselves widely apart, so shorebirds would still find ample foraging areas around the islands. Hunting at Crims Island could result in direct take of snipe (Price Island does not have suitable habitat for snipe), although such take would be minimal. Opening these areas is not expected to result in an increase in hunter use of the refuge or the estuary, as hunting opportunities are abundant and hunter numbers are declining. Any effects on snipe or other shorebirds from waterfowl hunter disturbance or take would be neutral overall.

Alternative 3 would be similar to Alternative 1 in that there would no changes in habitat management. Thus, Alternative 3 would have neutral effects on shorebird habitat. Like Alternative 2, Alternative 3 proposes to open Crims and Price islands to waterfowl and snipe hunting. The effects of waterfowl hunting would be same as discussed under Alternative 2 and would be expected to have an overall neutral and temporary effect.

Raptors

Alternative 1 proposes no changes in refuge habitat management practices. The existing refuge habitats would be maintained, with the exception that 180 of the refuge's 2,384 acres of grassland would be converted to riparian forest. Converting grassland to forest will reduce the extent of refuge habitat for grassland raptors such as northern harriers, white-tailed kites, red-tailed hawks, and American kestrels. On the other hand, as the planted forest matures it will provide nest and perch sites for many raptor species, as well as foraging areas for woodland hunters like Cooper's and sharp-shinned hawks. The existing bald eagle habitat (tidal marshes and swamps, nontidal wetlands, and late-successional riparian forest) would be maintained as is. There would be no changes in the refuge waterfowl and snipe hunting program except the proposed Elochoman Slough closure. Alternative 1 would be neutral in its effects on raptors.

Alternative 2 provides for habitat modifications that potentially benefit many raptor species. Providing an additional 40 acres of nontidal wetlands would increase foraging habitat for bald eagles and peregrine falcons. Establishing 100 acres of riparian forest (in addition to the 180 acres proposed in Alternatives 1 and 3) would provide potential perching and nesting habitat for eagles, as well as nesting and foraging habitat for other species such as red-tailed hawks, white-tailed kites, Cooper's hawks, sharp-shinned hawks, great horned owls and screech owls. These habitat benefits to raptors would be minor in scope, given the relatively small acreages involved. The conversion of 110 acres of weedy tall-grass fields to short-grass fields would be expected to have neutral effects on field-hunting raptors as they use both habitats.

Price Island and Crims Island would be opened to waterfowl and snipe hunting under Alternative 2. Both islands have bald eagle and osprey nest sites and are frequented by a variety of other raptors. Hunting might cause some disturbance to raptors; however, hunting would occur along the shorelines and is already occurring on State-owned tidelands immediately adjacent to the shorelines. The existing bald eagle nest sites are screened from the shorelines by mature cottonwood and spruce trees. Nesting ospreys are quite tolerant of human presence. Opening these areas to hunting is not expected to result in an increase in the number of hunters using the general vicinity. Potential additional disturbance to raptors would be minor and temporary. WDFW hunting seasons generally take place out of the critical nesting period for raptors.

Alternative 3 is similar to Alternative 1 in that no changes are proposed in the refuge's habitat management program. The existing acreages of raptor habitat would remain unchanged except for the effects of nature. Alternative 3 would have neutral effects on raptor habitat. Alternative 3, like Alternative 2, proposes to open Price and Crims islands to waterfowl and snipe hunting. The effects to raptors, if any, would be minor and temporary as discussed under Alternative 2.

Landbirds

We are using the term landbirds to describe all birds other than waterbirds, shorebirds, and raptors. Landbirds include passerine (perching) birds, woodpeckers, gallinaceous birds, kingfishers, swifts, hummingbirds, and other birds.

Alternative 1 would result in no changes to the refuge's current habitat management program. The existing refuge habitats would be maintained, with the exception of 180 acres—of the refuge's 2,384 acres of grasslands—that would be converted to riparian forest. Converting grassland to forest will reduce the extent of refuge habitat for grassland birds such as western meadowlark, while increasing habitat for forest birds. Initially, the newly planted forest would benefit shrub species such as yellow warbler and rufous hummingbird. As the trees mature, mid and late succession forest species such as red-eyed vireo, olive-sided flycatcher, and Vaux's swift would benefit. Losses to grassland species and gains to riparian forest species would be minor because of the small amount of acreage involved. Effects from Alternative 1 would be neutral on landbirds.

Alternative 2 proposes habitat modifications that would benefit many landbird species. An additional 40 acres of nontidal wetlands would be created. These wetlands would provide habitat for a variety of species, including red-winged blackbird, marsh wren, and purple martin. The acreage of short-grass fields would be increased by 110 acres, from 680 acres to 790 acres. This would benefit species such as American robin and western meadowlark. Alternative 2 also proposes planting 100 acres of riparian forest, in addition to the 180 acres proposed in all the alternatives. The additional forest will provide habitat for species such as Swainson's thrush, olive-sided flycatcher, and red-eyed vireo, among many others. The additional nontidal marsh, short-grass fields, and riparian forest would result from the conversion of other habitats, principally weedy tall-grass fields. Thus, the habitat for a few species, e.g., American goldfinch, common yellowthroat, and savannah sparrow, would be reduced. Any habitat manipulation results in benefits to some species and disadvantages to others. In the refuge's case, many more species would benefit than not. The overall effect of these habitat changes would be minor and positive because of the relatively small acreage involved and the relative abundance of similar habitats in the vicinity of the refuge.

There would also be changes in the refuge's hunting program under Alternative 2. The shorelines of Price and Crims islands would be opened to waterfowl and snipe hunting. Landbirds would not be targeted by hunters (nearly all species are protected by State and Federal regulations). The presence of hunters could cause some minor disturbance, but no more so than the presence of other outdoor recreationists including birdwatchers. Nesting would not be affected because the hunting season takes place in fall and winter, outside the nesting season.

Alternative 3, like Alternative 1, proposes no change in refuge habitat management practices. Existing habitat acreages would be maintained, except for converting 180 acres of grassland to riparian forest, which is common to all alternatives. The effects of Alternative 3 on songbird habitats would be essentially neutral, similar to Alternative 1. The waterfowl hunting program would be expanded under Alternative 3, like Alternative 2, to include the shorelines of Price and Crims islands. The effects, if any, on landbirds would be minor, as described for Alternative 2.

4.7.2.3 Effects to Mammals

Each alternative includes features (management actions) common to all alternatives that could affect mammals including the following: continuation of the current habitat management program; controlled permit hunting for Roosevelt elk; predator (primarily coyotes) control to benefit CWT deer; and continuation of a public use program that includes waterfowl hunting, fishing, boating, wildlife observation, and photography.

Coyote

Alternative 1 would continue the current refuge habitat management program. The existing refuge habitats would be maintained with the exception of 180 acres of the refuge's 2,384 acres of grassland that would be converted to riparian forest. Maintaining improved pasture that provides foraging habitat would benefit coyote populations. The currently approved, integrated coyote control program would continue under Alternative 1, because currently, state agencies in Oregon and Washington will not grant permits for relocating coyotes. The primary means to manage coyotes would be trapping and euthanizing (shooting) as well as opportunistic shooting during January 1 to April 15 (3.5 months). Since this control program began in 1997, 72 coyotes have been removed from Julia Butler Hansen Refuge, and the number removed in any given year ranged from one to 21 (Table 4-17).

Table 4-17 Number of Coyotes Removed from the Julia Butler Hansen Refuge

Management Unit	Year	Number Removed
Mainland	1997	9
	1998	1
	2005	4
	2006	11
	2007	8
	2008	13
Tenasillahe Island	2004	12
	2005	6
	2006	4
	2007	5
	2008	4
Crims Island	2005	3
	2006	6
	2007	3
	2008	3

There are no known estimates of coyote populations in the counties within which the Julia Butler Hansen Refuge is located; however, coyotes are abundant and likely number in the thousands in southwest Washington and northwest Oregon. As a conservative estimate, there are more than 50,000 coyotes in Washington (WDFW 2008) and 160,000 coyotes in Oregon (USDA 1997). In both states, coyotes may be hunted year-round with no bag limits.

Under Alternative 1, the coyote population using Julia Butler Hansen Refuge would be reduced temporarily through one or more consecutive years of coyote removal. After control ends, the coyote population on Julia Butler Hansen Refuge would likely increase rapidly as transient coyotes would move into vacant territories (Windberg and Knowlton 1988) and reproductive rates would increase in response to lower densities (Connolly 1978; Knowlton 1972). The coyote population likely would increase in size (possibly pre-control level) consistent with habitat conditions and the small-mammal prey base. During previous years with coyote removal on Julia Butler Hansen Refuge (see Table 4-18), coyotes quickly repopulated management units after control ceased (April 15), where the newly established (transient) coyotes preyed upon older fawns during late summer resulting in lower CWT deer recruitment. The small numbers removed from Julia Butler Hansen Refuge would not be expected to negatively affect coyote populations locally, regionally, or nationally.

Alternative 2 would entail habitat management on Julia Butler Hansen Refuge similar to Alternative 1, except for converting 110 acres of weedy tall-grass fields to short-grass fields, restoring 280 acres of riparian forest, and establishing an additional 40 acres of nontidal wetland. Because coyotes would utilize all existing and new habitats on Julia Butler Hansen Refuge, there would be a greater benefit to the coyote population using Julia Butler Hansen Refuge under Alternative 2, when compared with Alternative 1

Under Alternative 1, coyote control can occur for 3.5 months in winter to early spring. Because coyotes repopulate quickly, we propose under Alternative 2 to have the option of year-round coyote control if conditions of fawn recruitment and deer population are met (Section 4.5.3.2). This added time would initially result a greater annual harvest of coyotes from Julia Butler Hansen Refuge, but it is unlikely that the increase in harvest would be commensurate with the added time (a limit of 40 is proposed), as hunting and trapping success diminishes under constant implementation (see Table 4-17 for historical harvest levels). Over time, fewer overall coyotes would be removed under Alternative 2 because CWT deer population objectives would be achieved more quickly, at which point coyote control would be suspended if sufficient fawn:doe ratios were achieved. Therefore, we expect fewer consecutive years of coyote control under Alternative 2 as compared to Alternative 1. Because coyotes are more density dependent than deer, we expect less need for coyote control after deer population objectives are met.

Regardless of which alternative is implemented, the coyote population on Julia Butler Hansen Refuge would likely increase rapidly after control was stopped, as transients would move into vacant territories (Windberg and Knowlton 1988) and reproductive rates would increase in response to lower densities (Connolly 1978; Knowlton 1972). The coyote population would likely increase in size (possibly to pre-control levels) under both Alternative 1 and Alternative 2, consistent with habitat conditions and the small-mammal prey base. Even though a the initial number of coyotes removed may be greater under Alternative 2 compared with Alternative 1, the overall number would likely be smaller, and either option would not be expected to negatively affect coyote populations locally, regionally, or nationally.

Under Alternative 3, we propose to implement coyote control measures for eight months per year and continue the current refuge habitat management program. The effects of habitat management on coyote populations using refuge lands would be similar to those described under Alternative 1. Annually, more coyotes would probably be removed under Alternative 3 than under Alternative 1, considering the longer control period. However, long-term, more coyotes would probably be removed under Alternative 1, because coyote control would likely be needed for more consecutive years to achieve CWT population objectives.

Other Mammals

Alternatives 1 and 3 would continue the current habitat management program. As a result, there would be similar beneficial effects to habitats used by other mammals.

All three alternatives include coyote control. The primary methods of control are trapping and shooting. Both methods are reasonably selective when properly executed, but trapping may result in a small by-catch of nontarget mammals. The current refuge coyote trapping program has resulted in the take of fewer than 10 opossums and five raccoons per year. They were released when possible but some were euthanized because of injuries incurred in their attempts to escape the traps. Opossums and raccoons are abundant locally, regionally, and nationally. The few taken on the refuge would have no effect on opossum and raccoon populations. Other mammals would be expected to be unaffected.

In the event that a mountain lion or black bear becomes a threat to CWT deer, the individual animals would be removed by trapping by or shooting. The likelihood of trapping nontarget animals would be smaller than a coyote trapping program, due to the limited focus of trapping a single target animal (cougar or bear) rather than a group of coyotes. Because only individual mountain lions or bears would be removed on an infrequent basis, there would likely be no short-term or long-term effects to local, regional, or national populations of these large mammals.

Alternatives 2 and 3 would expand the time period for coyote control. Alternative 2 proposes year-round control when necessary to protect CWT deer and Alternative 3 proposes an annual eight-month window (January-August) for control. The by-catch might increase under either alternative. Still, the number lethally removed would be small—probably less than 20 opossums and 10 raccoons per year. The removal of such small numbers would have no effect on opossum and raccoon populations locally, regionally, or nationally. Because only individual cougars or bears would be targeted and removed on the refuge, by-catch would be much less or nonexistent, than it would for general coyote control. Other mammals would not be affected.

Alternatives 2 and 3 also propose opening the shorelines of Crims and Price islands to waterfowl and snipe hunting. The presence of hunters could cause minor disturbance to mammals frequenting these areas. Disturbed mammals would simply move away from hunters. Hunters would only be along the shoreline. There would be a neutral effect on mammal populations.

4.7.2.4 Effects to Reptiles and Amphibians

All three alternatives include installing new tidegates at some sloughs and modifying existing tidegates at others to improve connectivity between the sloughs enclosed by dikes and the Columbia River. The new tidegates will allow more water exchange, thereby benefiting reptiles and amphibians by improving water quality in the sloughs and connecting drainage ditches. Western pond turtles and aquatic breeding amphibians such as red-legged frogs, Pacific chorus frogs, long-toed salamanders and northwestern salamanders would be the chief beneficiaries.

Alternatives 1 and 3 propose no changes to the current habitat management program. The current acreages of reptile and amphibian habitat would remain essentially unchanged. The effects on reptile and amphibian habitat would be positive and would be minor because of the limited acreage involved.

Alternative 2 would provide the greatest benefit to reptiles and amphibians. Emphasis would be placed on working with partners to restore aquatic habitat. An additional 40 acres of managed nontidal wetland would be established. These shallow, heavily vegetated marshes are preferred breeding habitat for red-legged frogs, Pacific chorus frogs, and long-toed salamanders. Riparian forest, which provides habitat for terrestrial salamanders such as ensatina and western red-back, as well as foraging red-legged frogs, would be increased by planting an additional 100 acres of native trees. The positive impact of these habitat modifications on reptiles and amphibians would be minor because of the limited acreage involved.

4.7.2.5 Effects to Invertebrates

All three alternatives include installing new tidegates at some sloughs and modifying existing tidegates at others, to improve connectivity between the sloughs enclosed by dikes and the Columbia River. The new tidegates will allow more water exchange, thereby benefiting fresh water mussels and other aquatic invertebrates by improving water quality in the sloughs and connecting drainage ditches.

Alternatives 1 and 3 propose no changes in the habitat management program. There would be a neutral effect to invertebrate habitat.

Alternative 2 proposes planting 100 acres of riparian forest, 110 acres of short-grass fields, and constructing 40 acres of nontidal wetlands. Invertebrates that thrive in these habitats, such as aquatic invertebrates in freshwater wetlands, would benefit. These habitat projects would occur in areas that are presently occupied by weedy tall-grass fields. There is the potential for adversely affecting invertebrates that prefer weedy tall-grass fields, such as some species of nectar-feeding insects. There are no known rare, endangered, or threatened invertebrates that utilize these habitats on the refuge. The effects, if any, would be positive and minor because of the limited acreage involved.

4.7.2.6 Effects to Federally Threatened and Endangered Species

Fish

Thirteen species of federally listed salmon and steelhead utilize the lower Columbia River. In addition, small numbers of bull trout, a threatened species, may also be found in the Columbia River.

All three alternatives include installing new tidegates at some sloughs and modifying existing tidegates at others to improve connectivity between the sloughs enclosed by dikes (on Tenasillahe Island and the mainland) and the Columbia River. The new tidegates will allow more water exchange, thereby improving fish access and water quality in the sloughs and connecting drainage ditches. Approximately 180 acres of native trees and shrubs would be planted to establish riparian forest along the sloughs. The trees would eventually provide shade and detritus for the sloughs. Improved water quality and access passageways are expected to benefit fish in the sloughs, especially native species such as juvenile salmon, which use the sloughs for foraging and respite from river currents. Fish in the estuary would also likely benefit because the improved connectivity would result in increased export of plant detritus from the Mainland Unit and Tenasillahe Island. Detritus forms the base of the estuary food web. The overall effects on listed fish populations are expected to be difficult to detect because the affected area at the refuge is very small compared to the entire estuary.

Alternative 1 proposes no changes in the refuge habitat management, public use and CWT deer management programs. This alternative would be neither more positive nor more negative than the existing situation, including tidegate activities common to all alternatives, thus its effects on fish would be neutral.

Alternative 2 proposes establishing an additional 110 acres of short-grass fields, 100 acres of riparian forest, and 40 acres of nontidal wetlands. The additional riparian forest would improve water quality in the sloughs and drainage ditches by providing shade and detritus, thus benefiting juvenile salmon and other native fish. The additional nontidal wetlands, which drain into the sloughs, would provide invertebrates upon which juvenile salmonids forage. The habitat enhancements proposed in Alternative 2 would benefit threatened and endangered fish, but the overall benefits for listed fish populations would be difficult to detect because of the relatively small amount of refuge habitat within the entire estuary area.

Alternative 2 also proposes changes to the public use and CWT deer population management programs. The shorelines of Crims and Price islands would be opened to hunting for waterfowl and snipe. The predator control program would be expanded, and establishing an experimental population of CWT would be emphasized. Predator control occurs mostly on land and would have a neutral effect on fish or fish habitat. Opening Crims and Price islands to waterfowl hunting could result in slight increases in motorized boat use and water pollution in those areas. However, there would not likely be an increase in the number of hunters using the area; rather, the distribution of hunters would change somewhat. The effects, if any, on threatened and endangered fish would be neutral.

Alternative 3, like Alternative 1, proposes no changes in the refuge habitat management program, thus there would be no habitat changes that would affect fish. The area open to waterfowl hunting would be increased under Alternative 3, similar to Alternative 2. Opening Crims and Price islands to waterfowl hunting could result in slight increases in motorized boat use and water pollution in those areas. However, there would not likely be an increase in the number of hunters using the area; rather, the distribution of hunters would change somewhat. The effects, if any, on threatened and endangered fish would be negligible. The predator control program would be expanded under Alternative 3; however, predator control occurs on land and would have a neutral effect on fish.

Brown Pelican, Northern Spotted Owl, Marbled Murrelet, and Streaked Horned Lark

The brown pelican, northern spotted owl, marbled murrelet, and streaked horned lark are known to utilize the Columbia River estuary. The refuge does not contain suitable habitat for these species and their presence on the refuge has not been documented. The occurrence of any of these birds on the refuge would likely be just a “pass through.” The alternatives as described would have an overall neutral effect on brown pelicans, northern spotted owls, marbled murrelets, and streaked horned larks.

Steller Sea Lion

Steller sea lions follow salmon and smelt runs in the channels of the Columbia River. They do not frequent refuge lands. All of the alternatives would be expected to have a neutral effect on Steller sea lions.

Columbian White-tailed Deer

Habitat and Public Use Management

For all three alternatives, strategically installing new tidegates in selected sloughs and modifying existing ones would improve water exchange, water quality (dissolved oxygen), and (more importantly for the CWT deer) drainage, to reduce the frequency and severity of flood events. Shallow flooding of the Mainland and Tenasillahe Island units is a common winter occurrence;

however, deep, prolonged flood events (such as occurred winter 1996 and 2006) have resulted in substantial CWT deer mortalities, which was a major setback to population recovery in Julia Butler Hansen Refuge's secure habitats. Therefore, improved drainage may affect, but is not likely to adversely affect CWT deer, because effects to the deer population would be wholly beneficial, especially during severe flood events that have caused increased mortality previously.

Alternative 1 would continue the current resource management program that provides habitats to meet life-history requirements and promote recovery of CWT deer on refuge management units. Specifically, habitat management to benefit CWT deer on refuge lands includes the following: seasonal grazing and mowing to maximize palatability and nutritional quality of grasses in short-grass fields; periodic disking and reseeding of short-grass fields to maintain an optimal mix of palatable and nutritious grass and legume species; periodic drawdown of nontidal wetlands to promote growth of obligate and facultative wetland plants during late summer and fall; controlling invasive plants; and maintaining existing forested and riparian habitats that provide cover and browse during winter and early spring. These management activities would continue, where the acreage of each habitat type would remain essentially unchanged, except that 180 acres of grassland would be converted to riparian forest. In the long term, the increase in riparian forest would benefit CWT deer by providing additional cover and browse on refuge lands that are protected from flooding behind dikes. (At present, only about 20 percent of the diked lands are forested. We believe the deer would benefit most if about 50 percent of the land was forested in a mosaic pattern with grassland and wetland.) Therefore, the habitat management regime for Alternative 1 may affect, but is not likely to adversely affect CWT deer, because short-term, long-term, and cumulative effects to the deer population would be wholly beneficial, especially considering the increased cover and browse associated with more riparian forest protected by refuge dikes.

The current wildlife dependent recreation programs, including waterfowl hunting, would continue under Alternative 1. The presence of humans may cause temporary and localized disturbance to CWT deer. Because public uses would be restricted to the perimeter of the refuge's units (shoreline waterfowl hunting on islands, wildlife viewing and hiking on perimeter dikes), CWT deer would only need to move a short distance toward the interior of the refuge to avoid the disturbance.

Alternative 2 would provide the greatest short- and long-term benefits for the CWT deer population inhabiting secure habitats on refuge lands. The benefits Alternative 2 would provide to CWT deer, compared to Alternative 1, and based upon differences in habitat management on refuge lands, follow.

Habitat Management	Benefit for CWT deer
• Establish 100 acres of riparian forest (in addition to 180 acres proposed by all alternatives).	• Greater all-season cover and browse.
• Increase the extent of short-grass fields 110 acres.	• More widely distributed high quality grass and legume forage.
• Add 40 acres of nontidal wetlands.	• More high quality grass and forb forage during late summer and fall.

In summary, habitat management under Alternative 2 may affect CWT deer, but is not likely to adversely affect CWT deer, because short-term, long-term, and cumulative effects to the deer population would be wholly beneficial by providing additional all-season cover and high quality forage.

Wildlife-dependent recreation opportunities would increase under Alternative 2 compared to Alternative 1. The Service would work with Wahkiakum County to make Brooks Slough Road, which is presently open to motor vehicle traffic, a hiking/bicycling multi-use trail. At the same time, the Center Road hiking trail would be closed to public access. Brooks Slough Road is expected to be more popular than Center Road as a hiking trail. Therefore, the number of refuge visitors may increase in the short term and long term. Also, the shorelines of Price and Crims islands would be open to waterfowl hunting. For the most part, hunting is already occurring in or adjacent to these areas because State-owned tidelands, which abut refuge lands, are open to hunting. Increases in hiking, biking, and hunting could result in increased disturbance to CWT deer. Brooks Slough Road lies along the perimeter of the Mainland Unit. If disturbed, deer would be expected to move a short distance toward the interior of the refuge during times of high visitor use. Deer on Price and Crims islands would do likewise. From available scientific information, white-tailed deer are generally tolerant of moderate human disturbance. They often live in suburban neighborhoods and city parks, where human presence is nearly constant (Etter et al. 2002; Harveson et al. 2007). The relatively minor disturbance caused by hunters, hikers, and bicyclists using perimeter areas would cause temporary and localized disturbance to CWT deer.

In contrast with Alternative 1, under Alternative 2 we would also increase efforts to reintroduce CWT deer to areas of suitable habitat upstream of Julia Butler Hansen Refuge. Historically, CWT deer occupied the entire lower Columbia River floodplain from the Columbia Gorge to the river's mouth and the lower Willamette River valley. Reintroductions previously occurred on Crims, Fisher, and Lord islands, which are located 22-25 miles upstream of refuge lands. Other potential reintroduction sites include Cottonwood Island (near Longview and Kelso, Washington) and Ridgefield National Wildlife Refuge (near Vancouver, Washington). Successful reintroductions would increase CWT deer range and establish additional populations in secure habitat. The reintroductions would reduce the risk of extinction and promote delisting and recovery of CWT deer. In the long term, reintroductions would be wholly beneficial to the CWT deer population in the lower Columbia River.

Alternative 3 would continue the current refuge habitat management program as described under Alternative 1. As a result, the effects on CWT deer would be the same as discussed for Alternative 1.

Wildlife-dependent recreational opportunities would increase under Alternative 3, compared to Alternatives 1 and 2. Specifically, the shorelines of Crims and Price islands would be opened to waterfowl hunting. Additionally, the Service would seek agreement with Wahkiakum County to designate Brooks Slough Road a multi-use hiking/biking trail. The effects on CWT deer would be the same as discussed for Alternative 2.

Mammalian Predator Management

Lethal removal of mountain lions and black bears when found on refuge lands would beneficially effect the CWT deer population on the refuge. These large mammalian predators could prey upon juvenile and adult deer and substantially reduce deer numbers if they are not removed from refuge lands. Because removal of mountain lions and bears could occur under Alternatives 2 and 3, short- and long-term benefits to the CWT deer populations on refuge management units would be greater compared with Alternative 1.

Stochastic simulation modeling was conducted for CWT deer on the Mainland and Tenasillahe Island units using methods described in Phillips and White (2003). This modeling was specifically used to compare effects of coyote control on deer population size on Julia Butler Hansen Refuge relative to the CCP/EIS alternatives. Primary population parameters for the stochastic modeling were estimated survival and recruitment rates and their process standard deviations, as well as initial population size (N_0), correlation among age-sex-specific survival rates, duration in years of coyote control, and effect of coyote removal on CWT deer recruitment (dR). Estimated survival rates ($\hat{S}_J$, $\hat{S}_D$, and $\hat{S}_B$) for the Mainland and Tenasillahe Island units were derived from the optimized deterministic models (see Population Demographics under Section 4.5.3.2). Because population data from Julia Butler Hansen Refuge were not sufficient to estimate process standard deviation for survival rates, values for mule-deer juvenile and adult survival from Unsworth et al. (1999) were used for deterministic modeling.

The short-term effects of coyote control on the Mainland and Tenasillahe Island units were estimated as the average difference in recruitment ($dR(t)$) values, between consecutive years with coyote control and an equal number of years preceding coyote control on Julia Butler Hansen Refuge.

$$\hat{dR} = \frac{\sum R(t)_C - \sum R(t)_{NC}}{7} = 0.30 \text{ fawns/doe,}$$

Specifically, where subscript C signified years with coyote control (1997, 1998, and 2006 at the Mainland Unit and 2004-2007 at Tenasillahe Island Unit); and NC signified years without coyote control, immediately before years with coyote control (1995, 1996, and 2005 at the Mainland Unit and 2000−2003 at the Tenasillahe Island Unit). Two values of N_0 for each refuge management unit were used for modeling based data from the aerial classification survey conducted during March 2007. The two N_0 values represented the minimum and maximum population estimates for the March 2007 herd size, where minimum counts were not adjusted for sighting probability but "minimum + ½ probable" counts were adjusted.

Simulation models for the Mainland (M) and Tenasillahe Island (T) units were conducted based upon the following two coyote removal cases: M30 and T30–coyote removal resulting in dR = 0.30 fawns per doe and M45 and T45–coyote removal resulting in dR = 0.45 fawns per doe. In the second case, the ratio was the maximum observed increase in recruitment following one year of coyote control on either refuge unit (0.45 fawns per doe at M during 1997). These cases were evaluated in the stochastic model given the following N_0 values: 51 and 65 for the Mainland Unit, and 71 and 90 for the Tenasillahe Island Unit. Outputs (population trajectories) were generated for case × N_0 × end year (five, 10, 15, and 20 years) combinations by running 100,000 simulations of the stochastic model using SAS (SAS Institute). Modeling population projections were limited to 20 years because available refuge data did not support inclusion of density dependent factors and it coincided with horizons for refuge management planning.

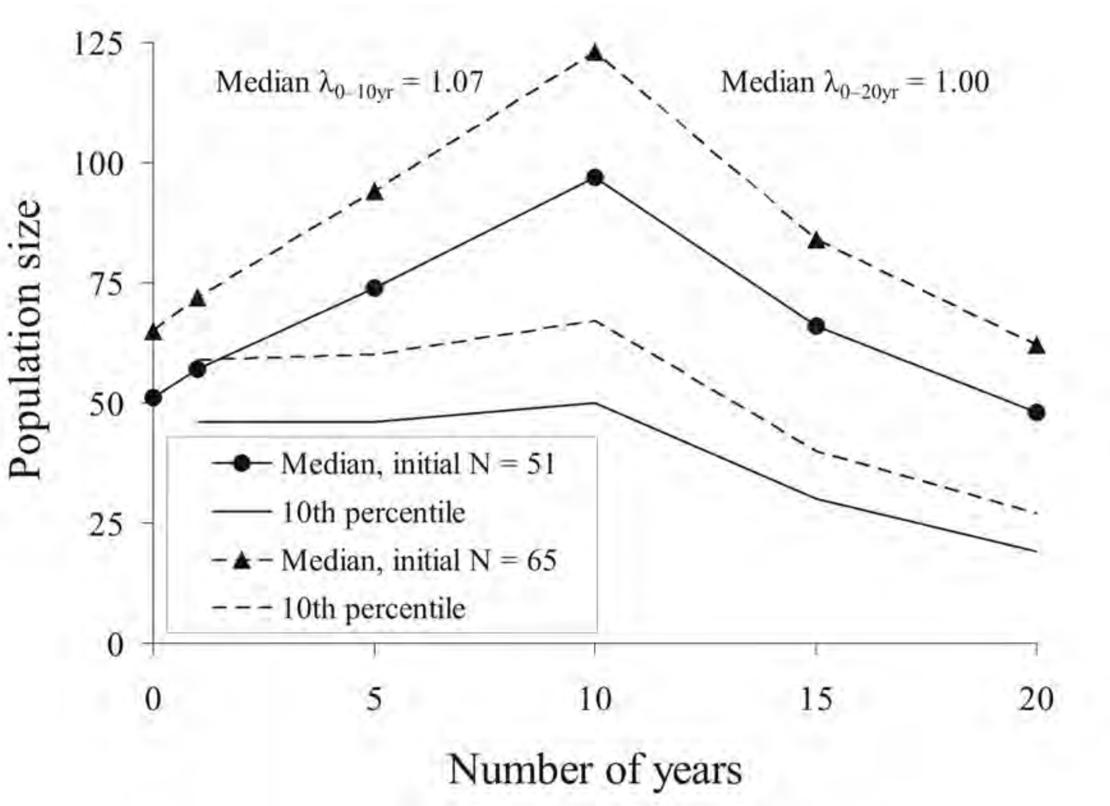
Stochastic modeling was used to estimate probabilities (percent) of extirpation as well as achieving N_t greater than or equal to (≥) 125 and $N_t \geq N_0$ based on percentiles of projected population sizes. For cases with coyote removals, the number of consecutive removal years required to achieve $N_t \geq 125$ with 50 percent and 90 percent probability given $dR_{mean} = 0.30$ fawns per doe and $dR_{max} = 0.45$ fawns per doe were also evaluated. The stochastic model was also used to estimate levels of R required to achieve or exceed $N_t \geq 125$ and $N_t \geq N_0$ with 50 percent and 90 percent probability at 10 years.

The behavior of the stochastic model with coyote control simulated for 10 years under case M30 (Alternatives 1 and 3) is depicted in Figure 4.5. Populations starting at N_0 = 51and 65 exhibited nearly linear growth at the 50th percentile during years with coyote control. When coyote removal ended, $R(t)$ reverted to $\hat{R}$, and the CWT deer populations declined on the Mainland Unit. Median and 10th percentile lines depict population size above which 50 percent and 90 percent of simulated population sizes occurred corresponding to probability levels of interest related to herd management on Julia Butler Hansen Refuge (see Tables 4-18 and 4-19).

Simulated coyote control used in consecutive years for case M30 (Alternatives 1 and 3) was not adequate to achieve $N_t \geq 125$ deer where t=20 years with probability ≥ 0.90 percent (Table 4-18). $N_t \geq 125$ was selected for the stochastic modeling because it represented approximate CWT deer population objectives for the Mainland and Tenasillahe Island units. However, ≥ 50 percent of population simulations were ≥ 125 within 15 years. In contrast, 90 percent of population simulations reached 125 deer within 15 years (50 percent achieved this population level within 8 years) for case M45 (Alternative 2) because there was a larger increase in the fawns per doe ratio from more intensive coyote control compared with M30. Stochastic modeling indicated approximately triple the historic, long-term R was required for 90 percent of the Mainland Unit population simulations to reach 125 deer in 10 years ($\hat{R}$ = 0.307 to fitted R of 0.811 or 0.911 fawns per doe depending on N_0 [Table 4-19]). Approximately doubling $\hat{R}$ was required for 50 percent of population simulations to reach 125 deer (0.626 or 0.692 fawns per doe) or to ensure a high probability (90 percent) of population growth (0.620 or 0.625 fawns per doe) in 10 years. Mean R had to increase by nearly 50 percent over historic levels (about 0.45 fawns per doe) providing equal probability of population growth or decline (stable population) after 10 years.

The herd on the Tenasillahe Island Unit would grow to 125 deer more quickly under simulated coyote control compared to the Mainland Unit herd (Table 4-18). For case T30 (Alternatives 1 and 3), $N_t \geq 125$ was achieved in three to 11 years depending on N_0 and desired confidence (50 or 90 percent probability). For case T45 (Alternative 2), $N_t \geq 125$ was achieved after two to seven years. Given 10 years to achieve $N_t \geq 125$, the required mean R ranged 0.446–0.679 fawns per doe (Table 4-19), which represented a 29-97 percent increase over $\hat{R}$ = 0.345 fawns per doe. Only 6-50 percent increases in mean R were required to achieve $N_t \geq N_0$ after 10 years.

Figure 4.5 Percentiles of population size distributions of CWT deer projected from a stochastic model of the Mainland Unit herd in northwest Oregon and southeast Washington.



Note: Coyote control was simulated for years 1–10 by an increase of 0.3 fawns per doe above baseline (0.307 fawns per doe) followed by 10 years without coyote control.

Table 4-18 Estimated Years of Consecutive Coyote Control Required to Achieve Greater Than or Equal to 125 CWT Deer at Julia Butler Hansen Refuge[a] in Northwest Oregon and Southeast Washington

Management Unit	Case[a]	Percent of Population Simulations	N_0[b]	Years of Coyote Control
Mainland	M30	90	51	more than 20
			65	more than 20
		50	51	15
			65	11
	M45	90	51	15
			65	12
		50	51	8
			65	5
Tenasillahe Island	T30	90	71	11
			90	8
		50	71	5
			90	3
	T45	90	71	7
			90	5
		50	71	4
			90	2

[a]Simulation models for the Mainland (M) and Tenasillahe Island (T) units were conducted based upon the following two coyote removal cases: M30 and T30 coyote removal resulting in dR = 0.30 fawns per doe; and M45 and T45 coyote removal resulting in dR = 0.45 fawns per doe.
[b]Initial population values (N_0) represent minimum and maximum herd size population estimates from March 2007.

Table 4-19 Mean Fawn per Doe Ratios (*R*) Required over 10 Consecutive Years to Achieve Management Objectives of 90 Percent or 50 Percent of Simulated[a] Populations with ≥ 125 CWT deer at Julia Butler Hansen Refuge in Northwest Oregon and Southeast Washington

Management Unit	Population	Percent of Population Simulations	N_0[b]	Mean *R* Fitted	Mean *R* Case	Mean *R* Δ
Mainland	$N \geq 125$	90	51	0.911	0.307	0.604
			65	0.811	0.307	0.504
		50	51	0.692	0.307	0.385
			65	0.626	0.307	0.319
	$N \geq N_0$	90	51	0.625	0.307	0.318
			65	0.62	0.307	0.313
		50	51	0.449	0.307	0.142
			65	0.451	0.307	0.144
Tenasillahe Island	$N \geq 125$	90	71	0.679	0.345	0.334
			90	0.604	0.345	0.259
		50	71	0.511	0.345	0.166
			90	0.446	0.345	0.101
	$N \geq N_0$	90	71	0.517	0.345	0.172
			90	0.506	0.345	0.161
		50	71	0.364	0.345	0.019
			90	0.365	0.345	0.02

[a]Each case × N_0 × year combination was based on 100,000 simulated population trajectories.
[b]The initial population values (N_0) represent the minimum and maximum population estimates for the herd size from March 2007.

Summary

The greatest short- and long-term benefits to the CWT deer population utilizing refuge lands would likely be realized by implementing management strategies proposed in Alternative 2. There would be more habitats available on refuge lands to meet the life-history needs of the deer, especially considering increased acres of foraging habitat (improved pastures) behind dikes protected from flooding. Moreover, a year-round coyote control program (when annually needed based upon criteria) and removal of mountain lions and black bears (when present) would maximize the recruitment of young as well as survival of yearlings and adults that would be needed to achieve population objectives for refuge management units. Because the predator management program under Alternative 2 would likely achieve CWT deer population objectives in fewer years, compared with Alternatives 1 and 3, there would be fewer coyotes removed from the refuge in the long term under Alternative 2.

4.7.2.7 Effects to Wetland Habitats and Associated Wildlife

Wetland habitats within the refuge include tidal marsh, tidal swamp, tidal open water, sloughs and nontidal wetlands. All of the alternatives propose protection of the existing wetlands. Invasive species would be controlled to preserve the native vegetation and wildlife of the Columbia River estuary. Management of tidal wetlands would consist of regulation of public use, invasive species control, wildlife and vegetation monitoring, research, and working with partners to protect the biological integrity and diversity of the estuary.

All three alternatives include installing new tidegates at some sloughs and modifying existing tidegates at others to improve connectivity between the sloughs enclosed by dikes (on Tenasillahe Island and the Mainland Unit) and the Columbia River. The new tidegates would allow more water exchange, thereby improving water quality in the sloughs and connecting drainage ditches. All native wildlife associated with the sloughs would benefit. Greater water exchange would also improve the flow of detritus and other nutrients from the sloughs to the estuary, thereby benefiting plant and animal life in the estuary. The benefits would not be considered significant because of the relatively small scale of the project when compared to the Columbia River estuary as a whole.

Alternative 1 proposes no changes to the existing habitat management program. No additional wetlands would be restored. The existing wetland acreages would continue to be managed as described above. The existing public use program, including waterfowl hunting, would continue unchanged. Hunters and hikers could potentially damage wetland habitat by trampling vegetation. Any such effects are minor and inconsequential, and would have a neutral effect overall because hiking is restricted to perimeter roads and hunting is highly dispersed, affecting only small areas.

Alternative 2 provides for the restoration of an additional 40 acres of nontidal wetland. These wetlands would provide forage for waterfowl, habitat for amphibians and aquatic invertebrates, and forage for CWT deer. The effects to wetlands and wetland wildlife would be beneficial, but they would not be considered significant because of the small acreage.

The public use program would be expanded under Alternative 2 by potentially converting Brooks Slough Road to a hiking/biking trail and opening the shorelines of Crims and Price islands to waterfowl hunting. Increased hiking and biking on Brooks Slough Road would have no effect on wetland habitat. Hunters might trample some wetland vegetation at Crims and Price islands; however, trampling would occur at such small, dispersed areas that overall effects on wetland habitat would be neutral.

Alternative 3, like Alternative 1, proposes no changes to the existing habitat management program. The effects of the habitat management program to wetland habitats would be the same as Alternative 1. The public use program would be expanded under Alternative 3, similar to Alternative 2, and the effects would be neutral.

4.7.2.8 Effects to Riparian (Nontidal) Habitats and Associated Wildlife

All three alternatives propose converting 180 of the refuge's 2,384 acres of grasslands to riparian forest to benefit CWT deer, other mammals, amphibians, and birds. Fish and other aquatic life would also benefit because the forest would provide detritus that fuels the food chain in the sloughs and the estuary. Grassland species would lose a small amount of habitat; however, more than 2,200 acres would remain. Effects would be positive yet minor overall because of the small acreage involved.

Alternative 1 would continue the existing habitat management program. The present acreages of grassland and riparian forest would be maintained, except for the 180 acres of additional riparian forest. Public use would also continue unchanged. Effects to riparian habitats and wildlife would be minor and positive under Alternative 1.

Alternative 2 proposes increasing the acreage of short-grass fields by 110 acres, from 680 acres to 790 acres. This would benefit CWT deer, Canada geese, and other birds. Alternative 2 also proposes planting 100 acres of riparian forest, in addition to the 180 acres proposed in all of the alternatives. The additional forest will provide habitat for CWT deer and other woodland wildlife. The additional short-grass fields and riparian forest would result from the conversion of other habitats, principally weedy tall-grass fields. Thus, the habitat for a few species (e.g., American goldfinch, common yellowthroat, and savannah sparrow) would be reduced. Any habitat manipulation results in both winners and losers. In the refuge's case, many more species would benefit than would lose. Most importantly, the CWT deer would benefit. The overall effect of these habitat changes would be positive for acreage involved.

Alternative 2 also provides for developing Brooks Slough Road into a multi-use hiking/biking and auto tour trail, if an agreement can be negotiated with Wahkiakum County. Hiking and biking would be restricted to the existing road; the speed limit would be reduced, so there would be no effect on riparian habitat.

Alternative 3, like Alternative 1, proposes no changes in the existing refuge habitat management program. The public use program would be expanded, similar to Alternative 2. Effects to riparian habitats and wildlife would be the same as Alternative 1.

Management of the refuge is focused on maintaining the existing habitats. Most of the refuge consists of wetlands that are some of the best remaining native habitats in the estuary. Therefore, neither of the alternatives proposes habitat manipulation, other than invasive species control. The existing acreage for each habitat type would remain unchanged, except for changes that might occur as a result of natural processes.

4.7.3 Lewis and Clark Refuge

4.7.3.1 Effects to Fish

Alternative 1 protects habitats used directly by fish species at the refuge, primarily tidally influenced sloughs, marshes, tidal flats, and shallow subtidal floodplains used for juvenile rearing. These habitats also indirectly provide benefits to fish through production and export of nutrients, organic matter, and invertebrates, which contribute to the food web in the estuary.

Alternative 2 would potentially provide greater indirect benefits to fish. Additional emphasis would be placed on working with partners to share resources, training, and equipment to control invasive species. Non-native, invasive plants and animals may degrade the estuary's productivity and negatively affect the food web for fish. Prompt and effective control of invasive species may prevent such consequences. The Service would meet with ODSL to discuss management options for State lands, including tidelands, located within the refuge boundary. An agreement between the Service and the State to include these lands in the refuge, or outright acquisition of the lands by the Service, would provide a higher level of protection for fish habitat.

Alternative 2 would also provide for additional interpretive signs in the refuge and the creation of a water trail. These actions might result in increased public use, especially by nonmotorized watercraft, but no effects on fish would be expected. Public visits to the refuge also involve the use of motorized watercraft which typically release small amounts of petroleum residues into the water. We are not aware of any evidence that such small amounts of residue are harming fish in the estuary. Most water in the refuge is classified as navigable and under the jurisdiction of the State of Oregon, thus we could not restrict boat traffic in an effort to reduce boat pollution. Overall, Alternative 2 would result in beneficial effects to fish, although these effects would be small and indirect.

4.7.3.2 Effects to Birds, Mammals, Reptiles, Amphibians, and Invertebrates

Alternative 1 proposes no changes in the refuge habitat management, resource management or public use programs. This alternative would have neither positive nor negative effects compared to the existing situation, thus its effects on wildlife would be neutral.

Alternative 2 potentially would provide greater indirect benefits to wildlife. Additional emphasis would be placed on working with partners to share resources, training, and equipment to control invasive species. Non-native, invasive plants and animals may degrade the estuary's wildlife habitats. For example, purple loosestrife is threatening to displace much of the native vegetation in the tidal marshes. Purple loosestrife provides no forage for waterfowl, whereas the native plants it is displacing produce the seeds, tubers, and foliage that sustain waterfowl. Control of invasive species like purple loosestrife would maintain plant diversity and wildlife food sources.

Under Alternative 2, the Service would meet with ODSL to discuss management options for State lands, including tidelands, located within the refuge boundary. An agreement between the Service and the State to include these lands in the refuge, or outright acquisition of the lands by the Service, would provide a higher level of protection for wildlife habitat. For example, camping is allowed on State-owned islands, but not on islands that are part of the refuge. The presence of people and dogs on the islands on a 24-hour basis results in disturbance to waterfowl, raptors, and other wildlife that use the islands and nearby waters.

Alternative 2 would also provide for additional interpretive signs on the refuge and creation of a water trail. These actions may result in increased public use, especially by nonmotorized watercraft, which could result in increased disturbance to wildlife. Alternatively, interpretive displays and a water trail would be expected to focus public use on a small part of the refuge, away from sensitive bird nesting areas, thus leaving large areas undisturbed. Most wildlife could move a short distance to avoid disturbance. Thus the effects of disturbance from increased public visitation are expected to be minor and not significant. Public visits to the refuge may also involve the use of motorized watercraft, which typically deposit small amounts of petroleum residues in the water. We are not aware of any evidence that such residues are harming wildlife in the estuary. Most water in the refuge is classified as navigable and under the jurisdiction of the State of Oregon, thus we could not restrict boat traffic in an effort to reduce boat pollution.

Overall, Alternative 2 would result in minor beneficial effects to wildlife, although these effects would be neutral.

4.7.3.3 Effects to Federally Threatened and Endangered Species

Fish

Thirteen species of federally listed salmon and steelhead utilize the lower Columbia River. In addition, small numbers of bull trout, a threatened species, may also be found in the Columbia River. Alternative 1 proposes no changes in the refuge habitat management, resource management, or public use programs; therefore, there would be a neutral effect to fish from Alternative 1.

Alternative 2 potentially would provide greater indirect benefits to listed salmonids and bull trout. Additional emphasis on working with partners to share resources, training, and equipment to control invasive species would occur. Non-native, invasive plants and animals may degrade the estuary’s productivity and negatively affect the fish food chain. Prompt and effective control of invasive species may prevent such consequences. We would meet with ODSL under Alternative 2, to discuss management options for State lands, including tidelands, located within the refuge boundary. An agreement between the Service and the State to include these lands in the refuge, or outright acquisition of the lands by the Service, would provide a higher level of protection for fish habitat. Alternative 2 would also provide for additional interpretive signs on the refuge and creation of a water trail. These actions might result in increased public use, especially by nonmotorized watercraft, but no effects on fish are expected. Public visits to the refuge may involve the use of motorized watercraft which typically release small amounts of petroleum residue into the water. We are not aware of any evidence that residues are harming fish in the estuary. Most water in the refuge is classified as navigable and under the jurisdiction of the State of Oregon, therefore, we could not restrict boat traffic in an effort to reduce boat pollution. Overall, Alternative 2 would result in beneficial effects to listed fish.

Brown Pelican, Northern Spotted Owl, Marbled Murrelet, and Streaked Horned Lark

Brown pelicans occasionally forage in waters around Lois and Miller Sands islands, at the downstream end of the refuge. Typically, only a few pelicans are present for short periods of time. They are not known to roost on refuge lands. Neither alternative would be expected to affect brown pelicans.

Northern spotted owls are not known to occur on the refuge. The only refuge unit with potentially suitable habitat is Tongue Point, which consists of uneven age forest dominated by old-growth Douglas fir and western hemlock. However, the minimum home range size of spotted owl pairs in the Oregon coast range is typically greater than 1,400 acres (Thomas et al. 1990). Tongue Point encompasses only 70 acres and is surrounded by habitat that is unfavorable for spotted owls (the Columbia River, a large Job Corps center, and a Coast Guard station); therefore, it is highly unlikely that spotted owls would occupy the site.

Marbled murrelets are not known to nest or forage within the refuge. Tongue Point, with its large old-growth trees, contains potentially suitable nesting habitat, but surveys by refuge staff have not detected the presence of marbled murrelets.

Streaked horned larks are commonly present at Rice Island, Miller Sands Spit, and Pillar Rock Island. These dredge spoil–created islands support the sparsely vegetated habitat preferred by streaked horned larks (Pearson and Hopey 2005). Although within the refuge boundaries, the islands are presently owned and managed by the State of Oregon.

Alternative 1 proposes no changes in the refuge's habitat management, resource management or public use programs. This alternative would have neither positive nor negative effects compared to the existing situation, thus its effects on streaked horned larks would be neutral.

Alternative 2 proposes that the Service meet with ODSL to discuss management options for State lands located within the refuge boundary. An agreement between the Service and the State to include these lands in the refuge, or outright acquisition of the lands by the Service, would provide a higher level of protection for streaked horned lark habitat. For example, camping is allowed on State-owned islands, but not on islands that are part of the refuge. The presence of people and dogs on the islands on a 24-hour per day basis may be a disturbance to streaked horned larks and may disrupt nesting, although we are aware of no site-specific studies on this subject. Alternative 2 would also provide for additional interpretive signs on the refuge and creation of a water trail. A water trail would not be located close to the dredge spoil islands; therefore, no effects on streaked horned larks are expected. Overall, Alternative 2 could be beneficial for streaked horned larks, but the effects would be neutral.

Steller Sea Lion

Steller sea lions follow salmon and smelt runs migrating upstream in the channels of the Columbia River. They haul out to rest, along with California sea lions and harbor seals, on sandbars within refuge boundaries.

Alternative 1 proposes no changes in the refuge habitat management, resource management, or public use programs. This alternative would have neither positive nor negative effects compared to the existing situation, thus its effects on Steller sea lions would be neutral.

Alternative 2 proposes additional interpretive signage and the creation of a water trail in the refuge. Public use might increase as a result and lead to increased disturbance to resting Stellar sea lions. This effect would be expected to be small and not significant. At any rate, the waters surrounding sea lion haul-outs are classified as navigable waterways and the refuge has little to no jurisdiction over boat traffic. Alternative 2 also proposes that the Service seek either an agreement to manage State-owned lands or acquire State-owned lands in the refuge. Either action would not affect Steller sea lions, thus Alternative 2's effects would be neutral.

Columbian White-tailed Deer

The habitat on most of the refuge islands is unsuitable for CWT deer because of daily tidal flooding. CWT deer have been observed on Welch and Karlson islands. Part of Karlson Island was formerly diked and supported a few resident CWT deer; however, the dikes were breached in the 1970s, and the island is now flooded during high tides. There is no evidence of a resident population of CWT deer on either island at the present time, although Welch Island, and perhaps other refuge islands, probably receive temporary use by CWT deer from nearby Tenasillahe Island.

Alternative 1 proposes no changes in the refuge's habitat management, resource management, or public use programs and thus there would be a neutral effect to CWT deer.

Alternative 2 potentially would provide greater indirect benefits to wildlife including CWT deer. Additional emphasis would be placed on working with partners to share resources, training, and equipment to control invasive species. Non-native, invasive plants and animals may degrade the estuary's wildlife habitats. The potential effects of such habitat degradation on CWT deer are not known, but it is expected that the deer would better thrive in a healthy habitat with native plants and animals.

Under Alternative 2, the Service would meet with ODSL to discuss management options for State lands, including tidelands, located within the refuge boundary. An agreement between the Service and the State to include these lands in the refuge, or outright acquisition of the lands by the Service, would provide a higher level of protection for wildlife habitat. There would be a neutral effect on CWT deer because the State lands in the refuge do not have suitable habitat for the deer.

Alternative 2 would also provide for additional interpretive signs on the refuge and creation of a water trail. These actions might result in increased public use and thus increased disturbance to

CWT deer. Public use would occur almost entirely on the water because the swampy ground and thick vegetation on the islands discourages hiking. To avoid disturbance from public use on the water, CWT deer would simply move a short distance inland. Because few CWT deer use the refuge, there would be a neutral effect on the population as a whole.

4.7.3.4 Effects to Wetland Habitats and Associated Wildlife

Wetland habitats within the refuge include tidal marsh, tidal scrub-shrub swamp, tidal Sitka spruce swamp, tidal cottonwood/willow swamp, mud flats and sandbars, and open water. Neither alternative proposes any direct changes to habitats, except invasive species control. The refuge encompasses most of the best remaining native habitats of the Columbia River estuary. The management goal is to preserve these habitats and allow natural processes to function unimpeded.

Alternative 1 proposes no changes in the refuge’s habitat management, resource management, or public use programs; therefore, there would not be any changes in effects to wetlands and associated wildlife, resulting in an overall neutral effect.

Alternative 2 potentially would provide greater indirect benefits to wetland habitats and wildlife. Additional emphasis would be placed on working with partners to share resources, training, and equipment to control invasive species. Non-native, invasive plants and animals may degrade the estuary’s wildlife habitats. For example, purple loosestrife is threatening to displace much of the native vegetation in the tidal marshes. Purple loosestrife provides no forage for waterfowl, whereas the native plants it is displacing produce the seeds, tubers, and foliage that sustain waterfowl. Control of invasive species like purple loosestrife would maintain plant diversity and wildlife food sources.

Under Alternative 2, the Service would meet with ODSL to discuss management options for State lands, including tidelands, located within the refuge boundary. An agreement between the Service and the State to include these lands in the refuge, or outright acquisition of the lands by the Service, would provide a higher level of protection for wetland habitat.

Alternative 2 would also provide for additional interpretive signs on the refuge and creation of a water trail. These actions might result in increased public use, which could result in increased trampling of vegetation and disturbance to wildlife. Any such effects would be minor and temporary, because the swampy ground and vegetation of the wetland habitats discourages foot travel.

Overall, Alternative 2 would result in beneficial effects to wetland habitats and wildlife, although the overall effects would be neutral.

4.7.3.5 Effects to Riparian and Upland Habitats and Associated Wildlife

Riparian and upland habitats within the refuge include riparian forest, upland conifer and mixed forest, and upland dredge spoil islands. Neither alternative proposes any direct changes to habitats, except invasive species control as needed. The refuge encompasses most of the best remaining native habitats of the Columbia River estuary. The management goal is to preserve these habitats and allow natural processes to function unimpeded.

Alternative 1 proposes no changes in the refuge's habitat management, resource management, or public use programs and thus there would not be any changes in effects, resulting in an overall neutral effect to riparian and upland habitats and associated wildlife.

Alternative 2 potentially would provide greater indirect benefits to riparian and upland habitats and wildlife. Additional emphasis would be placed on working with partners to share resources, training, and equipment to control invasive species. Non-native, invasive plants and animals may degrade the estuary's wildlife habitats. For example, the shrub scotch broom invades dredge spoil islands and suppresses the growth of native grasses, shrubs, and trees. Control of invasive species like scotch broom would maintain plant diversity and wildlife food sources.

Under Alternative 2, the Service would meet with ODSL to discuss management options for State lands, including riparian forest located within the refuge boundary. An agreement between the Service and the State to include these lands in the refuge, or outright acquisition of the lands by the Service, would provide a higher level of protection for riparian habitat.

Alternative 2 would also provide for additional interpretive signs on the refuge and creation of a water trail. These actions might result in increased public use, which could result in increased trampling of vegetation and disturbance to wildlife. Any such effects would be minor and temporary, because the thick vegetation of the riparian habitats discourages foot travel. Overall, Alternative 2 would result in neutral effects to riparian and upland habitats and wildlife.

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Chapter 5. Social and Economic Environment

Priority wildlife-dependent uses of units of the National Wildlife Refuge System include hunting, fishing, wildlife observation and photography, and environmental education and interpretation. *Photos:* USFWS

Chapter 5. Social and Economic Environment

5.1 Refuge Conditions, Infrastructure, and Administrative Facilities

5.1.1 Introduction

The majority of the public recreation in the local area centers on the Columbia River. Water-related recreational opportunities including power boating, sailing, kayaking, canoeing, waterfowl hunting, fishing, and camping provide the majority of the outdoor pursuits for the local and visiting public. Outdoor activities significantly increase during the summer season; however, many recreational activities such as fishing, boating and kayaking are not restricted to a specific season.

Designated camping facilities are limited in the local area. Vista Park, a county park just northwest of the Julia Butler Hansen Refuge, provides the area's only multi-use camping opportunities with approximately 47 camping sites, many with electrical and water hookups. Five newly established yurts help extend the camping season into the fall and winter for individuals without recreational vehicles (RVs) or other types of camp trailers. The park also provides a large sandy beach and a boat launch site and allows day use picnicking along the Columbia River. Two other camping areas nearby cater mainly to trailer and RV users.

Boat launch sites near the Julia Butler Hansen Refuge are available at the Elochoman Marina in Cathlamet, adjacent to Highway 4 between Cathlamet and Skamokawa, and next to Vista Park in Skamokawa. Near the eastern end of the refuge the Willow Grove Boat Launch is located just up river from the eastern tip of Crims Island. Two boat launch sites are located in the vicinity of the Lewis and Clark Refuge in Oregon. At the upstream end of the refuge, the Aldrich Point boat ramp is located at the east end of Brownsmead just down river from Tenasillahe Island, and the John Day Boat Ramp is located at the northwest end of the refuge by Karlson Island.

World-class sport and commercial fishing are some of the major attractions in the local area. Favorites among the anglers are spring and fall Chinook salmon, summer Coho salmon, and sturgeon. During good spring Chinook runs, boats may be seen packed into many areas in the lower Columbia. While the majority of fishing activities take place using watercraft, shoreline fishing is also fairly common. Winter steelhead fishing, on the Elochoman River and other tributaries that flow into the Columbia River, is another common outdoor recreational pursuit.

Hunting of local game generally occurs in the fall and winter. Elk and black-tail deer hunting is a popular fall activity with plenty of private lands but limited public areas available to local hunters. Waterfowl hunting for ducks and geese is another popular fall and early winter activity with both refuges providing the lion's share of the waterfowl hunt opportunities and acreage.

5.1.2 Lewis and Clark Refuge Infrastructure and Administrative Facilities

5.1.2.1 Emerald Heights Unit

A large apartment complex lies just to the west of this 80-acre forested unit. The Emerald Heights Unit has no existing roads within it. The ground has many small drainages running through it and averages a 25 percent slope. In December 2007 an intense wind storm toppled numerous trees damaging this mature forest extensively.

5.1.2.2 Tongue Point Unit

The south side of Tongue Point Unit is bordered by a U.S. Coast Guard Station and a Job Corps Center with numerous buildings, including residences, and several piers. Tongue Point Unit has many old roads running through it that were once used to access the many former military munitions bunkers throughout the area. The cement bunkers are now empty but remain onsite. The main gravel road around the perimeter is navigable and not overgrown like the roads on the hill above it. Access to the main perimeter road is through a chain-link fence gate which is located at the boundary intersection with the Coast Guard Station. A second access point is located at the boundary intersection with the Job Corps Center. Tongue Point is the historic site of a machine gun range, Coast Guard buoy maintenance area and navy fuel depot. Contaminants including sand grit contaminated with lead and ammunition lead have been found on the site. The sand grit lead was removed by a contaminants contractor in 2004 while the fuel depot site and machine gunnery range is being investigated under a contract with the Corps. There are a total of 70 acres on this unit. In December 2007 an intense wind storm caused numerous trees and boulders to crash down onto the main gravel road.

5.1.2.3 Brownsmead Unit

The Brownsmead-Knappa Fire District building and an old dilapidated barn are located on the 45-acre Brownsmead Unit. The fire district building and use of the administrative area of this site is covered under a memorandum of understanding (MOU).

5.1.2.4 Islands Unit

There are 32 privately owned hunting shacks, used primarily during waterfowl season within the acquisition boundary of the Lewis and Clark Refuge's Islands Unit. Thirty of these buildings are located on the water, on floats, 20-30 feet away from adjacent islands. Because they reside on tidelands owned by the State of Oregon, the duck hunting shacks are individually licensed and permitted by the ODSL. However since they are located within the designated acquisition boundary of the refuge, an MOU has been developed between the ODSL, Clatsop County, the Service, and hunting shack owners, setting stipulations to protect the conservation values of the refuge and surrounding waters.

Woody Island Floathouses adjacent to Lewis and Clark Refuge. Photo: USFWS

5.1.3 Julia Butler Hansen Refuge Infrastructure and Administrative Facilities

5.1.3.1 Mainland Unit

Refuge structures on the Mainland Unit include the refuge office, garage and parking lot, two residences, and a maintenance facility (shop building, pole barn and shop yard) all located off of Steamboat Slough Road in the northeast corner of the Mainland Unit. A wildlife viewing site with a parking lot and kiosks is located along Highway 4 approximately a quarter-mile south of Brooks Slough Road. At the northwest end of the unit, there is a private residence and a commercial flower greenhouse that are separated from the refuge by Steamboat Slough Road. Also at the northwest end, a 100-yard-wide strip of privately owned Sitka spruce swamp forest and Brooks Slough Road separate the refuge from two residences and commercial buildings in the town of Skamokawa. The refuge owns and manages an expulsion pump (60 horsepower) located adjacent to the Brooks Slough tidegate. Fourteen water control structures are located throughout the unit and are used to manage wetland water levels. Over 25 individual culverts, plastic and aluminum, channel slough and ditch water under refuge roads and crossings.

Six tidegates are located under the refuge perimeter dike (under Steamboat Slough and Brooks Slough Roads) to allow water to drain from inside the diked portion of the unit. The 48-inch diameter Duck Lake Slough tidegate drains water from the eastern portion of the unit, and at the head of Brooks Slough, a combined three-tidegate structure drains water from the northwestern portion of the refuge. The expulsion pump located at the head of Brooks Slough also helps to drain excess water off of the refuge and is especially beneficial during periods of high river levels when the tidegates do not open. Two additional smaller tidegates, one located at the west end of Steamboat Slough Road and one located at the west end of Brooks Slough Road also help to drain the northwest end of the refuge. The smaller northwest Steamboat Slough tidegate was replaced in 2003 to improve fish accessibility in that portion of the refuge. The smaller tidegate at the west end of Brooks Slough is extremely old (circa 1920), has a significant leak and is in need of replacement.

The Mainland Unit is located within Wahkiakum County Diking District #4 which has an easement for the refuge dike, and is responsible for maintenance of the refuge tidegates. Because the district has limited resources, the refuge has commonly either cost shared or provided sole funding for more recent tidegate and expulsion pump repairs and replacements. Both Steamboat Slough and Brooks Slough Roads are county roads and are managed and maintained by the county.

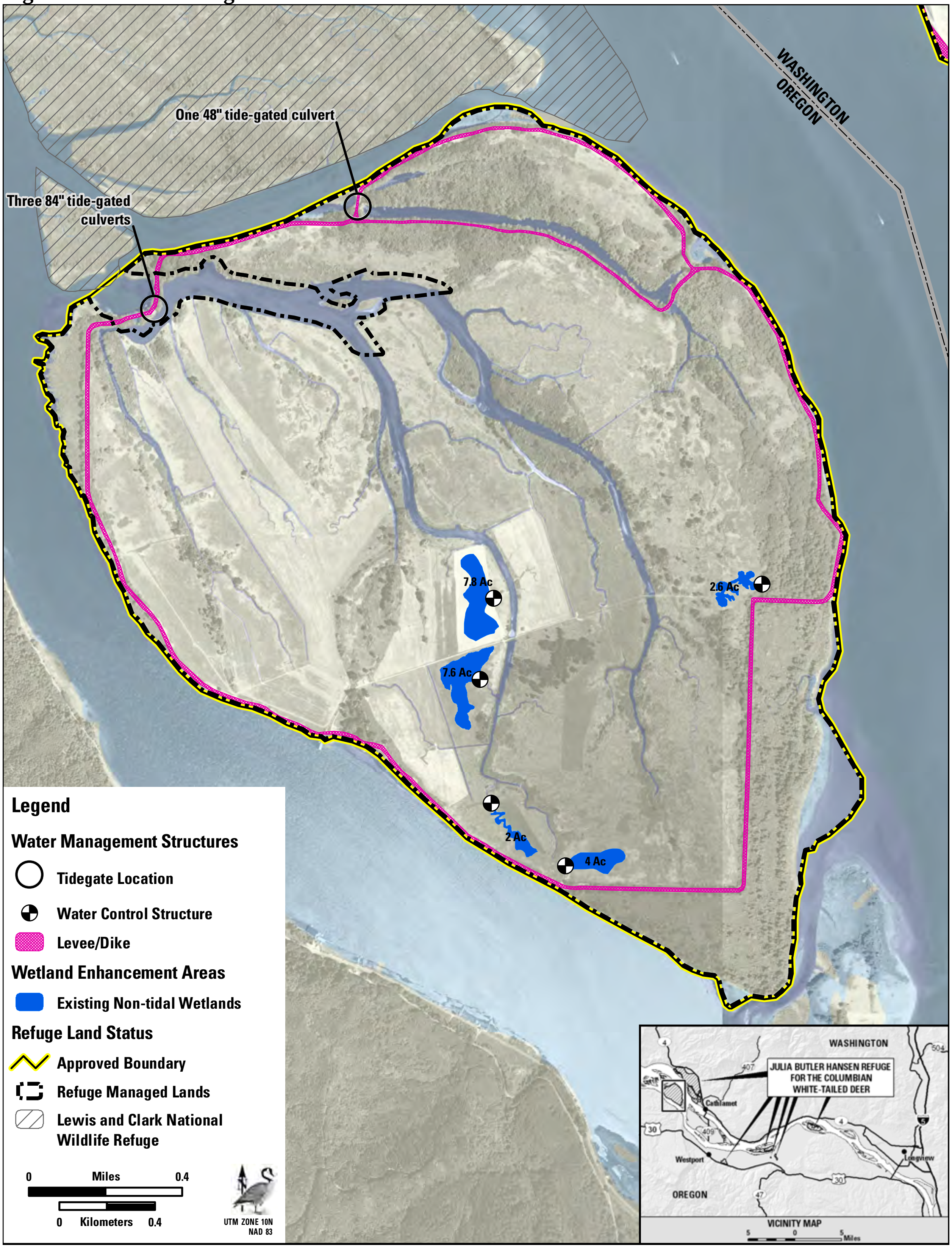
A 3.5-mile, 10-foot-high fence is located along the refuge boundary from the refuge headquarters along Steamboat Slough Road to the far end of field 4 along Brooks Slough Road. The fence serves as a deterrent for elk entering the Mainland Unit from the forested lands north and west of the refuge. However, a determined elk can still enter the unit by moving past either end of the fence line. Additional standard pasture fences are located in many of the grazed pastures to keep cattle away from riparian sites, wetlands, and forested locations.

5.1.3.2 Tenasillahe Island Unit

Refuge facilities located on this unit include a dock and barge loading facility which serves as the equipment/supply access point situated along the south side of the island in the Clifton channel. A maintenance area which includes a metal sided shop building and pole shed with wood framing is located approximately 300 yards inside the dike away from the docking facility. A floating hunting shack is also located in Multnomah Slough adjacent to the old dock site. This structure is covered under the same MOU that covers all of the hunting shacks in the Lewis and Clark Refuge. Technically the shack is outside the boundaries of both refuges but since it is directly adjacent to Tenasillahe Island and close to the Lewis and Clark Refuge boundary, it is covered by the MOU. The MOU is an agreement signed between the ODSL and the Service and the individual floathouse owners.

In the 1920s a series of dikes, which remain today, were constructed on Tenasillahe Island for farming/grazing purposes. The dikes were constructed to provide protection to pastures from the rising waters of the Columbia River. The 6-mile dike which surrounds the exterior edge of this island continues to protect valuable CWT deer habitat from flooding. Adjacent to this dike is an interior 1-mile dike that provides additional flood protection for the interior of the unit. The Service is responsible for maintaining the dikes on the island and providing quality habitat for the recovery of the CWT deer.

Figure 5.1 Water management structures on Tenasillahe Island.



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; County and State Boundaries from BLM; Hydrology from NOAA and USGS; Imagery from 2006 NAIP

The back sides of map pages are blank to facilitate map readability.

There are a total of four tidegates on the Island which allow water from the river to flow in and out of the sloughs, providing tidal inundation as naturally as possible to the interior sloughs (Figure 5.1). A set of three 84-inch tidegate structures are located on the main outflow channel of the island providing controlled movement of tidal waters in and out of the unit. These gates are made of aluminum and are side mounted to allow for improved fish passage. Each gate has a small fish door (photo on following page) which can be manually adjusted to allow water inflow and provide improved fish passage. The fish doors are open during the late spring through early fall seasons when the chances of flooding are reduced. A fourth 48-inch tidegate is located at the head of Multnomah Slough and allows water to drain from the northern portions of the island. To access various areas on the nearly 2,000-acre island unit there are gravel roads which run along the top of the Multnomah Slough Dike and perimeter dike, and through the center portion of the refuge. The refuge staff maintains each of the four tide gate structures, both dikes, and the gravel roads.

Water control structures are positioned at the five wetland sites on the unit and are used to manage optimum water levels in those areas. Two new bridges are located on the center road at the large slough crossing. These bridges were installed in 2007, to replace culverts, and to improve connectivity of fish movements in the sloughs. Several other locations along Center Road and Multnomah Dike Road have small culverts which channel water into roadside ditches and sloughs. The Tenasillahe Island Unit's main purpose is to provide quality habitat for the CWT deer.

5.1.3.3 Anunde Island Unit

At the north end of Anunde Island, adjacent to the refuge, there are a private residence and a large building that serves as a commercial fishing station and net drying facility.

5.1.3.4 Westport Unit

There are no structures in the vicinity of the Westport Unit. Railroad tracks belonging to the Portland and Western Railroad run along the outside boundary of the unit adjacent to Highway 30.

5.1.3.5 Wallace Island Unit

The Wallace Island Unit has been logged in the past and the second-growth forest, which is approximately 70 years old, is now well established. Old roads are barely distinguishable and the former hog pen is now dilapidated on the east side of the island.

5.1.3.6 Hunting Islands Unit

There are no structures or facilities on the Hunting Islands. The Service signed a 50-year agreement with the U.S. Coast Guard to allow vegetation removal for maintaining the line-of-site to a channel marker for navigation purposes on the Columbia River.

New Tenasillahe Island Tidegate with fish door closed. Photo: USFWS

5.2 Public Use

5.2.1 Area Outdoor Recreational Opportunities and Trends

A State agency known as the Interagency Committee for Outdoor Recreation (IAC) advises the State of Washington on matters of outdoor recreation. The IAC conducts inventory of outdoor recreation sites and opportunities, conducts studies of recreational participation and preferences, and periodically releases documents related to overall State Comprehensive Outdoor Recreation Planning (SCORP).

5.2.1.1 Current Outdoor Participation Rates

The most recently released SCORP Assessment (IAC 2002a) identified 14 major categories of outdoor recreation, subdivided into 170 activities. Of these 14 major categories, walking/hiking and nature activities figure as the two most popular, with 53 percent and 43 percent of Washington state residents participating in these activities, respectively. The IAC also indicated that observing/photographing nature and wildlife have participation rates of 42 percent, and visiting interpretation centers has a participation rate of 7.5 percent.

5.2.1.2 Forecast of Future Regional Recreation Demand and Key Recreation Needs Identified by IAC

Overall, outdoor recreation activity in most activities continues to increase at high growth rates. In a recent technical report (IAC 2002b), IAC projected future participation in 13 of 14 major outdoor recreation use categories over periods of 10 and 20 years. Nine of these activities will experience double digit growth (see Table 5-1).

The most recent estimates of recreation trends were based on the National Survey on Recreation and the Environment, projections for the Pacific Region (NSRE), which includes Washington State. The IAC adjusted the NSRE projections as necessary based on age group participation, estimates of resource and facility availability, user group organization and representation, land use and land designations, and "other factors" including the economy and social factors. Table 5-1 shows the percent of change expected for Washington State by activity as reported by IAC.

The 1995 assessment identified trails and environmental education as the two highest outdoor recreation needs in the state. Many outdoor activities generally permitted on refuges are expected to show increases of 20 percent to 40 percent over the next 20 years. The exception is hunting, in which participation is expected to fall at about that same rate.

Table 5-1 Projected Future Increase in Participation for Selected Outdoor Recreation Activities

Activity	Estimated Change, 10 years (2002-2012)	Estimated Change, 20 Years (2002-2022)
Walking	23%	34%
Hiking	10%	20%
Nature Activities (includes outdoor photography, observing wildlife and fish, gathering and collecting, gardening, and visiting nature interpretive centers)	23%	37%
Fishing	-5%	-10%
Hunting/Shooting	-15%	-21%
Sightseeing (includes driving for pleasure)	10%	20%
Camping – developed (RV)	10%	20%
Canoeing/kayaking	21%	30%
Motor Boating	10%	No Estimate
Equestrian	5%	8%
Non-pool swimming	19%	29%

5.2.2 Overview of the Refuges' Public Use

The Julia Butler Hansen Refuge and Lewis and Clark Refuge are popular destinations for local visitors as well as tourists from outside the area. As stated before, it is difficult to determine exact numbers of visitors to these refuges. However, it is estimated that they attract approximately 29,000 visitor-use days each year. The refuge complex provides funding for one full-time visitor services staff member dedicated to public use, education, and volunteer programs for three refuges. Many refuge visitors discover the refuges while on their way to and from other activities and destinations. The refuge staff takes advantage of these educational opportunities by providing refuge specific information, interpretive panels, and printed materials throughout the area both on-site and off-site.

5.2.2.1 Lewis and Clark Refuge

Wildlife-oriented public use is permitted on all lands within the Lewis and Clark Refuge except for the Brownsmead, Emerald Heights, and Tongue Point units. Due to the dense vegetation on many of the refuge islands, use is essentially restricted to shoreline locations. The refuge islands of the Columbia River estuary are accessible by boat only. Refuge activities include photography, wildlife observation, fishing, and hunting. Access to Lewis and Clark Refuge requires careful planning due to water conditions (tides and safety). Tidal flows and fluctuations, strong winds, and wakes from ships in the navigation channel can make boating difficult and dangerous. Deep channels separate most of the islands at high tide but tide tables and current navigation charts need to be consulted to avoid grounding on sandbars.

Waterfowl hunting is allowed in all locations except the old diked portion of Karlson Island and the embayment at Miller Sands Island. Both mainland locations (Tongue Point and Emerald Heights) are not appropriate for waterfowl hunting. Fishing is permitted along the shoreline of all refuge islands and in the sloughs and other waters surrounding the islands.

On the refuge islands, enforcement activities most commonly involve illegal camping, commercial guiding of hunters, and various other hunting violations such as over-bag limits or hunting without a license—all of which are currently prohibited on the refuge. Regulatory authority over public use issues including hunting, fishing, and boating is not always clear. In some portions of the refuge, the Service has ownership over the lands and nonnavigable interior sloughs, but does not have authority over the navigable waters of the refuge. In many but not all areas, the State of Oregon has control of all submerged lands below mean high tide (tidelands).

A brief history of refuge management agreements follows.

- When established in 1972, the Service owned only a small portion within the 33,000-acre refuge acquisition boundary of the Lewis and Clark Refuge. Through land management agreements, both the state and county lands within the designated boundaries of the refuge were managed by the Service. Navigable waters on the Columbia River remained under the domain of the State of Oregon.

- The land management agreement with the State of Oregon was canceled in 1994 pending a land trade which involved trading federally owned lands outside the refuge boundary to the State of Oregon in return for state lands within the refuge boundary going to the Service. The trade gave the Service approximately 75 percent of the state lands within the refuge boundary.

- The land management agreement with Clatsop County expired in 1997. At that time the County was willing to donate its lands to the refuge with the stipulation that historic floathouses within the refuge boundary be allowed to remain.

- Clatsop County donated all county lands (4,535 acres) inside the refuge boundary to the Service in May 2004.

- As of August 2008, a land management agreement with the State of Oregon to manage state lands within the boundaries of the refuge has not yet been implemented.

- Thirty-two floating recreational cabins (FRCs) commonly termed "duck hunting shacks" exist within the boundary of the Lewis and Clark Refuge. Some of these structures are historic, having been located in the same area since the early part of the twentieth century while others were constructed in more recent history (1970s and 1980s). The FRCs are located on pilings within the refuge acquisition boundary located on State-owned waters. They are used primarily as recreational hunting and fishing shacks, intermittently throughout the year. The Service's position on the FRCs has varied since the inception of the refuge. Clatsop County has supported the continued existence of the FRCs and was reluctant to consider transfer of County-owned islands within the refuge boundary to the Service until the issue was resolved.

- All but two of the FRCs are located in navigable waters of the Columbia River and are affixed to mooring pilings that are located on submerged lands owned by the State of Oregon. As the Service does not exert primary jurisdiction for most of the FRCs, an alternative approach involving establishing an MOU with the County, State and FRC owners was initiated. The MOU addressed refuge concerns regarding sanitation, appropriate public use activities, and modification or construction of new facilities. To date, all of the MOUs have been approved, and the County has donated all of its 4,535 acres of Columbia River islands to the refuge.

- On January 22, 2003, Clatsop County passed Ordinance 03-01, which allowed any FRC in existence and legally moored before January 1, 2000, to be considered a legal nonconforming structure, and allowed to remain, if it met ODSL requirements and the Oregon Department of Environmental Quality (DEQ) waste disposal requirements. The ordinance prohibited any new FRCs on the Columbia River and gave FRC owners until January 1, 2006, to become compliant.

5.2.2.2 Julia Butler Hansen Refuge

To reduce disturbance to the CWT deer, public use is restricted to the Steamboat Slough and Brooks Slough Dike roads; the headquarters area; the interpretive area and pull-off along Highway 4; and seasonally, to the Center Road on the Mainland Unit. Public use at the headquarters area includes day use activities which involve use of the public parking lot, restroom, viewing deck, and office reception area. Steamboat Slough Road provides access and opportunities for wildlife viewing, fishing, walking, bike riding, and photography. Uses along the road are not regulated by the refuge because the road is owned by Wahkiakum County. Some motor home and tent camping does occur on the beach shoreline across from the old maintenance shop site. The beach referred to locally as "Hornstra Beach" is in private ownership and has been the site of trash dumping, illegal fires, deposition of human waste, and unregulated camping.

The Center Road hiking trail is open seasonally from June through September to allow visitors to view wildlife from outside their vehicles. However, the only access point for the hiking trail is located at the west end of the refuge. Because the roads surrounding the refuge are elevated on the dikes, they provide better opportunities for visitors to view wildlife than the one way hiking trail on Center Road. There is a significant amount of vehicle traffic on the county roads and the refuge has no management authority over the road system. Other than the seasonal opening of Center Road as a public trail and other administrative sites, all locations interior to the Mainland Unit dikes are closed to public use to protect, reduce, and minimize disturbance to the CWT deer and waterfowl.

The Julia Butler Hansen Refuge islands include; Price, Hunting, Wallace, Crims and the Westport Unit which are all open to the public for day-use wildlife-dependent public uses. Activities on these islands are self limiting due to dense vegetation with public uses generally occurring only on the shorelines of these sites. Waterfowl hunting including geese, ducks, coots, and snipe is permitted along the shorelines of Wallace and Hunting Islands in accordance with state and Federal regulations. Additionally, we are proposing to open the shorelines of Price and Crims islands to waterfowl hunting in this CCP/EIS, including the interior sloughs of Crims Island.

Waterfowl hunting seasons have generally been open from mid-October through mid-January. Other areas of the refuge are closed to hunting with the exception of the Mainland Unit which has a limited cow elk hunt, first instituted during late fall and winter of 2005-2006. The hunt is intended to reduce elk numbers, which have been shown to compete with CWT deer for food and other limited refuge resources and thereby create unnecessary stress on the CWT deer population. Environmental assessments have been completed for both the waterfowl and elk hunt programs.

Fishing opportunities on the refuge are permitted in all areas except the areas interior to the Mainland and Tenasillahe Island units' dikes. Fishing is available along Steamboat Slough Road dike which parallels both the Elochoman and Columbia rivers.

Law enforcement problems are occasionally encountered on the Mainland Unit, but are not widespread, and are often either trespassing and/or vandalism violations. On the refuge islands there has been less intensive oversight of the public use programs. Public use management activities on refuge lands in the river most often deal with the issues of camping and commercially guided hunting, both of which are prohibited on the refuge.

5.2.3 Wildlife-dependent Public Uses

5.2.3.1 Hunting Opportunities

Recreational hunting (a wildlife-dependent activity) has been identified in the National Wildlife Refuge System Improvement Act of 1997 as a priority public use, provided it is compatible with the purpose for which the refuge was established. Because hunting is one of the six designated wildlife-dependent public uses of the Refuge System, refuges grant these six uses special consideration in planning and management.

5.2.3.2 Lewis and Clark Refuge-Hunting

The majority of the refuge is open to waterfowl hunting with the exceptions of the old diked portion of Karlson Island and the embayment at Miller Sands Island. The closures at these two islands represent lands purchased with Duck Stamp Act funds, which require 40 percent of the lands/acres to be closed to hunting, and allowing the remainder to be open to waterfowl hunting. Only a handful of islands were purchased with duck stamp funds. The remaining islands were either donated by the State, or purchased with migratory bird conservation funds. The two non-island units, Tongue Point and Emerald Heights, are also closed to hunting. Hunting is consistent with State regulations except as specifically noted herein.

- Geese, ducks, coots, and common snipe are permitted to be taken. Hunting periods and specific species/numbers to be taken are set by the respective state agencies (ODFW and WDFW), to match adjacent areas open to waterfowl hunting. The islands on the lower river differ from islands at Julia Butler Hansen Refuge in that there are more sloughs and interior waterways which make hunting of the islands' interiors much more accessible. Therefore, hunting is allowed in all areas of the lower river islands.

- The hunt areas are on islands in the Columbia River where access is only available by boat. Camping, overnight use, and fires are prohibited. Hunters may use dogs to aide in the retrieval of birds but dogs have to be kept under control at all times. Hunters can set up temporary blinds along the shoreline but they must be removed at the conclusion of each hunting day. Only nontoxic shot is allowed for the hunt.

5.2.3.3 Julia Butler Hansen Refuge-Hunting

Waterfowl hunting is one of the more popular recreational activities occurring on the refuge. Approximately 30 percent of the refuge is open to waterfowl hunting. Closed areas include the Mainland Unit, the Tenasillahe Island Unit, Crims Island, Price Island Unit, and the scattered tracts that make up the Westport Unit. Units currently open to hunting include the refuge owned portion of the Hunting Island and the Wallace Island Unit. We are proposing to open the Crims Island and Price Island units to waterfowl hunting in the preferred alternative of this CCP. We are also proposing to close a small section of Elochoman Slough with WDFW, for safety purposes, due to the proximity of the county road. Waterfowl hunting is permitted immediately adjacent to all refuge lands on waters and tidelands surrounding each of the refuge units owned by the states of Oregon and Washington. These adjacent waters are all tidally influenced, submerged lands below mean high water, of which the refuge has no jurisdiction. Hunting is consistent with state regulations except as specifically noted herein.

- Geese, ducks, coots, and common snipe are permitted to be taken. Hunting periods and specific species and numbers to be taken are set by the respective state agencies (ODFW or WDFW), to match adjacent areas open to waterfowl hunting. Only the shoreline of the refuge islands is opened for hunting waterfowl, because no potential for a quality hunt exists on the islands' interior as it is made up of dense forested upland.

- The hunt areas are on islands in the Columbia River where access is only available by boat. Camping, overnight use, and fires are prohibited. Hunters may use dogs to aide in the retrieval of birds; however, dogs have to be kept under control at all times. Hunters can set up temporary blinds along the shoreline, but they must be removed at the conclusion of each hunting day. Only nontoxic shot is allowed for the hunt.

Another type of hunting allowed on the refuge is the Mainland Unit's elk hunt, which is specifically designed to reduce the competition for CWT deer critical habitat. The Service's Environmental Assessment of Proposed Additions to Julia Butler Hansen (USFWS 2004) outlined how elk removal would be managed on the refuge, using a three-tiered approach.

- The initial tier includes a State-regulated limited permit muzzleloader hunt with a maximum of 10 permits issued per designated hunt period. The number of permits, number of hunt periods, and type of animals to be taken (cow, spike, bull etc.) is determined annually, based on the number of elk found on the refuge. Permits are not issued for the largest of the refuge's bulls to allow for continued observation and photography opportunities. If population numbers fall below the designated goals of 20 to 30 animals, there is no elk hunting on the refuge until numbers have increased.

- If the limited hunt does not reduce herd numbers to management goals, then the refuge can proceed to a second-tier action or primary state backup plan. This action involves a State-regulated special hunt (a specially designated state hunt to control a sudden depredation problem, not necessarily during a designated hunting season) which would have the same general stipulations as the limited permit hunt.

- If management goals are still not met, the refuge could proceed to a third tier action or secondary state backup plan. The third tier would involve either a management cull (elk removed by a professional sharpshooter) or relocation of the elk (elk moved off of the refuge). This state backup plan would be dependent on WDFW policy and preferences at the time the action is required. This three-tiered approach gives the refuge and WDFW a variety of tools to deal with high elk numbers while also addressing State concerns with the current elk relocation process.

As of fall 2007 the refuge has managed three elk hunts. During the first hunt, five elk were removed from the refuge, in the second hunt no elk were removed from the refuge, and in the third hunt one elk was taken. At this time it appears the as-needed hunt program is working well, as current elk numbers (fall 2008) have been reduced to the approximate management level of 20 to 30 animals. However, the potential for elk to access the refuge, and thereby increase elk numbers beyond the management goals, which would trigger a fall hunt, remains a possibility.

5.2.3.4 Fishing Opportunities

With their lengthy shorelines, wide open spaces, and diverse river, slough, and wetland habitats, the waters surrounding both refuges provide opportunities for anglers to catch everything from enormous wild Chinook salmon to a variety of warm water fish. Fishing continues to be one of the most popular activities for visitors and local residents near both refuges. It is estimated that more visits are made to the refuges for fishing than for any other use.

5.2.3.5 Fishing Opportunities-Lewis and Clark Refuge

Visitors to Lewis and Clark Refuge arrive by watercraft on the Columbia River. Locally there are five boat launches which give visitors access to the waters surrounding the refuge Islands Unit. Three boat launches are located on the Washington side of the river, including the Cathlamet Marina, Brooks Slough State Boat Launch, and Wahkiakum Port District 2 Boat Launch adjacent to Vista Park in Skamokawa. Only the Cathlamet Marina has a developed launch site with a concrete ramp, docks, and fuel available with the other two locations only providing a gravel launch ramp. A total of two boat launches are available on the Oregon shoreline. There is a paved launching facility just east of Astoria at the John Day River site, as well as a primitive gravel launch run by Clatsop County located at the upstream portion of the Lewis and Clark Refuge at Aldrich Point near the unincorporated town Brownsmead.

As with the Julia Butler Hansen Refuge, anglers make up the largest number of refuge visitors, although many who come to fish are probably unaware that they are even near a refuge. Almost all of the fishing occurs by boat on the Columbia River and though much of the fishing in the lower estuary occurs within the acquisition boundaries of the refuge, the refuge has no jurisdictional control over the waters of the Columbia River and other navigable waters in both Washington and Oregon. Fishing from the shorelines of the Islands Unit is relatively uncommon because boat fishing is so much more accessible and successful.

5.2.3.6 Fishing Opportunities-Julia Butler Hansen Refuge

Even though anglers make up the largest number of refuge visitors, many are probably unaware that they are even on a refuge because the use is somewhat dispersed and not directly managed or regulated by refuge staff. Much of the fishing occurs on the periphery of the Mainland Unit along the outside of the Steamboat and Brooks Slough dike roads where fishing occurs in the Elochoman and Columbia Rivers. Although much of the exterior dike county road is open for fishing, all areas interior to the dike except for the area immediately adjacent to the Brooks Slough tide gate are closed to fishing access to reduce disturbance to the CWT deer. Fishing from the shorelines of the other island units is relatively uncommon although boat fishing is a very popular activity. The refuge has no jurisdictional control over the waters of the Columbia River and other navigable waters in both Washington and Oregon.

There are no refuge owned or managed fishing facilities, although there are three public use boat launch sites within four miles of the Mainland Unit and several others in the vicinity of the upstream managed refuge islands.

5.2.3.7 Wildlife Observation and Photography-Lewis and Clark Refuge

The Lewis and Clark Refuge does not provide any public use facilities; however, the lower river estuary provides a multitude of natural viewing opportunities for visitors to observe and photograph wildlife. Because the refuge is only accessible by watercraft, which allows for numerous access points, visitation numbers are harder to quantify and visitors are more dispersed than on the Julia Butler Hansen Refuge.

5.2.3.8 Wildlife Observation and Photography-Julia Butler Hansen Refuge

Wildlife viewing and photography are popular activities on both refuges. Visitors at the Julia Butler Hansen Refuge can drive along the Steamboat and Brooks Slough Roads to capture views of CWT deer, elk, waterfowl a variety of birds and other nongame species. The viewing deck at the headquarters and the wildlife viewing blinds off of State Highway 4 are the two designated wildlife viewing facilities at the refuge. The viewing site at Highway 4 was originally set up to reduce traffic congestion which occurred when visitors stopped in the highway to watch elk on the refuge. At that time over 120 elk were known to occur on the refuge. With increased emphasis on reducing elk numbers to protect CWT deer habitat, elk are now rarely observed at the viewing site, therefore, this location may be better utilized as an interpretive site.

Because usage patterns for the CWT deer, elk, and other wildlife species are somewhat unpredictable, visitors are likely to see wildlife at just about any location when traveling the county roads that surround the Mainland Unit, which is by far the single most visited unit on the refuge. Other island locations, including Tenasillahe Island, provide limited viewing opportunities due to riparian cover. Because these islands can only be reached by boat, they receive fewer visitors than the Mainland Unit.

5.2.3.9 Environmental Education and Interpretation

Due to the limited staff size for both refuges, very few environmental education activities have taken place on these refuges. Some onsite habitat and wildlife monitoring programs have been established with local high schools. These projects have included amphibian monitoring, weed mapping, and most recently, riparian forest planting in which students planted a 2-acre site near the refuge office. Occasionally when requested, refuge staff members have and will continue to provide talks to local colleges, scouting groups, community organizations, and local schools. Because the visitor services position for the refuge complex resides at Willapa Refuge's headquarters, most of the environmental education programs for the refuges have been focused in the Willapa Bay area. It is expected that in the future, this position will have a greater and more active role in expanding environmental education programs for both Julia Butler Hansen and Lewis and Clark refuges.

Interpretative information and brochures for both refuges is located at the refuge office/visitor contact station. The refuge office/contact station is open to the public when staff is available to answer visitors' questions. The headquarters observation deck remains open year-round and provides refuge and interpretive information, and a restroom facility. There is also a wildlife viewing site located off Highway 4. This site provides interpretive information for refuge visitors and a view of the refuge pasture and forest habitats. The Lewis and Clark Refuge has several small informational panels at three sites in the lower river (Cathlamet Marina, Vista Park, and the John Day Boat Ramp) including information from the refuge brochure.

5.2.4 Nonwildlife-dependent Recreation

5.2.4.1 Recreational Boating, Waterskiing, Swimming, and Beach Use

Pleasure boating using motor boats, jet skis (also known as personal watercraft or PWC), and canoes or kayaks are popular activities on the Columbia River during the warmer months. Most of the pleasure boating is concentrated near boat launches bordering refuge lands and waters. Facilities used for this activity are discussed under 5.2.3 Fishing Opportunities. Waterskiing, swimming, and beach use also occur during the warmer months, especially on ODSL's dredge spoil areas that are used as beaches, located adjacent to refuge islands. As has been noted elsewhere, because most of the refuges water areas outside of interior dikes are below mean high tide, jurisdiction of these areas reside with the states of Oregon and Washington.

5.2.4.2 Recreational Boating, Waterskiing, Swimming, and Beach Use-Lewis and Clark Refuge

Because 95 percent of the refuge acreage consists of island habitat, visitors to Lewis and Clark Refuge must use some type of watercraft to access it. Nonwildlife-dependent recreation occurs on the refuge, most commonly associated with motorized and nonmotorized boating activities operating in State owned waters. While swimming and jet skiing do occur, these activities happen less in this portion of the lower river due to safety concerns including winds, tides, and numerous submerged objects. As with the Julia Butler Hansen Refuge, the refuge staff does not have firm visitation numbers for visitors partaking in these off-refuge, nonwildlife-dependent activities.

5.2.4.3 Recreational Boating, Waterskiing, Swimming, and Beach Use-Julia Butler Hansen Refuge

Boating, waterskiing, and kayaking are most prevalent adjacent to the upstream end of Hunting Islands in the vicinity of Cathlamet Marina and along Steamboat Slough. Nonmotorized boating on the refuge has become increasingly popular, especially in the last 10 years. From the marina down through the Skamokawa area, kayaking is a very common activity throughout most of the year. High winds and rough waters farther downstream in the reaches of the lower river make kayaking and canoeing much more of a challenge, which tends to limit the number of nonmotorized boaters using the mainstem of the lower river from about the Cathlamet area downriver. The refuge does not have firm numbers on the number of visits made to the refuge's islands. Many visitors within the acquisition boundary are there solely for pleasure boating, fishing, waterskiing, swimming, beach use, and nonmotorized boating. Other nonwildlife-dependent recreational activities that occur on lands adjacent to the Mainland Unit of the refuge include dog walking, lighting fireworks, and camping. These activities occur on or along the dike road which is owned and managed by Wahkiakum County.

A private parcel of land referred to as Hornstra Beach located outside the mainland dike immediately adjacent to the county road, consists of old dredge spoil material that has become vegetated with a mix of willows. The property for the most part is unregulated, with camping, dog use, day use activities, and a wide range of other recreational activities, both legal and illegal.

5.2.5 Illegal Uses

The most common law enforcement issues encountered in the field are trespass into closed areas, waterfowl hunting violations (lead shot, hunting in closed areas, taking birds out of season, and unplugged shotguns), vandalism (broken gates and defaced signs), theft (stolen gas, tools, equipment, and signs), and illegal camping. There is currently one full-time refuge law enforcement officer assigned to cover three refuges within the Willapa Refuge Complex. The refuges' staff coordinates internally with other Federal officers/agents and works with the U.S. Coast Guard as well as state, county and local law enforcement offices.

5.3 Cultural Resources

5.3.1 Native American Cultural History and Landscape

The geographic setting of the two refuges—occupying both islands and mainland along the lower Columbia River—places them at the heart of prehistoric and historic travel, hunting, and resource-collecting routes. The refuges are situated within the traditional domain of the Cathlamet and Wahkiakum groups of Lower Chinookan Indians. Chinookans lived on the Columbia River thousands of years before Euro-American explorers first arrived in the area. Settling in autonomous villages on both shores from its mouth to The Dalles, the Chinookans used the river as a highway to carry trade goods between the coast and interior areas. Their strategic control over the lower Columbia made them wealthy and powerful traders.

The way native inhabitants used the landscape and its resources in pursuit of survival and trade dictates the types of cultural resources that might be expected to occur on the refuges. Their primary subsistence activities focused on riverine resources which would have been abundant in and around the refuges. The single most important resource for both personal consumption and trade appears to have been fish (Gilbow et al. 1981). Small, specially built river canoes were maneuvered around the marshy islands, to fish for salmon, sturgeon, eulachon (candlefish or smelt), and steelhead trout, using spears, seine nets, dip nets, hook and line, and weirs (which sometimes survive in the archaeological record). Mainland game hunting supplemented the Chinookans' diet with species such as deer, elk, bear, cougar, and smaller animals such as beaver and porcupine. A wide variety of roots, shoots, and berries were gathered throughout the area.

While portable dwellings made from cattail mats were erected at seasonal fishing, hunting, and gathering camps (Silverstein 1990:538), the permanent settlements of the Wahkiakum and Cathlamet Indians were the cedar plankhouses characteristic of Chinookan cultures all along the Columbia River. According to Clark, their houses differed from those upriver in a few significant ways, specifically, the use of above-ground construction and doors that opened on the sides of the building (Moulton 1990).

Two villages, "Elochoman" and "Wahkiakum," appear frequently in the historic and ethnographic record as being situated at the mouth of the Elochoman River where it meets the Columbia (Ray 1938; Strong 1906). As such, the villages locations would have been within or adjacent to the boundaries of present day Julia Butler Hansen Refuge. Clark, it is believed, was referring to one of the villages when he wrote the following on November 7, 1805.

> *"....two Canos of Indians met and returned with us to their village which is Situated... behind a cluster of Marshey Islands, on a narrow chanl of the river through which we passed to village of 4 Houses..."* (Moulton 1990)

Today those marshy islands are known as the Hunting Islands. The expedition members traded with the villagers, offering fish hooks in exchange for food such as salmon and wapato, and for otter skins which they used for clothing. Later that same day as they were being piloted through the sloughs by an Indian in a sailor's uniform, they observed a "temporary residence" on another "marshey island," probably Tenasillahe Island (Moulton 1990). This area on the east side of the island continued to be referenced as a fishing site as late as 1841, when Charles Wilkes noted a "fishery" there during his United States Exploring Expedition (Gilbow et al. 1981).

In addition to documenting the existence of prehistoric and contact-era settlements in the vicinity of the refuges, historical narratives and ethnographies also describe the prominent use of the islands and marshy areas for Chinookan canoe burials (Moulton 1991; Ray 1938). A turn of the twentieth-century account by Thomas N. Strong, son of early settler William Strong, paints a vivid image of this tradition:

> *Between the Elokomon and the Skamokawa the sloughs were lined with the burial canoes of the dead, as only distinguished men were so buried, this stood for a very large population. . . These canoe burials were ancient to say the least. Cedarwood is almost indestructible and no living Indians knew the name or lineage of the dead. . ."* (Strong 1906)

The Wahkiakum and Cathlamet were active participants in the Euro-American trade network that evolved during the first half of the 1800s. But their population numbers dwindled as warfare, liquor, and especially introduced diseases took their toll on the native people of the Columbia River. By the 1840s, few Chinookans remained in their traditional places on the river, and white settlers began arriving in the 1850s.

5.3.2 Euro-American Cultural History and Landscape

5.3.2.1 Early Exploration, Lewis and Clark, and the Fur Trade: 1790s-1840s

The early history of the refuges is dominated by Euro-American exploration and the fur trade on the lower Columbia River from the 1790s to the 1840s. American Captain Robert Gray was the first to make an incursion up the Columbia River in May of 1792. He sailed as far as Grays Bay, anchoring the *Columbia Rediviva* across the river from Tongue Point at what is now the very western edge of Lewis and Clark Refuge. This "discovery" was soon followed by further exploration by the British. In October 1792, Lieutenant William Broughton traveled through both refuges, camping for a night on either Tenasillahe Island or one of the adjacent islands (Gilbow et al. 1981).

Lewis and Clark first passed through Julia Butler Hansen Refuge and the refuge that bears their names 13 years and one month later, paddling downstream from the east. Though their visit was brief, their narratives of the time spent navigating among the islands both in November 1805 and

March 1806 document a landscape and a diversity of flora and fauna that are preserved on the refuges 200 years later. From their campsite of November 26, 1805, on the south shore overlooking the islands of Lewis and Clark Refuge, one of the explorers observed, “We saw along the shore, a number of Islands that lay very low & marshy. The Geese, swan & Ducks are in the greatest plenty at this place, & our Hunters killed a number of them” (Moulton 1997).

The explorers’ scientific descriptions of the area’s ecology and the physical characteristics, abundance, and range of the flora and fauna also offer a unique glimpse of the Columbia River before modern settlement and development occurred. In addition to the now-endangered CWT deer for which it was established, the Julia Butler Hansen Refuge provides habitat for other species originally described by Lewis and Clark, such as Roosevelt elk and tundra swans. Likewise, the Lewis and Clark Refuge preserves estuarine habitat critical to the survival of fish and wildlife species.

On the heels of the Corps of Discovery came the continental fur trade, which was dominated early on in this area by a company of traders organized by New York merchant John Jacob Astor. Later, the Canadian North West Company and then the Hudson’s Bay Company took over operations on the lower Columbia River. Throughout the period from 1810 to 1846, natives and nonnatives alike traveled the waters between the islands as they plied their trade. Occasional journal references to the names of islands or the people encountered there provide glimpses into the changing status of the natural and cultural landscape. Gilbow et al. (1981) provide a detailed compilation of historic accounts regarding this portion of the Columbia River.

Of particular interest to the history of Lewis and Clark Refuge, are a few mystery-shrouded references regarding an aborted attempt to build a North West Company Fort on Tongue Point. Historic sources suggest that construction began in February of 1814, but by May 1, 1814, the unfinished fort was abandoned abruptly, and without an explanation offered in the historical record (Corbyn 1989). Though no remnants have been found to date, the physical remains of the fort would provide a valuable time capsule for understanding the construction of the trading company’s early fortification systems as well as the material culture of the time.

5.3.2.2 Euro-American Settlement, the Fishing Industry, and Farming: 1840s-1970s

Homesteaders began arriving in the lower Columbia River area in the late 1840s, filing land claims wherever the land was suitable for agriculture. Most of the islands, it appears, were considered more valuable for fisheries than farming (Gilbow et al. 1981). Within a few years, in fact, fisheries began to develop in places like the east side of Tenasillahe Island (Tenasillahe Fishery, Mitchel’s Fishery on Julia Butler Hansen Refuge) and Welch Island (Fitzpatrick’s Fishery, Welch’s Fishery on Lewis and Clark Refuge). Structures and docks associated with the fisheries were built as early as the 1850s and in some cases used well into the 1890s. Fish weirs were also constructed in the vicinity of several islands. By the late 1800s into the 1900s, homesteaders were increasingly attracted to the area by the fishing; building small shanties on pilings or platforms along the shorelines of many islands. The nearby communities of Skomakawa and Cathlamet thrived as commercial centers for the salmon fishing and canning industry, as well as the logging industry. Timber was logged for construction but also to feed the engines of steamboats, which were the primary mode of transportation. Steamboat Slough at the north end of Julia Butler Hansen Refuge is named for the boats that stopped there for fuel wood.

The landscape at Julia Butler Hansen Refuge underwent major environmental changes in the 1920s when the Mainland and Tenasillahe Island units were diked and drained by the newly-formed County Diking District No. 4. Approximately half a dozen families moved into the diked bottomlands which were converted to pastures for grazing dairy and beef cattle. Tenasillahe Island was the site of a dairy and cheese factory. Farming continued for nearly 50 years until the refuges were established in 1972.

Portions of islands within Lewis and Clark Refuge were reclaimed, diked, and drained for farming. For examples, Long Island, where the Brownsmead Unit is located, was diked by the U.S. Army Corps of Engineers in the 1940s. The Brownsmead Unit consists of diked pasturelands, which are now seasonally grazed for the benefit of wintering Canada geese.

Over the course of the twentieth century, land use on Tongue Point included construction of a submarine and destroyer base during World War I (completed in 1924, but never used); development of a naval air station in World War II for the purpose of coastal seaplane patrols (1939-1946); storage of mothballed naval ships (1946-1962); establishment of a Coast Guard station (1964-1966); and use as a Job Corps Center (1966-present). The forested area on the north end of Tongue Point was acquired by the refuge in 1992.

5.3.3 Archaeological Resources and Historic Properties

Though the historic accounts indicate that native utilization of the area was long and intensive, the constantly changing course of the Columbia River channel and its sloughs, as well as the sedimentation, flooding, subsidence, and erosion of its islands, make the likelihood of discovering intact cultural resources within refuge boundaries fairly remote. Any resources that still exist could be buried under several feet of sediment (Gilbow et al. 1981). In comparison to other areas of the Columbia River, little archaeological investigation has taken place in this region (Minor 1983)

5.3.3.1 Lewis and Clark Refuge

No comprehensive survey or cultural resource overview has been conducted for the refuge. A project-specific survey on the Brownsmead Unit identified no cultural resources (Raymond 1995). The known archaeological sites in the vicinity (0.7 to 2.5 miles away) are located on high ground near sloughs and rivers, rather than in the tidally influenced lowlands and islands that characterize the refuge.

Though the Corps of Discovery camped at the mouth of Mill Creek near Tongue Point on the night of November 26, 1806, the exact location is unknown. Likewise, the exact location of the reported fort construction at Tongue Point is unknown, and no remains have been discovered to date. The entire point has been severely altered as a result of development. Facilities associated with military operations and later, the Job Corps Center still exist at Tongue Point adjacent to refuge boundaries.

5.3.3.2 Julia Butler Hansen Refuge

An archaeological survey and cultural resource overview of the Mainland, Hunting Islands, and Tenasillahe Island units was conducted in 1980 by faculty and staff of Eastern Washington University (Gilbow et al. 1981). Dense vegetation hindered survey efforts and restricted the intensity of coverage, though auger testing was conducted to augment the surface survey. The archival research conducted in conjunction with the survey generated a detailed history of this portion of the Columbia River which is useful as a reference. No evidence of the two village sites (WK-10 and WK-11, recorded but apparently not located on the ground by Smith and Hudziak in 1948), the Tenasillahe Island fishing encampment (no site number), or any other cultural resource was identified as a result of the survey. Since then, other units have been acquired by the refuge. These include portions of Crims Island (originally named “Fanny’s Island” by Clark after his sister) (2003); Wallace Island (1995); and some small parcels near Westport, Oregon (1995-1996). No surveys or sites have been documented on these parcels.

Project-specific archaeological surveys have been conducted by the Service’s archaeologists for refuge construction and restoration activities on the Mainland and Tenasillahe Island units in compliance with Section 106 of the National Historic Preservation Act (NHPA) (Bourdeau 1995, 2001; Raymond 1993; Speulda 2005). No cultural resources have been discovered as a result of these surveys.

At least 30 of the floating houses still exist along the island margins, but they are privately owned and are not within the jurisdiction of the Service. No other remains of the structures, docks, or weirs associated with the fishing industry are visible today. Many of the farm buildings were moved or demolished at the time of acquisition by the refuge. One of the few exceptions is Quarters 36, a small gothic arch barn built in 1937 by former landowner A.P. Hebeisen. It was acquired by the Service in 1972, though Mr. Hebeisen continued to live in it. By 1977 it was used for housing a Service employee. It was damaged by flooding in 1996 and finally slated for removal in 2005. The structure was evaluated for its historic significance and determined ineligible for listing in the National Register of Historic Places (Speulda 2005). It was removed from the refuge in 2006 due to lead paint issues.

5.4 Social and Economic Conditions

5.4.1 Population, Housing, and Income

5.4.1.1 Lewis and Clark Refuge

The Lewis and Clark Refuge is situated entirely within Clatsop County, Oregon. The nearest communities are Knappa and Astoria, Oregon, and the community of Skamokawa, Washington. The population of Clatsop County is approximately 37,000 people and its population growth has been less than Oregon’s average. However, because of the proximity of the refuge to population centers in the Portland/Vancouver areas of northwest Oregon and southwest Washington, the refuge can expect much greater pressure for recreational use in the future.

5.4.1.2 Julia Butler Hansen Refuge

The refuge is mainly situated in Wahkiakum County, Washington, and Clatsop County, Oregon, though parts of the refuge (Crims Island and Wallace Island) extend into Columbia County, Oregon. Cowlitz County, Washington is directly adjacent to the upstream Crims Island Unit. The nearest communities include Cathlamet and Skamokawa, Washington, and Westport and Clatskanie, Oregon. The Mainland Unit is close to the town of Cathlamet, Washington (see Map 2). The population base is rather small in Wahkiakum County mainly due to its rural nature and limited industrial infrastructure.

The refuge area's population as a whole is growing at a slower rate than the rest of the State, except for population growth in Columbia County, Oregon which is growing at a rate of 13 percent annually. Overall populations of the local counties of Columbia, Cowlitz, and Wahkiakum are smaller than the states' average. The refuge can expect greater pressure for recreational use in the future due to the proximity of the refuge to large population centers in the Portland/Vancouver areas of northwest Oregon and southwest Washington. Table 5-2 shows the populations of each of the relevant counties, growth rates, and other social statistics collected by the U.S. Census Bureau.

Table 5-2 Selected Population and Associated Social Statistics, Local Counties

Population Parameter	Wahkiakum County	Cowlitz County	Washington	Clatsop County	Columbia County	Oregon
Population, 2006 estimate	4,026	99,905	6,395,798	37,315	49,163	3,700,758
Population, percent change April 1, 2000 to July 1, 2006	5.3%	7.5%	8.5%	4.7%	12.9%	8.2%
Population, 2000	3,824	92,948	5,894,121	35,630	43,560	3,421,399
Persons under 5 years old, percent, 2005	3.5%	6.0%	6.3%	5.1%	5.6%	6.2%
Persons under 18 years old, percent, 2005	19.4%	24.3%	23.6%	21.3%	24.1%	23.3%
Persons 65 years old and over, percent, 2005	20.1%	13.5%	11.5%	15.9%	11.3%	12.9%
White persons, percent, 2005	96.1%	94.1%	85.0%	95.3%	95.4%	90.8%
Black or African American persons, percent, 2005	0.3%	0.7%	3.5%	0.8%	0.5%	1.8%
American Indian and Alaska Native persons, percent, 2005	1.7%	1.6%	1.7%	1.1%	1.4%	1.4%
Asian persons, percent, 2005	0.5%	1.3%	6.4%	1.3%	0.7%	3.4%
Native Hawaiian and Other Pacific Islander, percent, 2005	0.0%	0.1%	0.5%	0.1%	0.1%	0.3%
Persons reporting two or more races, percent, 2005	1.4%	2.1%	3.0%	1.4%	2.0%	2.3%
White persons, not of Hispanic/ Latino origin, percent, 2005	93.6%	89.0%	77.1%	89.7%	92.3%	81.6%
Persons of Hispanic or Latino origin, percent, 2005	2.6%	5.6%	8.8%	6.1%	3.3%	9.9%
Living in same house in 1995 and 2000, percent age 5+, 2000	62.2%	52.6%	48.6%	47.9%	53.4%	46.8%
Foreign born persons, percent, 2000	1.3%	3.7%	10.4%	4.2%	1.8%	8.5%
Language other than English spoken at home, percent age 5+, 2000	4.3%	6.0%	14.0%	7.1%	3.9%	12.1%
High school graduates, percent of persons age 25+, 2000	84.2%	83.2%	87.1%	85.6%	85.6%	85.1%

Population Parameter	Wahkiakum County	Cowlitz County	Washington	Clatsop County	Columbia County	Oregon
Bachelor's degree or higher, percent of persons age 25+, 2000	14.8%	13.3%	27.7%	19.1%	14.0%	25.1%
Homeownership rate, 2000	79.7%	67.6%	64.6%	64.2%	76.1%	64.3%
Housing units in multi-unit structures, percent, 2000	4.7%	18.7%	25.6%	22.0$	11.5%	23.1%
Median value of owner-occupied housing units, 2000	$147,500	$129,900	$168,300	$143,400	$150,700	$152,100
Households, 2000	1,553	35,850	2,271,398	14,703	16,375	1,333,723
Persons per household, 2000	2.42	2.55	2.53	2.35	2.65	2.51
Median household income 2004	$41,344	$41,893	$48,438	$37,703	$49,277	$42,568
Per capita money income 1999	$19,063	$18,583	$22,973	$19,515	$20,078	$20,940
Persons below poverty, percent, 2004	9.8%	14.3%	11.6%	13.0%	9.5%	12.9%

Source: U.S. Census Bureau, State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing http://quickfacts.census.gov/.

5.5 Effects to the Social and Economic Environment

This section provides an analysis of the environmental consequences of implementing the alternatives described in Chapter 2. Effects addressed under this chapter will include public use, hunting, fishing, wildlife viewing, photography, environmental education, interpretation, nonwildlife-dependent recreation, and law enforcement. A summary of the cumulative effects from implementing the various alternatives are presented in Chapter 6.

This section began with an assessment of the change in refuge user groups expected under each of the alternatives. Following this assessment, how management actions under each alternative could affect quality opportunities for each of the wildlife-dependent public uses is evaluated. In addition, opportunities for nonwildlife-dependent public uses are examined, as is the amount of illegal uses.

Adverse effects to opportunities for recreational public uses would be considered significant if a proposed action resulted in:

- Substantial displacement of a wildlife-dependent public use (more than 25 percent of existing activities or opportunities moved to a different area or terminated at the refuge); or

- Substantial reduction in the quality of the wildlife-dependent experience (crowding increasing by more than 50 percent or substantial anticipated losses of wildlife or habitat supporting the experience).

Positive effects to opportunities for recreational public uses would be considered significant if a proposed action resulted in substantial increase in opportunity for or quality of a wildlife-dependent public use (more than 25 percent increase over existing opportunity or quality of experience).

5.5.1 Projected Future Public Uses

A growing visitor presence on the refuges can be expected in the future under all alternatives. Many of the public use opportunities currently provided on the refuges are very popular activities within the states and are forecasted to attract more participants in the coming years.

A 2002 report by Washington State's IAC (IAC 2002a) estimated the percent of change in the number of people participating in recreational activities in the future compared to current levels. According to the study, it is estimated that "nature activities," including outdoor photography and wildlife observation, will increase 30 percent during the next 15 years. Hunting and fishing are expected to decrease (18 percent and 8 percent respectively) during the next 15 years. The IAC's estimates for future use were used in calculating future visitor activity numbers for Julia Butler Hansen and Lewis and Clark refuges. In alternatives that improve or add visitor facilities, additional visitation is likely to occur and increase use of the refuges above IAC's estimates.

It is important to consider the significant amount of population growth forecasted for the Longview, Portland, and Seattle areas. Population growth will occur regardless of which alternative is selected. Population growth and increasing demand for recreation, particularly in nature activities will increase on the refuges.

Tables 5-3 and 5-4 show refuge visitation (number of refuge visits annually) estimates for each refuge, under several categories, both current and expected under the different alternatives.

These estimates are based on two factors. The first factor is the percent of change in the number of people participating in a recreational activity in the future compared to the current levels. Future participation rates are based on the IAC's 2002 Estimates of Future Participation in Outdoor Recreation in Washington State (IAC 2002b). Projected population growth is incorporated into these figures already. Some activities offered at the refuges do not correspond exactly to the categories used in the IAC reports; the nearest equivalent was used. The second factor is that alternatives that emphasize or improve facilities for a type of recreational activity are given additional weight of 10 percent; those that diminish opportunities are reduced.

Table 5-3 Julia Butler Hansen Refuge's Projected Annual Visitation in 15 Years, by Alternative

Recreational Activity	Current Visitation	IAC Project Change[1]	Alt. 1	Alt. 2	Alt. 3
Waterfowl Hunting	1,200 visits	-17%	1,200 visits	1,600 visits	1,200 visits
Fishing	4,500 visits	-7.5%	4,120 visits	4,400 visits	5,000 visits
Environmental Education/ Interpretation	600 visits	+30%	780 visits	900 visits	1,500 visits
Wildlife Observation/ Photography	6,700 visits	+30%	8,700 visits	9,400 visits	11,000 visits

1. The IAC report estimated percent changes over 10 year intervals and 20 year intervals. The two intervals were averaged for our purposes in estimating changes over the 15-year lifetime of the CCP.

Table 5-4 Lewis and Clark Refuge's Projected Annual Visitation in 15 Years, by Alternative

Recreational Activity	Current Visitation	IAC Project Change[1]	Alt. 1	Alt. 2
Waterfowl Hunting	3,500 visits	-17%	2,900 visits	3,200 visits
Fishing	800 visits	-7.5%	740 visits	1,000 visits
Environmental Education/Interpretation	See Julia Butler Hansen Refuge	See Julia Butler Hansen Refuge	See Julia Butler Hansen Refuge	See Julia Butler Hansen Refuge
Wildlife Observation/Photography	3,100 visits	+30%	4,030 visits	4,600 visits

1. The IAC report estimated percent changes over 10 year intervals and 20 year intervals. The two intervals were averaged for our purposes in estimating changes over the 15-year lifetime of the CCP.
2. Although statewide decreases in hunting are expected by the IAC, the popularity and status of hunting programs at these refuges, together with anticipated habitat improvements led the Planning Team to anticipate that there would be no change in hunter visits over the next 15 years.
3. Environmental education on the refuge is limited by refuge staffing and volunteers devoted to presenting environmental education programs.

5.5.2 Opportunities for Quality Wildlife Observation and Photography

Adverse effects are not expected under any of the alternatives, because none of the alternatives are expected to result in increasing crowding by more than 50 percent or in substantial anticipated losses of wildlife or habitat supporting the wildlife viewing or photography experience for either refuge. Visitation is expected to increase under all alternatives and most likely on Julia Butler Hansen Refuge, due to regional population increases, easy vehicular access (compared to Lewis and Clark Refuge), and the overall growing popularity of wildlife viewing and photography.

5.5.2.1 Lewis and Clark Refuge

No changes to facilities are planned under Alternative 1. Growth in wildlife observation and photography is expected to remain unchanged on the Lewis and Clark Refuge. There may be a slight increase in visitors on the river with the current popularity of nonmotorized boating. Most visitor activity is expected to remain on the State-owned waters. A boat is required to access the refuge's islands; therefore, effects from public visitation are expected to be essentially unchanged.

The proposed actions are not expected to increase the opportunities for or quality of wildlife viewing or photography by 25 percent or more over the existing conditions. A boat is required to access the refuge's islands; therefore, the overall effects associated with public visitation are expected to be the same as Alternative 1.

5.5.2.2 Julia Butler Hansen Refuge

No changes to facilities would occur under Alternative 1. The potential growth in the general population and potential demands for more recreational opportunities such as wildlife observation and photography may increase visitation. The number of facilities available to accommodate the visitors under this alternative would remain the same.

Facilities to improve opportunities for wildlife observation and wildlife photography (trail additions) would be expanded and enhanced under Alternative 2, and to a somewhat greater extent, under Alternative 3 (trail additions and auto pull-outs). These facility improvements would improve wildlife viewing and photography opportunities. Alternative 2 emphasizes improved refuge habitat management and CWT deer management. It would be reasonable to assume that additional habitat improvements proposed under this alternative would improve opportunities for viewing wildlife and photography. Alternative 3, which emphasizes wildlife-dependent public uses, may also improve the chances for visitors to observe and photograph a greater spectrum of native plants and animals.

Under Alternatives 2 and 3, the minor positive effects stemming from facility enhancements would not be considered significant, because the proposed actions are not expected to increase the opportunities for, or quality of, wildlife viewing or photography by 25 percent or more over existing conditions.

5.5.3 Opportunities for Quality Hunting

In each of the alternatives presented, the Service strived to provide a quality hunting program in concert with other wildlife-dependent public uses and habitat programs on the refuge. No significant adverse effects are expected under any of the alternatives presented, because none of the alternatives as presented would displace any hunting activities. None of the alternatives are expected to result in increasing crowding by more than 50 percent or in substantial anticipated losses of wildlife or habitat supporting the quality hunting experience for either refuge. It is likely that hunting as an activity may decrease in popularity in the future as described and referenced in Section 5.5.1.

5.5.3.1 Lewis and Clark Refuge

There are no significant changes identified in the waterfowl hunting program between the two alternatives. In both alternatives we strived to provide a quality hunting program in concert with other wildlife-dependent public uses and habitat programs on the refuge. The proposed actions under both alternatives, which include improved signage, updated maps, hunting brochures, and increased law enforcement, would result overall in a neutral effect on opportunities for quality hunting experiences.

5.5.3.2 Julia Butler Hansen Refuge

Under Alternative 1, waterfowl and snipe hunting would continue to be allowed on Hunting and Wallace islands. Waterfowl hunting would not be allowed for safety purposes on Elochoman Slough between Hunting Island and the Mainland Unit dike. This change would have only a minor to neutral effect to the waterfowl hunt program since there has never been much hunting pressure in this area, and there is ample space available to accommodate the anticipated numbers of hunters in this area.

Under Alternatives 2 and 3, Crims and Price islands would be added to the waterfowl and snipe hunt programs. The other change under Alternatives 2 and 3 would be the closure of hunting on the lower Elochoman Slough between the Mainland Unit dike and Hunting Islands because of potential safety issues due to the close proximity of hunting activities adjacent to the county road/refuge auto tour loop. Overall, these changes would have a minor positive effect to the waterfowl hunting program.

5.5.4 Opportunities for Quality Fishing

5.5.4.1 Lewis and Clark Refuge

Most of the fishing occurs from boats on the state navigable waterways on the Columbia River and its backwater sloughs and channels adjacent to the refuge lands. Although a boat is required to access the refuge islands, the shorelines of refuge islands receive little or no fishing use because fishing success is generally better from a boat. Because there are no changes proposed for the refuge fishing program, fishing opportunities are expect to remain unchanged.

5.5.4.2 Julia Butler Hansen Refuge

Fishing opportunities on the Mainland Unit occur along Steamboat Slough and Brooks Slough Roads, which are both county roads and which overlay refuge lands. Additional fishing occurs along the narrow strip on the outside of the Mainland Unit dike. All other areas of the interior Mainland Unit, (except the seasonal walking trail) are closed to all public access including fishing. In addition, the interior of Tenasillahe Island is closed to all public access including fishing.

A boat is required to access the other refuge units; therefore, although technically open to fishing, the shorelines of refuge islands receive little or no fishing use because fishing success is generally better from a boat. Proposed changes to the fishing program include improved signage, updating of maps and fishing information, and increased law enforcement, which would have no effect on fishing opportunities.

5.5.5 Opportunities for Quality Environmental Education and Interpretation

5.5.5.1 Lewis and Clark Refuge

Because the refuge largely consists of islands located in the Columbia River, hosting environmental and interpretive programs on the refuge is largely impractical. Therefore, the focus of any environmental education activities would be on the Mainland Unit of the Julia Butler Hansen Refuge. Environmental education/interpretation (EEI) activities would remain similar under both alternatives, resulting in identical effects.

5.5.5.2 Julia Butler Hansen Refuge

The Mainland Unit would be the focus of most EEI activities due to the relatively easy access to the sites. Interpretation infrastructure at the Headquarters and Highway 4 sites will continue to be used with new and improved interpretive panels being developed at the Highway 4 site under Alternatives 2 and 3. Due to minimal staff availability and workload—only one biologist and one manager available onsite—the refuge will rely on the expertise of the visitor services park ranger located at the Willapa Refuge's headquarters to oversee most EEI activities. In addition, by partnering with other organizations and local schools, partnerships will provide information to the public about topics of concern and interest regarding endangered species, water quality, and refuge goals. Because EEI activities would be essentially similar under all alternatives, differences in effects would be minimal.

5.5.6 Opportunities for Quality Nonwildlife-dependent Recreation

Nonwildlife-dependent recreational uses are refuge uses that are unrelated to wildlife recreational activities and may include such things as camping, swimming, running, picnicking, boating, etc. There are no proposed or current plans to manage for nonwildlife-dependent recreational activities for either refuge. Recreation alternatives for both refuges are geared toward the priority wildlife-dependent public uses. These uses include wildlife observation, wildlife photography, environmental education, environmental interpretation, hunting, and fishing. Opportunities for other public and refuge uses not considered priority public uses would be contingent on the completion of refuge compatibility determinations for each appropriate use. Some of these uses are described in Appendix B.

5.5.7 Illegal Uses

All public use alternatives for both refuges include a strategy for increased law enforcement presence to ensure a safe and quality recreational experience for refuge visitors. Effects from this increased law enforcement presence would result in minor positive effects by improving visitor safety and habitat and wildlife protection.

5.5.8 Cultural Resources

While no cultural resources have been located on either of the refuges, the historic record indicates the existence of at least four sites (three at Julia Butler Hansen Refuge and one at Lewis and Clark Refuge). Therefore, these areas should be considered sensitive. Cultural resources have the potential to be directly affected by ground-disturbing activities such as facilities construction or dike repairs as well as indirectly by activities that increase public access to sensitive cultural areas.

As described in the alternatives, proposed activities such as wildlife observation, interpretation, photography, and environmental education, when confined to nonsensitive cultural areas, result in minimal to no effects on cultural resources. Moreover, public programs that include interpretation of the cultural history of the refuges provide an educational benefit.

The management of any cultural resources located will comply with the regulations of Section 106 of the NHPA. Therefore, determining whether a particular action within an alternative has the potential to affect cultural resources is an ongoing process that occurs within the planning stages of each project.

Section 110 of the NHPA stipulates the implementation of a program by the agency to identify and protect historic properties, including evaluation of properties eligible to be on the National Register of Historic Places. To that end, ongoing efforts should be made to locate and evaluate known ethno-historic sites, if they still exist, and to conduct systematic archaeological surveys of newly acquired parcels to identify cultural resources.

5.5.9 Environmental Justice

Since the CCP implementation is expected to result in generally positive effects on the human environment, all proposed public use actions have little risk of resulting in disproportionate adverse effects on human health, economics, or the social environment.

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Chapter 6. Environmental Effects

Photos: Columbian white-tailed deer fawn and Canada goose with goslings / USFWS

Chapter 6. Environmental Effects

This chapter provides a summary of the environmental consequences of implementing the alternatives described in Chapter 2 and analyzed in Chapters 3 through 5 including physical, biological, cultural, and socioeconomic resources. The cumulative effects on the environment are described in Section 6.3.

6.1 Effect Ratings Description

The information used in this CCP/EIS was obtained from relevant scientific literature, existing databases and inventories, consultations with other professionals, and personal knowledge of resources based on field visits and experience. The thresholds and severity ratings defined below were used to analyze the scope, scale, and intensity of effects on natural, cultural, and recreational resources.

- **Negligible.** Resources would not be affected, or the effects would be at or near the lowest level of detection. Resource conditions would not change or would be so slight there would not be any measurable or perceptible consequence to a population, wildlife or plant community; recreation opportunity; visitor experience; or cultural resource.

- **Minor.** Effects would be detectable but localized, small, and of little consequence to a population, wildlife or plant community; recreation opportunity; visitor experience; or cultural resource. Mitigation, if needed to offset adverse effects, would be easily implemented and successful.

- **Intermediate.** Effects would be readily detectable and localized with consequences to a population, wildlife, or plant community; recreation opportunity; visitor experience; or cultural resource. Mitigation measures would be needed to offset adverse effects, and would be extensive, moderately complicated to implement, and probably successful.

- **Significant (major).** Effects would be obvious and would result in substantial consequences to a population, wildlife or plant community; recreation opportunity; visitor experience; or cultural resource within the local area and region. Extensive mitigating measures may be needed to offset adverse effects and would be large scale in nature and very complicated to implement, and may not have a guaranteed probability of success. In some instances, major effects would include the irretrievable loss of the resource.

Time and duration of effects have been defined as follows.

- **Short-term or Temporary.** An effect that generally would last less than a year or season.
- **Long-term.** A change in a resource or its condition that would last longer than a single year or season.

6.2 Summary of Effects for Lewis and Clark and Julia Butler Hansen Refuges

Table 6-1 CCP Alternatives Summary of Effects for Lewis and Clark Refuge

	Alternative 1	Alternative 2
EFFECTS TO WILDLIFE AND HABITAT		
Effects to fish	Fishing occurs in navigable waters independent of the refuge.	Negligible difference in effects because fishing would likely occur in navigable waters independent of the refuge.
Effects to birds, mammals, reptiles, amphibians and invertebrates	No effects from current refuge management other than minor negative and temporary effects due to waterfowl hunting.	Negligible difference in effects, same habitat management and public use program as at present.
Effects to threatened and endangered (T&E) species	Negligible effects to T&E species due to small amount of refuge habitat compared to the entire estuary.	Same as Alternative 1.
Effects to wetland habitats and associated wildlife	Natural processes generally dictate habitat conditions; public use disturbance would be minimal.	Negligible difference in effects–natural processes dictate habitat changes, public use disturbance would be about the same as Alternative 1.
Effects to riparian forest and associated habitat	Natural processes generally dictate habitat conditions; public use disturbance would be minimal.	Negligible difference in effects–natural processes dictate habitat changes, public use disturbance would remain about the same as Alternative 1.
PHYSICAL ENVIRONMENTAL EFFECTS		
Effects to air quality	Negligible effect.	Negligible effect.
Effects to water quality	Negligible effect.	Negligible effect.
Effects to soils	Negligible effect.	Negligible effect.
SOCIAL EFFECTS		
Opportunities for wildlife observation and photography	No change in opportunities available under current management.	Negligible effect because opportunities would remain nearly the same as Alternative 1.
Opportunities for quality hunting	No change in opportunities under current management.	Negligible effect—same hunting program as Alternative 1.
Opportunities for quality fishing	No change in limited opportunities available under current management.	Negligible effect because of limited ability to affect fisheries resources and same management program as present.
Opportunities for quality EEI	No change in limited opportunities available under current management.	Negligible effect because of no changes to current program.
OTHER EFFECTS		
Effects to cultural/ historical resources	No management actions expected to affect these resources.	Same as Alternative 1.
Economic effects	Refuge management and public use programs have minimal effects on local economy	Same as Alternative 1.

Table 6-2 CCP Alternatives Summary of Effects for Julia Butler Hansen Refuge

	Alternative 1	Alternative 2	Alternative 3
EFFECTS TO WILDLIFE AND HABITAT			
Effects to waterfowl and waterbirds	Minor positive effects from management of wetlands pastures and minor negative effects due to waterfowl hunting.	Same as Alternative 1.	Same as Alternative 1.
Effects to shorebirds	Slight reduction in snipe habitat from converting 210 acres of unmanaged fields to riparian. Other shorebird habitat would remain unchanged.	Same as Alternative 1.	Same as Alternative 1.
Effects to raptors	Habitat conversion of 210 acres of unmanaged fields to riparian sites will provide minor positive and negative effects depending raptor species.	Same as Alternative 1. Hunting disturbance expected to be minor and temporary.	Same as Alternative 2.
Effects to landbirds	Conversion of grasslands to riparian with reduce extent of habitat for grassland birds while increasing extent of habitat for forest birds.	Overall minor positive effects. Both minor positive/negative effects from habitat conversion however habitat acreages involved are relatively small. Minor hunting disturbance due to waterfowl hunting.	Similar to Alternative 1, but with minor disturbance as in Alternative 2.
Effects to predators	Minor and temporary negative effect on coyote population from existing predator control program. Neutral effect to bear or cougar due to limited take.	Overall intermediate negative effect. Effects to coyotes would be temporary. We would expect coyotes to repopulate quickly. Neutral effect to bear or cougar due to limited take.	Effects would be the same as Alternative 2.
Effects to elk	Minor negative effect due to reduction in elk numbers from fall elk hunt. Note: this is offset by improved riparian conditions due to limited elk numbers.	Minor negative effect due to reduction in elk numbers from fall elk hunt. Note: this is offset by improved riparian conditions due to limited elk numbers.	Minor negative effect due to reduction in elk numbers from fall elk hunt. Note: this is offset by improved riparian conditions due to limited elk numbers.
Effects to reptiles and amphibians	Overall minor positive effects. Improved slough connectivity would provide better conditions for reptiles and amphibians.	Overall minor positive effects. Improved slough connectivity and increased wetland habitat would provide better conditions for reptiles and amphibians.	Overall minor positive effects. Improved slough connectivity would provide better conditions for reptiles and amphibians.
Effects to invertebrates	Minor positive effects from tidegate installations	Same as Alternative 1.	Same as Alternative 1.

	Alternative 1	Alternative 2	Alternative 3
Effects to endangered and threaten-ed marine mammals	Marine mammals not present on refuge.	Marine mammals not present on refuge.	Marine mammals not present on refuge.
Effects to Columbian white-tailed deer	Significant negative effects on overall deer population resulting from limited predator control effort. Significant positive effects from reintroductions.	Significant positive effects on overall deer populations resulting from expanded predator control effort and population reintroduction/ expansion.	Intermediate positive effects on overall deer populations resulting from seasonally expanded predator control efforts and population reintro-duction/expansion.
Effects to endangered and threaten-ed bird species	Occurrence of these birds on the refuge is very intermittent.	Negligible effects due to intermittent occurrence of these birds on the refuge.	Negligible effects due to intermittent occurrence of these birds on the refuge.
Effects to endangered and threatened fisheries species	Relatively small amount of Service owned habitat supports threatened and endangered fish species.	Overall negligible effects to fish habitat due to relatively small amount of Service owned habitat compared to the entire estuary.	Overall neutral effects to fish habitat due to relatively small amount of Service owned habitat compared to the entire estuary.
Effects to fish	Intermediate positive effects due to tidegate enhancement.	Same as Alternative 1.	Same as Alternative 1.
Effects to non-tidal wetland and slough habitats and assoc. wildlife	No change to acres.	Minor positive effect to wetland habitat from increased acres. Neutral effect to slough habitat.	Same as Alternative 1.
Effects to short grass fields	Pasture improvement would proceed at about the current rate, future public use levels expected to remain about the same as at present.	Intermediate positive effect as additional acreage would be managed as pasture but with negligible disturbance factors from improved public use facilities.	Negligible effect as pasture improvement would proceed at about the same rate as at present with negligible disturbance factors from improved public use facilities.
Effects to non-tidal riparian forest (early-successional). **Conversion of unmanaged grasslands to early**	Minor positive effects from conversion of unmanaged grasslands to riparian forest. Future level of public use maintained.	Intermediate positive effects from conversion of unmanaged grasslands to riparian forest. (Doubling riparian plantings over Alternatives 1 and 3 but with negligible disturbance factors from improved public use facilities).	Minor positive effects from conversion of unmanaged grasslands to riparian forest and negligible disturbance factors from improved public use facilities.

	Alternative 1	Alternative 2	Alternative 3
successional riparian forest			
Effects to non-tidal riparian forest (mid-successional)	No change..	Same as Alternative 1.	Same as Alternative 1.
Effects to non-tidal riparian forest (late-successional)	No change.	Same as Alternative 1.	Same as Alternative 1.
Effects to tidally influenced freshwater wetlands and swamp habitats	No change.	Same as Alternative 1.	Same as Alternative 1.
PHYSICAL ENVIRONMENT EFFECTS			
Effects to air quality	No change.	Same as Alternative 1.	Same as Alternative 1.
Effects to hydrology	No change.	Same as Alternative 1.	Same as Alternative 1.
Effects to soils	No change.	Same as Alternative 1.	Same as Alternative 1.
Effects to water quality	No change.	Same as Alternative 1.	Same as Alternative 1.
SOCIAL EFFECTS			
Opportunities for quality wildlife observation and photography	No change in availability of opportunities.	Minor positive effect because facility enhancements and habitat management actions would increase opportunities to see wildlife and more visitors would be able to view wildlife.	Minor positive effect because facility enhancements and habitat management actions would increase opportunities to see wildlife and more visitors would be able to view wildlife.
Opportunities for quality hunting	No change in availability of opportunities.	Minor positive effect stemming from increase of hunt area and initiation of a safety zone between the Mainland Unit and Hunting Island.	Minor positive effect stemming from increase of hunt area and initiation of a safety zone between the Mainland Unit and Hunting Island.
Opportunities for quality fishing	No change in availability of opportunities.	Same as Alternative 1.	Same as Alternative 1.

	Alternative 1	Alternative 2	Alternative 3
Opportunities for quality environmental education/ interpretation	No change in availability of opportunities.	Minor positive effect because of trail improvements and interpretation/EE program enhancements.	Minor positive effect because of trail improvements and EEI program enhancements.
OTHER EFFECTS			
Effects to cultural/ historical resources	No management actions expected to affect these resources.	Same as Alternative 1.	Same as Alternative 1.
Economic effects	Minor positive effect due to increased operation and visitor expenditures.	Same as Alternative 1.	. Same as Alternative 1.

6.3 Cumulative Effect Analysis

6.3.1 Introduction

Cumulative effects can result from the incremental effects of a project when added to other past, present, and reasonably foreseeable future projects in the area. Cumulative impacts can result from individually minor but cumulatively significant actions over a period of time. This analysis is intended to consider the interaction of activities at the Julia Butler Hansen Refuge and the Lewis and Clark Refuge with other actions occurring over a larger spatial and temporal frame of reference. The interrelated effects of separate actions under the alternatives are also considered.

The Council on Environmental Quality (CEQ) regulations, which implement the provisions of NEPA, that define several different types of effects that should be evaluated in an EIS, including direct, indirect, and cumulative effects. Direct effects are addressed in the resource-specific sections of this CCP/EIS (Chapters 3-5). This section addresses indirect and cumulative effects.

The CEQ (40 CFR § 1508.7) provides the following definition of indirect effects. *[Impacts that are] caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems including ecosystems.*

The CEQ (40 CFR § 1508.7) provides the following definition of cumulative effects. *The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.*

It should be noted that the comprehensive nature by which direct and indirect effects associated with implementing the various alternatives has been conducted largely comprises a cumulative effects analysis. The analysis in this section primarily focuses on effects associated with reasonably foreseeable future events and/or actions regardless of what entity undertakes that action.

6.3.2 Cumulative Impacts Lewis and Clark Refuge

Both of the proposed alternatives are similar in terms of public use activities. Due to the lack of visitor facilities and limited access to the refuge (boat only), most visitor use activities are focused on the Julia Butler Hansen Refuge. Under both alternatives there would be no changes to the hunting and fishing programs on Lewis and Clark Refuge. There would potentially be a very slight temporary increase in visitor recreational use under Alternative 2, due to improved signs and information about the refuge and interest in the potential for wilderness designation. Overall, visitor use is expected to remain the same since the majority of boaters do not land on or explore the refuge islands. Impacts to refuge wildlife and habitats from this use are expected to be very similar to current levels.

6.3.3 Cumulative Impacts Julia Butler Hansen Refuge

6.3.3.1 Hunting and Migratory Waterfowl

Waterfowl populations throughout the United States are managed through an administrative process known as flyways, of which there are four (Pacific, Central, Mississippi, and Atlantic). The review of the policies, processes and procedures for waterfowl hunting are covered in a number of documents.

The Service's NEPA considerations for hunted migratory game bird species are addressed by the programmatic document, "Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FSES 88– 14)," filed with the Environmental Protection Agency on June 9, 1988. The Service published a Notice of Availability in the Federal Register on June 16, 1988 (53 FR 22582), and the Record of Decision on August 18, 1988 (53 FR 31341). Annual NEPA considerations for waterfowl hunting frameworks are covered under a separate Environmental Assessment and Finding of No Significant Impact. Further, in a notice published in the September 8, 2005, Federal Register (70 FR 53776); the Service announced its intent to develop a new Supplemental Environmental Impact Statement for the migratory bird hunting program. Public scoping meetings were held in the spring of 2006, as announced in a March 9, 2006, Federal Register notice (71 FR 12216).

Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the Migratory Bird Hunting Frameworks. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, Federal annual regulations both allow and limit the hunting of migratory birds.

The Migratory Bird Hunting Frameworks provide season dates, bag limits, and other options for the States to select that should result in the level of harvest determined to be appropriate based upon Service-prepared annual biological assessments detailing the status of migratory game bird populations. In North America, the process for establishing waterfowl hunting regulations is conducted annually. In the United States, the process involves a number of scheduled meetings (Flyway Study Committees, Flyway Councils, Service Regulations Committee, etc,) in which information regarding the status of waterfowl populations and their habitats is presented to individuals within the agencies responsible for setting hunting regulations. In addition, public hearings are held and the proposed regulations are published in the Federal Register to allow public comment.

For waterfowl, these annual assessments include the Breeding Population and Habitat Survey, which is conducted throughout portions of the United States and Canada, and is used to establish a Waterfowl Population Status Report annually. In addition, the number of waterfowl hunters and resulting harvest are closely monitored through both the Harvest Information Program (HIP) and Parts Survey (Wing Bee). Since 1995, such information has been used to support the adaptive harvest management (AHM) process for setting duck hunting regulations. Under AHM, a number of decision-making protocols render the choice (package) of predetermined regulations (appropriate levels of harvest) which comprise the framework offered to the States that year. Oregon’s Fish and Wildlife Commission then selects season dates, bag limits, shooting hours and other options from the Pacific Flyway package. Their selections can be more restrictive but cannot be more liberal than AHM allows. Thus, the level of hunting opportunity afforded each State increases or decreases each year in accordance with the annual status of waterfowl populations.

Each national wildlife refuge considers the cumulative impacts to hunted migratory species through the Migratory Bird Frameworks published annually in the Service’s regulations on Migratory Bird Hunting. Season dates and bag limits for refuges open to hunting are never longer or larger than the State regulations. In fact, based upon the findings of an environmental assessment developed when a refuge opens a new hunting activity, season dates, and bag limits, and other aspects of a hunt may be more restrictive than the State allows.

As a result of the recent regulations, the estimated average annual duck harvest for the Pacific Flyway is 2.5 million birds, which represent approximately 18 percent of the estimated average annual U.S. harvest of 14 million ducks (USFWS 2004). The estimated average annual goose harvest for the Pacific Flyway is 383,091 which represent 12.4 percent of the estimated annual U.S. harvest of over 3.5 million geese.

For comparison, in 2005, the breeding duck population estimate for those areas surveyed (California, Oregon, Nevada, Utah, and Washington) in the Pacific Flyway was 1,097,276 birds, which was a 22.7 percent increase from the 2004 average (USFWS 2005). The estimated average annual duck breeding population for these areas from 1994-2005 was approximately 1.10 million birds. These numbers serve to demonstrate the relative importance of the more southern portions of the Pacific Flyway for wintering waterfowl, rather than waterfowl production. In fact, the vast majority of birds wintering and subsequently harvested in the Flyway come from breeding grounds to the north. The estimated duck breeding population in traditional survey areas of the western and central U.S. (Alaska, prairie pothole region of the west, Canada) was 36.2 million (USFWS 2005).

In 2005, the midwinter survey index of ducks for the Pacific Flyway was over 5.7 million, an 18 percent increase from the 10-year (1995-2005) average of 4.9 million. The index for Canada geese was 416,000, down 1.7 percent from the 10-year average of 432,270. The index for total geese (Canada, snow/Ross', white-fronted, and brant) was over 1.6 million, a 46 percent increase over the 10-year average of 1.1 million (USFWS 2005).

Regional Analysis

The estimated breeding duck population in 2005 in Oregon was 225,349. The estimate for neighboring Washington was 111,504 (USFWS 2005). Neither state is a major duck breeding area. Wintering birds from breeding areas farther north make up the bulk of the states' waterfowl populations.

The duck midwinter survey index for Washington was 956,979. The index for Oregon was 379,256. The midwinter surveys are conducted in January, after waterfowl that winter farther south (California, etc.) have passed through and more than two-thirds of the waterfowl hunting season is over. The Canada goose midwinter indexes were 43,908 for Washington and 125,763 for Oregon (USFWS 2005).

The estimated total duck harvests for Oregon and Washington in 2004 were 256,798 and 353,299 (USFWS 2005), respectively. The estimated total Canada goose harvest in 2004 was 67,610 in Oregon and 72,147 in Washington (USFWS 2005). Waterfowl numbers in the Pacific Flyway are remaining relatively stable. The 2005 midwinter survey indices for the 11 Pacific states were 18 percent and 46 percent above the 10-year average for ducks and geese, respectively.

The number of waterfowl hunters, as reflected in the sales of duck stamps, has been declining in both states. In 2004, duck stamp sales in Oregon and Washington were 28,086 and 28,184 respectively, far below the 50,000-70,000 that was typical in both states during the 1970s (USFWS 2005).

Local Analysis

The lower Columbia River in Oregon and Washington has long been a popular place for waterfowl hunting. Ridgefield Refuge, Lewis and Clark Refuge, and the State of Oregon's Sauvie Island Wildlife Management Area are well known hunting destinations. Most of the Julia Butler Hansen Refuge is closed to hunting. Many other areas of the lower river are in state or private ownership and are also used by waterfowl hunters. In many cases, there is no check in or mandatory reporting procedure, so harvest estimates for the region are not available. At Sauvie Island, where reporting is mandatory, a total of 19,720 ducks (2.2 ducks per hunter visit) and 140 Canada geese (2.2 geese per hunter visit) were harvested during the 2005/2006 hunting season. The 2006/2007 season harvests at Ridgefield Refuge were 3,268 ducks and 283 geese. No estimates are available for Lewis and Clark Refuge, but area managers/biologists estimate that the total harvest ranges between harvest numbers at Ridgefield Refuge and Sauvie Island.

Direct effects of hunting on waterfowl are mortality, wounding, and disturbance (DeLong 2002). Hunting can alter behavior (e.g., foraging time), population structure, and distribution patterns of wildlife (Bartelt 1987; Cole and Knight 1990; Madsen 1985; Owens 1977; Raveling 1979; Thomas 1983;White-Robinson 1982,). These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur, and birds can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et. al 1992). The Mainland and Tenasillahe Island units, with a total acreage of about 4,000, are closed to waterfowl hunting and often draw many thousand ducks and geese. Closed areas are also available within Lewis and Clark Refuge, Ridgefield Refuge, and Sauvie Island Wildlife Management Area.

All the alternatives propose continuation of the existing refuge hunting program. Additionally, alternatives 2 and 3 for the Julia Butler Hansen Refuge propose to open Price and Crims Island to waterfowl and snipe hunting. Opening these areas is not expected to be additive to waterfowl mortality because of declining hunter numbers and the fact that hunting already occurs on state-owned tidelands immediately adjacent to the islands.

Conclusion

Waterfowl hunting in the United States is based upon a regulatory-setting process that involves numerous sources of waterfowl population and harvest monitoring data. As a result of the regulatory options produced in recent years and despite continued hunting nationwide, waterfowl continue to be abundant and available for both hunting and viewing. Current harvest levels are not threatening waterfowl populations at the flyway, regional, or local level. Allowing hunting at Julia Butler Hansen Refuge is not expected to have any effect on either harvest levels or waterfowl populations.

6.3.3.2 Non-Hunted Migratory Wildlife

Migratory species other than waterfowl that are present on or near the refuge include other waterbirds, neotropical migrant birds, migratory bats, raptors, salmon, other migratory fish, and various invertebrates (butterflies, etc). California sea lions and harbor seals frequent the mainstem Columbia River, but are not expected to be present close to the islands where the hunt would occur during the waterfowl season (late fall and early winter).

Flyway, Regional, and Local Analysis

While non-hunted migratory wildlife would not be targeted, some individual animals might be disturbed by hunting activities. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors, as well as the presence of humans. This disturbance, especially when repeated over a period of time, may compel some wildlife species to change food habits or move to other areas.

Waterfowl hunting takes place during the late fall and winter, generally from about mid-October to late January (the season length may vary from year to year, depending on waterfowl breeding success rates and other factors). Many species, such as migratory bats, migratory invertebrates, and many neotropical migrant birds, have migrated south for the winter and are not present during the hunting season.

Hunting would occur only on the shorelines. The interior of the islands is forested swamp with thick underbrush; that is not suitable for waterfowl hunting. Migratory wildlife that is disturbed by hunting could escape the disturbance by moving to the island’s interior or to other nearby areas of the lower Columbia River. The Tenasillahe Island and Mainland units, which total about 4,000 acres, are closed to waterfowl hunting and could act as sanctuaries for wildlife disturbed by hunting. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et al. 1992).

Hunting season would not coincide with the nesting season of migratory birds. Long-term future impacts that could occur if reproduction was reduced by hunting are not relevant for this reason. Disturbance to the daily wintering activities of birds, such as feeding and resting, might occur and be temporary and localized. Disturbance to birds by hunters would probably be commensurate with that caused by nonconsumptive users.

Hunting, as proposed for Julia Butler Hansen Refuge under alternatives 2 and 3, would not be expected to result in an increase in the relatively small number of hunters using the refuge area of the river. It is doubtful that more than four or five hunting parties would use the refuge on any given day. The river surrounding the islands is open to hunting and would remain so. One of the reasons for proposing hunting is that a closure would be virtually unenforceable given the lack of a clear boundary between refuge-owned "uplands" and State-owned tidelands.

Conclusion

Waterfowl hunting on the Julia Butler Hansen Refuge would result in some minor disturbance to other migratory wildlife. We conclude that the impacts to migratory wildlife would be temporary and localized and result in negligible effects to non-hunted migratory wildlife.

6.3.3.3 Resident Wildlife

The term *resident wildlife* refers to those wildlife species that are not migratory. The ODFW and WDFW are the lead agencies for managing the States' fish and wildlife. Resident wildlife species are protected by State regulations to ensure their continued existence.

Resident wildlife found on and near the refuge would include river otters, mink, muskrats, nonmigratory species of bats, CWT deer (see Section 4.3), ruffed grouse and other resident birds, a variety of small mammals, reptiles, amphibians, nonmigratory fish, many invertebrates, and plants.

The refuge would not be open to hunting of resident wildlife; therefore, there are unlikely to be any direct impacts. The human presence and activities (boating, shooting, etc.) associated with hunting have the potential to cause disturbance to non-hunted resident wildlife. This disturbance, especially when repeated over a period of time, may compel some wildlife species to change food habits or move to other areas.

Relatively few hunters would be expected to use the refuge hunting areas and these would likely be people who already hunt on the State-owned tidelands adjacent to the islands. Opening the shorelines to waterfowl hunting is not expected to add to existing disturbance caused by hunters and other users of the river such as boaters, anglers, sightseers, and marine workers.

Waterfowl hunting takes place during late fall and winter, generally from about mid-October to late January (the season length may vary from year to year, depending on waterfowl breeding success rates and other factors). Most resident wildlife produce and rear their young in the spring and summer, so disturbance caused by hunting would be unlikely to have long-term regional or local effects on reproduction of resident wildlife. Reptiles and amphibians are largely in a state of winter torpor during the hunting season, so it is unlikely they would be affected at all. Terrestrial invertebrates are also largely inactive during winter and would be unlikely to come in contact with hunters. Fish are under water and are not likely to be affected by waterfowl hunting.

Conclusion

Hunting might result in disturbance to other wildlife species on or near the refuge's units; however, the cumulative effects, if any, of the disturbance would be temporary, localized, and result in only negligible effects to resident wildlife.

6.3.3.4 Endangered Species

It is our policy to protect and preserve all native species of fish, amphibians, reptiles, birds, mammals, invertebrates, and plants, including their habitats, which are designated as threatened or endangered with extinction. Endangered, threatened, proposed, and candidate species that could occur on or near the refuge include CWT deer, marbled murrelet, northern spotted owl, Howellia (a plant), Nelson's checkermallow (a plant), streaked horned lark, Mazama pocket gopher, and Pacific fisher. There are also endangered and threatened salmonids and bull trout in the waterways; however, they would not be affected by the waterfowl hunting program.

The marbled murrelet, northern spotted owl, streaked horned lark, Mazama pocket gopher, Howellia, Nelson's checkermallow and Pacific fisher are not known to occur on the refuge, so they would not be affected by a waterfowl hunt.

Regional and Local Analysis

A Section 7 consultation (USFWS 2007) concluded that waterfowl hunting at Wallace Island would not likely adversely affect CWT deer and bald eagles, and would have no effect on the other endangered, threatened, proposed, or candidate species listed in the paragraph above.

Conclusion

We conclude that waterfowl hunting at Julia Butler Hansen Refuge would have no adverse cumulative effects on endangered, threatened, proposed, or candidate species or critical habitat.

6.3.3.5 Anticipated Direct and Indirect Effects of Proposed Action on Refuge Programs, Facilities, and Cultural Resources

Other Wildlife-dependent Recreation

Hunting affects other wildlife-dependent recreation opportunities in a variety of ways. Many nonhunters plan their vacations or visits to avoid being on a refuge during hunting seasons. Many refuge visitors tend to seek out areas that offer amenities such as trails, parking areas, and information kiosks, as are available at the Mainland Unit. These facilities provide bird watchers, photographers, and students an opportunity to experience a safe, informally guided refuge visit. The bulk of wildlife-dependent recreation use on the refuge occurs during the spring and summer months, when waterfowl hunting is not occurring. The Mainland Unit, which receives the bulk of visitor use, is not open for waterfowl hunting.

All of the alternatives propose to continue the present hunting program. Crims and Price islands would also be opened to waterfowl hunting under alternatives 2 and 3. These islands receive very little visitor use. Access is by boat only and the thick vegetation on the islands is not conducive to hiking. However, substantial numbers of recreational boaters and anglers pass by the island and it is reasonable to assume that many enjoy viewing wildlife on the islands. There is the potential that hunting activity could detract from the enjoyment of nonhunters. That potential exists throughout the lower Columbia River. Waterfowl hunting on Price and Crims Islands would not be expected to increase the number of hunters in that area and thus would not affect the potential for conflicts between nonhunters and hunters. Hunting already occurs, and will continue to occur, on State-owned tidelands adjacent to the island. Also, hunting occurs during late fall and early winter when other recreational use is at a minimum. The cumulative effects of hunting on other wildlife-dependent recreation would be minimal.

Refuge Facilities

There are no refuge buildings, roads, trails, or other facilities on Price and Crims Islands. Hunters accessing the island do not pass through other refuge units. Therefore, the hunt would have no effect on refuge facilities.

Cultural Resources

There are no known cultural resources on the refuge. Prior to construction of Columbia River dams, the islands would have been inundated by the river’s annual spring freshet (Christy and Putera 1992). Flooding still occurs at high river levels. If historical artifacts were ever present, they have either washed downstream or were buried under sediments where they would not be readily accessible by visitors, and therefore would not be affected by waterfowl hunting.

Conclusion

The Service concludes that waterfowl hunting at the refuge would have few if any cumulative effects on other wildlife dependent recreation, refuge facilities, or cultural resources.

6.3.3.6 Anticipated Effects of Proposed Hunting on Refuge Environment and Community

Hunting would be conducted by boat and on foot along the shoreline. Impacts to refuge soils and vegetation by hunters would be expected to be minimal, such as insignificant soil compaction. Impacts to air and water quality would be minimal and restricted to automobile emissions as hunters travel to and from public boat ramps, and boat motor emissions. Boat motors sometimes discharge oil and gasoline into the water. These impacts would be a minute fraction of the impacts caused by refuge visitors' automobiles and general boat traffic on the river. Hunting at the refuge would not be expected to result in an increase in hunting activity; therefore, the hunt would have no cumulative effect on air and water quality.

Impacts associated with solitude would be expected to be minimal given time and space zone management techniques such as seasonal access and area closures used to avoid conflicts among user groups. Hunting already occurs on State-owned tidelands adjacent to the islands. The proposed hunt would have no additional effects on solitude.

The refuge would work closely with State, Federal, and private partners to minimize impacts to adjacent lands and its associated natural resources; however, no indirect or direct impacts are anticipated. The newly opened hunt would result in a net gain of public hunting opportunities positively impacting the general public, nearby residents, and refuge visitors, although no gain in the actual number of hunters is would be expected. The Service expects that as a result of opening Crims and Price islands to hunting (alternatives 2 and 3) there would be no effect upon the area's economy.

Conclusion

The Service concludes that waterfowl hunting at the refuge would have few if any effects to air quality, water quality, soils, vegetation, adjacent lands and natural resources, the general public, nearby residents, and refuge visitors. There would be negligible, if any, economic benefit to local communities.

6.3.3.7 Other Past, Present, Proposed, and Reasonably Foreseeable Hunting and Anticipated Effects

Past

The refuge was established in 1971 to preserve habitat for the CWT deer. Prior to that, the land was in multiple small, private ownerships where traditional hunting had been conducted for generations. Hunting ceased on the refuge mainland and Tenasillahe Island once the refuge was established. Waterfowl and snipe hunting were allowed on the Hunting Islands Unit. Hunting has long been a traditional activity along the lower Columbia River. Waterfowl hunting in the marshes and lowlands was popular during fall and winter. Elk, black-tailed deer, and small game were hunted in the uplands.

Present

Hunting continues to be a popular activity along the lower Columbia River. Wintering waterfowl draw thousands of hunters to Federal, state, and private lands in southwest Washington and northwest Oregon. Elk hunting in the uplands attracts hunters from all over Washington and other states. Hunting for black-tailed deer and small game is also popular with hunters.

The small hunting program on the refuge is insignificant compared to overall hunting activity in the lower Columbia River area. Local and regional populations of hunted wildlife continue to thrive. Hunting is a highly regulated activity, and generally takes place at specific times and seasons (at dawn, during fall and winter) when game animals are less vulnerable (e.g., not in breeding season) and other wildlife-dependent activities (e.g., wildlife observation and photography, environmental education and interpretation) are less common, reducing the magnitude of disturbance to refuge wildlife. We did not find any evidence that managed and regulated hunting of wildlife would reduce species populations to levels that would affect other wildlife-dependent uses.

Reasonably Foreseeable Hunts

The most important consideration in the maintenance of wildlife populations is the protection of their habitat. The Service, ODFW, WDFW, The Nature Conservancy, the Columbia Land Trust, and a multitude of other agencies and organizations are all working to protect and restore native habitat along the lower Columbia River. Habitat protection and restoration helps the Service fulfill the U.S. Congress mandate to preserve, restore, and enhance riparian habitat for threatened and endangered species, songbirds, waterfowl, other migratory birds, anadromous fish, resident riparian wildlife, and plants. Habitat restoration would also have a positive effect on wildlife populations on the refuge.

Hunting is carefully regulated by Federal and State laws and regulations to ensure that wildlife populations and habitats are not jeopardized. Moreover, the amount of hunting on the refuge is not expected to increase significantly in the future.

Conclusion

We conclude that waterfowl hunting at the refuge, taken in context with other past, present, and reasonably foreseeable hunts, would have no effects or only minor effects on populations of waterfowl and other wildlife, other refuge resources, and other wildlife-dependent activities and public uses.

6.3.3.8 Anticipated Effects if Individual Hunts are Allowed to Accumulate

There are 18 national wildlife refuges in Oregon and 22 in Washington. Hunting, fishing, wildlife observation, photography, environmental education, and interpretation are enjoyed by millions of visitors annually. These refuges are also wild places where people can find solace and reconnect with nature. For the reasons cited earlier, the proposed waterfowl hunting program at Julia Butler Hansen Refuge would be expected to have no effects on wildlife populations on other refuges.

National wildlife refuges, including Julia Butler Hansen Refuge, conduct hunting programs within the framework of State and Federal regulations. The proposed waterfowl hunting program is as restrictive as the State of Oregon's. By maintaining hunting regulations that are as restrictive as or more restrictive than the State, we ensure that individual refuges are maintaining seasons which are supportive of hunting management on a more regional basis. The proposed hunt plan has been reviewed and is supported by ODFW. Additionally, refuges in Oregon coordinate with ODFW annually, to maintain regulations and programs that are consistent with the State management program. Therefore, there should be no cumulative effects from an accumulation of hunts.

Conclusion

The Service has concluded that hunting would not cause significant cumulative effects on the refuge's hunted and non-hunted wildlife populations. The Service has also concluded that the proposed action would not cumulatively affect the refuge environment or refuge programs. This determination was based upon a careful analysis of the potential environmental impacts of hunting on the refuge together with other projects and/or actions. Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance would occur during the hunting seasons. Proper regulations and refuge seasons would be designed to minimize any negative effects on wildlife populations using the refuge.

6.3.3.9 Cumulative Effects from Predator Control

Coyotes

Local and Regional Analysis

The authority for managing coyote populations in Oregon and Washington rests with the states' respective departments of fish and wildlife. There are an estimated 50,000 coyotes in Washington (WDFW 2008a) and 160,000 in Oregon (USDA 1997a). In both states, coyotes may be hunted year-round and there is no bag limit. Coyotes may also be taken for fur and damage control by shooting or trapping, although leg-hold traps are banned in Washington (there is an exception on the trap ban for removal of animals that are causing damage).

The Mainland Unit is located in Wahkiakum County, Washington. We are aware of no estimates of the number of coyotes in the county, although they appear to be abundant, and likely number in the many hundreds, if not thousands. In response to damage complaints, the U.S. Department of Agriculture's Wildlife Services removed five coyotes from the county in 2007, in addition to the eight removed from the Mainland Unit as part of the refuge's predator management program. No coyotes were reported taken in the county during the Washington fur harvest season in 2006 (WDFW 2008b). There are no available data on the number that were taken by hunters and in private control efforts. Statewide, Wildlife Services removed 585 coyotes in 2006 (USDA 2008) and 113 were reported taken during the state furbearer harvest season (WDFW 2008b). There is no data on the number of coyotes taken by sport hunters and in private control efforts, although it was probably not more than 4,100 as was estimated in 1996 (approximately 9 percent of the estimated population) (USDA 1997b).

The Tenasillahe Island and Crims Island units are respectively located in Clatsop and Columbia counties, Oregon. Coyote populations are not monitored in these counties, so there is no data on numbers. It is reasonable to assume that there are thousands of coyotes in the two counties. Wildlife Services removed 14 coyotes in 2006 in Columbia County (none in Clatsop County) in response to damage complaints. The numbers taken by sport hunters and in private control efforts are not known. The total number taken annually in these counties apparently is not enough to negatively impact the population, as coyotes are abundant. Statewide, Wildlife Services removed 1,168 coyotes in 2006 (USDA 2008) and 5,451 were reported taken during the 2005 state furbearer harvest season (ODFW 2006a). There is no data on the number that were taken by sport hunters and in private control efforts. Given the abundance of coyotes in the state, it is unlikely that the total number taken each year is enough to negatively impact the population.

Coyote populations are able to compensate for high annual losses by increasing their rate of reproduction. Connolly and Longhurst (1975) found that through compensatory reproduction coyotes could withstand an annual control level of 70 percent. Although the total numbers of coyotes taken each year by hunting, trapping, and damage control efforts in Washington and Oregon are unknown, it is reasonable to conclude that they are much less than 70 percent of the states' populations, and probably less than 10 percent. The expected annual take from the refuge under any of the three alternatives would be a maximum of about 40 individuals. The refuge control program would have a negligible effect on local and regional coyote populations.

National Analysis

Coyotes occur throughout most of North America. They are not migratory wildlife; therefore, the removal of coyotes from the refuge would have no effect on national coyote populations.

Conclusion

Coyotes are plentiful in both Oregon and Washington. The small annual take resulting from the refuge predator control program would have negligible cumulative effects on local, regional, and national coyote populations.

6.3.3.10 Other Predators of Deer

Black bears are quite common in western Oregon and Washington. There are an estimated 25,000-30,000 black bears in each state (ODFW 2008a; WDFW 2003). Both states have hunting seasons for bears. In western Oregon, 657 bears were taken by hunters in 2006 (ODFW 2007). In western Washington (Coastal and Puget Sound units), 367 bears were taken by hunters in 2006 (WDFW 2008c).

Although less numerous than black bears, cougars are also fairly common with a widespread distribution in Oregon and Washington. The statewide populations are estimated at 5,100 in Oregon (ODFW 2006b) and 2,600 in Washington (WDFW 2003). Both states have hunting seasons for cougars. In 2006, the numbers reported taken by hunters were 292 cougars in Oregon (ODFW 2008b), and 146 cougars in Washington (WDFW 2007).

Both cougars and black bears—should individuals of either or both species include the refuge in their home range—are capable of inflicting severe predation losses on CWT deer. If it becomes necessary to remove either predator from the refuge, the Service would work closely with the appropriate state. The state would decide whether the offending animal(s) needed to be removed by relocation or by lethal means. To date, there has not been a need to remove either cougars or bears from the refuge. If a need arose, it is unlikely that more than a very few (probably one or two) animals would be involved.

Both Oregon and Washington manage cougar and black bear populations on a sustainable basis. The very small numbers that might be removed from the refuge would have no discernable cumulative effects on cougar or bear populations locally or regionally.

6.3.3.11 Columbian White-tailed Deer

There are numerous ongoing efforts to protect and enhance the CWT deer population and achieve the recovery of the species. These include:

- Management of refuge habitat to provide maximum benefits for the deer.
- Acquisition of CWT deer habitat by the Service and private conservation organizations.
- State and Federal laws protecting CWT deer from take.
- Technical assistance to private landowners to improve CWT deer habitat.
- Reintroductions of CWT deer to suitable habitat within their former range.
- Predator control.

The loss of excessive numbers of CWT deer to predators, especially coyotes, undermines other recovery efforts. Alternatively, predator control on the refuge complements these recovery efforts. A more effective predator control program, as proposed in alternatives 2 and 3, in concert with proposed reintroduction and population expansion efforts, are expected to have significant beneficial cumulative effects on the deer.

6.3.3.12 Impacts to Fisheries

In Washington State, fishing season options are developed each year in the late winter and early spring by the WDFW in conjunction with State and Tribal fish managers based on the best available scientific information on the number of fish a given stream or lake is capable of supporting. Even after seasons are set each April, WDFW monitors in-season activity to gauge what is actually happening on the water and whether seasons should be adjusted accordingly. For example, a fishery may be closed because a quota has been reached; fishing rules may be modified to allow recreational fishing to increase or decrease by limits, or fishing opportunities may be changed if information from test fisheries indicates the number of fish actually returning is substantially different from preseason estimates.

For anadromous fish such as salmon, the annual process of setting scientifically sound fishing seasons begins each year with a preseason forecast of the abundance of various individual fish stocks. These forecasts are based on estimates of the number of juvenile wild salmon produced in a river system, surveys of adult fish spawning in the wild, counts of fish returning to hatcheries, and samples from fisheries in “terminal” areas—the waters near the home streams where fish are returning. Taken together, these numbers usually can give an indication of the strength of the upcoming season's fish populations.

The forecast is added to a base of information on the historic run size strength and fishery impacts for the various fish populations. The primary tool used to develop this base of information for Chinook salmon is coded wire tags, which bear identifying information and are inserted into the snouts of young fish. Later, the coded wire tags can be extracted from fish sampled in fisheries or recovered from spawning grounds.

The WDFW participates in three separate harvest management panels including: The Pacific Salmon Commission which consists of representatives of Alaska, Washington, Oregon, and Canada; the treaty Indian tribes of Washington and the Columbia River and the Federal government; the Pacific Fisheries Management Council (PFMC) which includes the principal fisheries officials from the states of California, Oregon, Washington, and Alaska; the Regional Director, NOAA Fisheries Service and eight private citizens appointed by the U.S. Secretary of Commerce; and the North of Falcon public planning process in which Federal, state and tribal fish managers meet in tandem with PFMC deliberations on ocean seasons, to set recreational and commercial salmon fisheries for waters within three miles of the coast of Washington and northern Oregon, as well as Puget Sound.

Because we allow people to fish from the refuge we expect a relative small number of fish to be taken from refuge and adjacent waters. The number of fish taken on the refuge is minor compared to the number of fish harvested from other fishing activities (sport and commercial) on the lower Columbia River; therefore, the refuge fishing program would have a negligible effect on local and migratory fish populations. Fishing rules and regulations are in general governed by the individual states. While there are no specific refuge regulations regarding the number of fish that can be taken, the interior sloughs of the Mainland and Tenasillahe Island units are closed to all public access including fishing.

In Washington State in 2006 there were an estimated 538,000 recreational freshwater anglers with a total of 7,524,000 fishing days amassed during the year. In Oregon, the number of freshwater anglers was 491,000 with an estimated 7,053,000 fishing days in the state (USFWS 2006). While no overall surveys have been completed for fishing activities that occur on refuge lands, it is obvious to the casual observer that the amount of recreational anglers is very small.

On the Mainland Unit there are at the most 10-15 anglers per day. Expanding this out to the entire refuge would produce a figure of around 40 anglers per day. An average daily rate of 40 anglers per day would result in a total of 14,400 fishing days per year which is less than 0.002 percent of the total yearly freshwater fishing days for the state of Washington.

6.3.3.13 Public Use Program

The Mainland Unit is the focus of the public use program for both refuges. This is the only area where the public can drive to access the refuge and associated facilities. Most of the lower river refuge islands receive limited visitor use. Access is by boat only and the thick vegetation on the islands is not conducive to hiking. However, substantial numbers of recreational boaters and anglers pass by the islands and it is reasonable to assume that some scan the shoreline for birds and other wildlife.

Based on current public use program, cumulative impacts from refuge visitors who visit both by car and by boat are expected to be minimal when put in the context of overall recreational use of the lower Columbia River. Other local/regional areas that provide public recreational facilities include Vista Park in Skamokawa, Lewis and Clark National Historic Park near Astoria, Fort Clatsop State Park near Warrenton, Fort Stevens State Park near Ilwaco, and the Mount Saint Helens National Monument. In addition, much of the public use in the lower Columbia is not site specific, with many visitors coming to spend time on the river as opposed to a park or other recreational unit.

Although no recreational use data were found specifically for the lower Columbia River counties of Washington and Oregon State (Columbia, Cowlitz, Wahkiakum, and Pacific counties), survey results were found for Washington State. The Washington State IAC has compiled statewide participation data and conducted recreational use surveys on a somewhat regular basis. A 2003 report by the IAC provides estimates of future participation in 13 of 14 major categories over periods of 10 and 20 years. The estimates are based on:

- National Survey on Recreation and the Environment (NSRE) projections for the Pacific Region, including Washington State;
- Age group participation and age trends in Washington;
- Estimates of resource and facility availability;
- User group organization and representation;
- Land use and land designations; and
- Other factors including the economy and social pressures.

The resulting estimates, as a percent of change in the number of people participating in the future compared to current levels, are depicted in the following table.

Table 6-3 Estimates of the Percent of Change to Occur in Recreation Participation over the next 10 to 20 Years (IAC 2002b)

Activity	Estimated 10 year change	Estimated 20 year change
Walking	+23%	+34%
Hiking	+10%	+20%
Outdoor team and individual sports	+6%	+12%
Nature activities	+23%	+37%
Sightseeing	+10%	+20%
Bicycle riding	+19%	+29%
Picnicking	+20%	+31%
Motor boating	+10%	No estimate
Non-pool swimming	+19%	+29%

Activity	Estimated 10 year change	Estimated 20 year change
Visiting a beach	+21%	+33%
Canoeing/kayaking	+21%	+30%
Downhill skiing	+21%	No estimate
Cross-country skiing	+23%	No estimate
Snowmobile riding	+42%	No estimate
Fishing	-5%	-10%
Camping (primitive dispersed)	+5%	No estimate
Camping (backpacking)	+5%	+8%
Camping (developed for RVs)	+10%	+20%
Off-road vehicle riding	+10%	+20%
Hunting-shooting	-15%	-21%
Equestrian	+5%	+8%
Air activities	No estimate	No estimate

The survey indicates that hiking, nature activities, sightseeing, canoeing and kayaking are expected to increase between 20 percent and 37 percent depending on the activity throughout the State over the next 15 to 20 years. Other recreational activities such as hunting and fishing are expected to decline between 10 and 20 percent. The hunting and fishing figures are especially telling because even with population gains throughout the state these activities are expected to decline over time.

Cumulative impacts from public uses are based on anticipated population gains in this region during the next 15 years as well proposed new/improved recreational opportunities and facilities which would potentially bring in additional refuge visitors. Managing the refuge under Alternative 1 would continue current management. Management under alternatives 2 and 3 would provide for improvements to public recreation including: improvements for wildlife observation and photography with a designed foot trail proposed to allow the public to easily view wildlife; allowing additional refuge islands to be opened for waterfowl hunting; establishment of a YCC program (Alternative 2); and installation of new interpretive panels along with development of school curriculum and study sites (Alternative 3).

Impacts from the various alternatives are expected to have minimal affect on refuge resources. Because hunting and fishing activities are expected to decline over time, even if we provide additional hunting opportunities on refuge islands, impacts from these activities should be less than current levels over time. Other nonconsumptive activities such as wildlife observation and photography are expected to increase. Current visitor use is relatively minimal and the recreational activities planned for specific locations and times will not have any significant impacts to the refuge's habitats or its wildlife.

6.3.3.14 Refuge Habitat Management Activities and Actions

Long-term management of the Julia Butler Hansen Refuge will be focused on upland, riparian and wetland habitats. Short-term uses that enhance long-term productivity within the Mainland and Tenasillahe Island units are primarily related to habitat restoration and ongoing pasture management.

The following habitat restoration activities would be undertaken under all alternatives.

- Mowing and discing in preparation of planting trees and pastures.
- Recontouring wetland sites to allow for better water manipulation.
- Removing vegetation—usually invasive species—through chemical or physical means (e.g., mowing, discing, chopping).

The short-term effects of these activities would include temporary effects on aesthetics, connectivity, and localized wildlife use of the site. Over time impacts from the various alternatives are expected to have a positive affect on refuge resources.

6.4 Placement of Dredged Spoil Material

Columbia River channel maintenance and deepening activities continue to generate dredge spoil accumulations within the refuge boundary. Dredge spoil provides habitat for colonial nesting birds and streaked horned larks. While dredged spoils are generally placed on State-owned islands the activity does occur within the acquisition boundary of the Lewis and Clark Refuge.

Colonial nesting birds (great blue herons, gulls, terns, and cormorants) occur throughout the Lower Columbia River Estuary. The management of these birds is generally limited to protection of the roosting and nesting areas from disturbance. Colonial nesting birds have been the focus of recent attention because they feed on young salmon smolts as well as other fish that travel through the estuary. Continued placement of dredged spoils at existing spoil sites can be expected to encourage use by colonial nesting birds as well as horned larks, and Canada geese.

Impacts from placement of dredged spoils would be negligible as long as dredge spoils continue to be placed at existing locations. Continued use of dredge spoil areas by the wildlife species discussed above, would be the likely result of this action. Predation on salmon smolts in the vicinity of these islands would be expected to continue at an increased rate over non-dredged spoil sites. There are not expected to be any additional cumulative impacts resulting from refuge habitat management of the islands.

6.5 Columbia River Channel Dredging

According to the Corps the Columbia River channel deepening project is designed to improve the deep-draft transport of goods on the authorized navigation channel and to provide ecosystem restoration for fish and wildlife habitats. The project proposes to deepen the existing 40-foot channel to 43 feet, enabling the use of larger, more efficient vessels to transport commodities. Construction will remove approximately 14.5 million cubic yards (mcy) of material. Approximately 11-13 mcy of material is removed to maintain the Columbia River navigation channel at the current authorized depth of 40 feet. Following construction, maintenance of the 43-foot channel will require the removal of about 8 mcy per year initially and decline to 3 mcy per year as the channel reaches equilibrium. Dredging operations are conducted so as not to conflict with movement of endangered salmonids and other fish species. Impacts from Columbia River dredging operations have been extensively discussed in the 1999 Columbia River Feasibility Study and Channel Deepening Environmental Impact Statement, completed by the Corps.

6.6 Proposed Bradwood Liquefied Natural Gas Plant

Northern Star Natural Gas has proposed the Bradwood Landing Liquefied Natural Gas (LNG) receiving terminal on 55 acres of a 420-acre site at Bradwood, located between Astoria and Clatskanie at about River Mile 38 on the Columbia River. The facility would be designed to have a peak send out capacity of 1.3 billion cubic feet of natural gas per day, and would be capable of continuous operation. The proposed project also includes a 34-mile long pipeline that would run from the site to Port Westward and then under the Columbia River into Washington. The proposed site is located approximately one mile northwest of Tenasillahe Island on the Oregon side of the Columbia River.

Overall impacts from the proposed facility are still being debated although a final EIS was issued by the Federal Energy Regulatory Commission (FERC) in June 2008. According to FERC the Bradwood LNG project would have limited adverse environmental impacts if appropriate mitigating measures are taken. The states of Washington and Oregon have yet to officially review the project and issue permits, and both states have filed lawsuits over the approval process for the project.

NOAA’s Fisheries Service has joined Washington and Oregon in challenging federal regulators’ approval of the Bradwood Landing LNG terminal. The Fisheries Service, which has raised concerns about the proposed Columbia River terminal’s effect on salmon, is among six or more state agencies and environmental groups challenging the decision in the U.S. 9th Circuit Court of Appeals.

Impacts to off-refuge CWT deer from the project are currently being reviewed by the Service’s Western Washington Ecological Services Office with input from the refuge. Likely impacts to refuge habitat and wildlife are expected to be minimal as the project site and pipeline are generally located away from refuge resources.

6.7 Other Wildlife Management Actions on the Lower Columbia River

In addition to the Service, other conservation agencies and groups that manage and protect habitat in the area include The Nature Conservancy, the Columbia Land Trust, the Lower Columbia River Estuary Partnership, WDFW, and ODFW. Impacts to area habitats resulting from the enhancement of rivers, streams, wetlands, riparian forests, and managed pastures will result in an overall long term benefit to a wide variety of native birds and animals.

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Appendix A. Appropriate Use Determinations

Introduction

The Appropriate Refuge Uses Policy outlines the process that the Service uses to determine when general public uses on refuges may be considered. Priority public uses previously defined as wildlife-dependent uses (hunting, fishing, wildlife observation and photography and environmental education and interpretation) under the National Wildlife Refuge System Improvement Act of 1997, are generally exempt from appropriate use review. Other exempt uses include situations where the Service does not have adequate jurisdiction to control the activity and refuge management activities.

In essence, the appropriate use policy, 603 FW 1 (2006), provides refuge managers with a consistent procedure to first screen and then document decisions concerning a public use. When a use is determined to be appropriate, a refuge manager must then decide if the use is compatible before allowing it on a refuge. The policy also requires review of existing public uses. During the CCP process the refuge manager evaluated all existing and proposed refuge uses at both Julia Butler Hansen and Lewis and Clark Refuges using the following guidelines and criteria as outlined in the appropriate use policy:

- Do we have jurisdiction over the use?
- Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?
- Is the use consistent with applicable Executive orders and Department and Service policies?
- Is the use consistent with public safety?
- Is the use consistent with goals and objectives in an approved management plan or other document?
- Has an earlier documented analysis not denied the use or is this the first the use has been proposed?
- Is the use manageable within available budget and staff?
- Will this be manageable in the future within existing resources?
- Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?
- Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1 for recreational uses description), compatible, wildlife dependent recreation into the future?

Using this process and these criteria, and as documented on the following pages, the refuge manager determined the following use(s) are not appropriate: camping (Julia Butler Hansen Refuge), dog training (Julia Butler Hansen Refuge), and camping (Lewis and Clark Refuge). The refuge manager also determined the following refuge use(s) were appropriate, and directed that compatibility determinations be completed for each use: haying, silage harvest, and cattle grazing (Julia Butler Hansen Refuge).

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Julia Butler Hansen Refuge for the Columbian White-Tailed Deer

Use: Camping

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?		✓
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✓
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✓
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✓
(g) Is the use manageable within available budget and staff?		✓
(h) Will this be manageable in the future within existing resources?		✓
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✓
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✓

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate**_____

Refuge Manager:______________________ Date: May 1, 2009

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:______________________ Date:____________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Finding of Appropriateness of a Refuge Use
Supplement to FWS Form 3-2319
Camping (JBHNWR)

Further Explanation of answers provided for the Decision Criteria:

(a) The use takes place within the boundaries of the refuge.

(b) The use conflicts with 50 CFR 26.31, which states that “Public recreation will be permitted on national wildlife refuges as an appropriate incidental or secondary use only after it has been determined that such recreational use is practicable and not inconsistent with the primary objectives for which each particular area was established or with other authorized Federal operations.” At Julia Butler Hansen Refuge allowing camping is not consistent with the refuge purpose of endangered species conservation.

(c) The use is inconsistent with Service Policy. Specifically, 8 RM 9.5 (b) states that “Camping and picnicking may be permitted only when required to implement or sustain an approved wildlife/wildlands oriented activity only when no other alternative is practical.” At Julia Butler Hansen Refuge, camping is not required in order for the public to engage in wildlife-dependent public uses.

(d) The use is generally consistent with public safety.

(e) The use is not consistent with any goals or objectives in an approved refuge management plan or other refuge document.

(f) This use has previously been requested and denied on the refuge. The last documented official request for camping occurred prior to the implementation of Refuge’s Appropriate Use policy.

(g) This use is not currently manageable with available budget and staff. The amount of oversight needed to adequately carry out this activity would require significant upgrades.

(h) Based on current staffing, budget etc., this use would not be manageable in the future within existing resources.

(i) The use by itself does not necessarily contribute to public understanding of the refuge’s natural or cultural resources. The use is not beneficial to the refuge’s natural or cultural resources and because the use would reduce available wildlife habitat it would be detrimental to those resources.

(j) It is likely that this use would at least somewhat impair existing wildlife-dependent uses by impacting other refuge recreational users.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Julia Butler Hansen Refuge for the Columbian White-Tailed Deer

Use: Dog Training

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?		✓
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✓
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✓
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✓
(g) Is the use manageable within available budget and staff?		✓
(h) Will this be manageable in the future within existing resources?		✓
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✓
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✓

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate**_____

Refuge Manager:____________________ Date: May 1, 2009

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:____________________ Date:____________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Finding of Appropriateness of a Refuge Use
Supplement to FWS Form 3-2319
Dog Training (JBHNWR)

Further Explanation of answers provided for the Decision Criteria:

(a) The use takes place within the boundaries of the refuge.

(b) The use conflicts with 50 CFR 26.31, which states that "Public recreation will be permitted on national wildlife refuges as an appropriate incidental or secondary use only after it has been determined that such recreational use is practicable and not inconsistent with the primary objectives for which each particular area was established or with other authorized Federal operations." At Julia Butler Hansen Refuge allowing dog training is not consistent with the refuge purpose of endangered species conservation.

(c) The use may be consistent with Service Policy provided that the activity is compatible with refuge objectives. Specifically, 8 RM 8.1 states that "Field trials may be permitted on units of the refuge system provided the activity is compatible with refuge objectives." Since the appropriate use review is conducted prior to a compatibility determination, this decision criterion cannot be determined until after a compatibility determination is completed.

(d) The use is generally consistent with public safety.

(e) The use is not consistent with any goals or objectives in an approved refuge management plan or other refuge document.

(f) This use has previously been requested and denied on the refuge prior to the Appropriate Use policy implementation.

(g) This use is not currently manageable with available budget and staff. The amount of oversight needed to adequately carry out this activity would require significant upgrades.

(h) Based on current staffing, budget etc., this use would not be manageable in the future within existing resources.

(i) The use does not contribute to public understanding of the refuges natural or cultural resources. The use is not beneficial to the refuge's natural or cultural resources and due to loss of habitat may be detrimental to those resources.

(j) It is likely that this use would impair existing wildlife-dependent uses by impacting other refuge recreational users.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Lewis and Clark National Wildlife Refuge

Use: Camping

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?		✓
(c) Is the use consistent with applicable Executive orders and Department and Service policies?		✓
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?		✓
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✓
(g) Is the use manageable within available budget and staff?		✓
(h) Will this be manageable in the future within existing resources?		✓
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✓
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?		✓

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate ✓ **Appropriate**____

Refuge Manager:________________________ Date: May 1, 2009

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:________________________ Date:____________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Finding of Appropriateness of a Refuge Use
Supplement to FWS Form 3-2319
Camping (LCNWR)

Further Explanation of answers provided for the Decision Criteria:

(a) The use takes place within the boundaries of the refuge.

(b) The use conflicts with 50 CFR 26.31, which states that “Public recreation will be permitted on national wildlife refuges as an appropriate incidental or secondary use only after it has been determined that such recreational use is practicable and not inconsistent with the primary objectives for which each particular area was established or with other authorized Federal operations.” At Lewis and Clark NWR allowing camping is not consistent with the refuge purpose of endangered species conservation.

(c) The use is inconsistent with Service Policy. Specifically, 8 RM 9.5 (b) states that “Camping and picnicking may be permitted only when required to implement or sustain an approved wildlife/wildlands oriented activity only when no other alternative is practical.” At Lewis and Clark NWR, camping is not required in order for the public to engage in wildlife-dependent public uses.

(d) The use is generally consistent with public safety.

(e) The use is not consistent with any goals or objectives in an approved refuge management plan or other refuge document.

(f) This use has previously been requested and denied on the refuge. The last documented official request for camping occurred prior to the implementation of Refuge’s Appropriate Use policy.

(g) This use is not currently manageable with available budget and staff. The amount of oversight needed to adequately carry out this activity would require significant upgrades.

(h) Based on current staffing, budget etc., this use would not be manageable in future within existing resources.

(i) The use by itself does not necessarily contribute to public understanding of the refuge’s natural or cultural resources. The use is not beneficial to the refuge’s natural or cultural resources and because the use would reduce available wildlife habitat it would be detrimental to those resources.

(j) It is likely that this use would at least somewhat impair existing wildlife-dependent uses by impacting other refuge recreational users.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Julia Butler Hansen Refuge for the Columbian White-Tailed Deer

Use: Haying, Silage Harvest and Cattle Grazing

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_______________________ Date: May 1, 2009

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_______________________ Date:_______________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Finding of Appropriateness of a Refuge Use
Supplement to FWS Form 3-2319
Haying\Grazing (JBHNWR)

Further Explanation of answers provided for the Decision Criteria:

(a) The use takes place within the boundaries of the refuge.

(b) The use does not violate applicable laws and statues.

(c) The use is consistent with Service Policy. FWS policy at 6 RM 5 (Grassland Management) states that "Grazing programs may be implemented only when they benefit or are not harmful to wildlife and wildlife habitat" and "Frequency of grazing will vary according to productivity and condition of the site and should be held to the minimum necessary to achieve the desired results" (6 RM 5.6 A.). The policy also states that, "…annual haying of grasslands leads to reduced plant vigor, removal of organic material, and a reduction of wildlife values. However, under some circumstances annual haying may be necessary in order to provide emergent growth on seasonally flooded sites or otherwise support refuge objectives. In some situations, occasional haying can be used to remove excessive mulch accumulation that is inhibiting growth of desired plant species. Haying should be timed to achieve the desired results while minimizing the adverse effects…" (6 RM 5.6 C.).

(d) The use is generally consistent with public safety.

(e) The use is consistent with goals and objectives in an approved refuge management.

(f) Plan or other refuge document, specifically the objective to maintain short grass pastures for the benefit of Columbian white-tailed deer and Canada geese.

(g) This use has not been previously denied on the refuge.

(h) The use requires the issuance of permits and oversight by refuge personnel. The refuge currently has the available budget and staff that would be required to administer this use.

(i) This use is more economical than using refuge personnel and equipment to manage the entire refuge pasture system. It is anticipated that this cost savings would continue into the future.

(j) Although the use by itself does not necessarily contribute to public understanding of the refuge's natural or cultural resources, the use is definitely beneficial to the refuge's natural resources providing management of the refuges grasslands for the benefit of Columbian white-tailed deer and Canada geese.

(k) It is anticipated that this use would not impair existing wildlife-dependent uses or impact other refuge recreational users.

Appendix B. Compatibility Determinations

Introduction

The compatibility determinations (CDs) developed during the CCP/EIS planning process evaluates uses projected to occur under Alternative 2, the Preferred Alternative in the CCP/EIS. The evaluation of funds needed for management and implementation of each use also assumes implementation as described under Alternative 2. Chapter 6 of the CCP/EIS also contains analysis of the impacts of public uses to wildlife and habitats. That portion of the document is intended to be incorporated through reference into this set of CDs.

Uses Evaluated at this Time

The following section includes full CDs for all refuge uses that are required to be evaluated at this time. According to Service policy, CDs will be completed for all uses proposed under a CCP. Existing wildlife-dependent recreational uses must also be reevaluated and new CDs prepared during development of a CCP or every 15 years whichever comes first. Uses other than wildlife-dependent recreational uses are not explicitly required to be reevaluated in concert with preparation of a CCP, unless conditions of the use have changed or unless significant new information relative to the use and its effects have become available or the existing CDs are more than 10 years old. However, the Service planning policy recommends preparing CDs for all individual uses, specific use programs, or groups of related uses associated with the proposed action. Accordingly, the following CDs are included in this document for public review.

Table B.1 Summary of Compatible Use Determinations

See Page	CD #	Refuge Use	Refuge*/ Compatible	Next Year Due for Re-evaluation
B-7	B.1	Waterfowl Hunting: Crims, Wallace, Price, and Hunting Islands	JBH/yes	2025
B-17	B.2	Elk Hunting; Mainland Unit	JBH/yes	2020
B-23	B.3	Sport Fishing	JBH/yes	2025
B-29	B.4	Environmental Education, Interpretation, Wildlife Observation, and Photography	JBH/yes	2025
B-35	B.5	Haying, Silage Harvest, and Cattle Grazing	JBH/yes	2020
B-41	B.6	Waterfowl Hunting	LAC/yes	2025
B-49	B.7	Sport Fishing	LAC/yes	2025
B-55	B.8	Environmental Education, Interpretation, Wildlife Observation, and Photography	LAC/yes	2025

* Julia Butler Hansen Refuge (JBH) and Lewis and Clark Refuge (LAC)

Compatibility—Legal and Historical Context

Compatibility is a tool refuge managers use to ensure that recreational and other uses do not interfere with wildlife conservation, the primary focus of refuges. Compatibility is not new to the Refuge System and dates back to 1918, as a concept. As policy, it has been used since 1962. The Refuge Recreation Act of 1962 directed the Secretary of the Interior to allow only those public uses of refuge lands that were "compatible with the primary purposes for which the area was established." Legally, refuges are closed to all public uses until officially opened through a compatibility determination. Regulations require that adequate funds be available for administration and protection of refuges before opening them to any public uses. However, wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are to receive enhanced consideration and cannot be rejected simply for lack of funding resources unless the refuge has made a concerted effort to seek out funds from all potential partners. Once found compatible, wildlife-dependent recreational uses are deemed the priority public uses at the refuge. If a proposed use is found not compatible, the refuge manager is legally precluded from approving it. Economic uses that are conducted by or authorized by the refuge also require compatibility determinations.

Under compatibility policy, uses are defined as recreational, economic/commercial, or management use of a refuge by the public or a non-Refuge System entity. Uses generally providing an economic return (even if conducted for the purposes of habitat management) are also subject to compatibility determinations. The Service does not prepare compatibility determinations for uses when the Service does not have jurisdiction. For example, the Service may have limited jurisdiction over refuge areas where property rights are vested by others; where legally binding agreements exist; or where there are treaty rights held by tribes. In addition, aircraft over-flights, emergency actions, some activities on navigable waters, and activities by other Federal agencies on "overlay refuges" are exempt from the compatibility review process.

The compatibility policy required by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), was adopted by the Service in October, 2000. The policy requires that a use must be compatible with both the mission of the Refuge System and the purposes of the individual refuge. This standard helps to ensure consistency in application across the Refuge System. The Improvement Act also requires that compatibility determinations be in writing and that the public have an opportunity to comment on most use evaluations.

The Refuge System mission emphasizes that the needs of fish, wildlife, and plants must be of primary consideration. The Improvement Act defined a compatible use as one that "…in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the Refuge." Sound professional judgment is defined under the Improvement Act as "….a finding, determination, or decision, that is consistent with principles of sound fish and wildlife management and administration, available science and resources…" Compatibility for priority wildlife-dependent uses may depend on the level or extent of a use.

Court interpretations of the compatibility standard have found that compatibility is a biological standard and cannot be used to balance or weigh economic, political, or recreational interests against the primary purpose of the refuge (Defenders of Wildlife v. Andrus [Ruby Lake Refuge]). The Service recognizes that compatibility determinations are complex. For this reason, refuge managers are required to consider "principles of sound fish and wildlife management" and "best available science" in making these determinations (House of Representatives Report 105-106). Evaluations of the existing uses on Julia Butler Hansen and Lewis and Clark refuges are based on the professional judgment of refuge personnel including observations of refuge uses and reviews of appropriate scientific literature.

In July 2006, the Service published its Appropriate Refuge Uses Policy (603 FW1). Under this policy, most proposed uses must also undergo a review prior to compatibility. Exceptions from the policy include the six wildlife-dependent public uses and uses under reserved rights—see policy for more detail. Appropriate use reviews that are not found appropriate are included here for camping and dog training (Appendix A).

Compatibility Determinations for Julia Butler Hansen Refuge

This section contains Compatibility Determinations for the following uses on Julia Butler Hansen Refuge:

- Environmental education, interpretation, wildlife observation, and photography
- Waterfowl hunting
- Sport fishing
- Elk hunting (Mainland Unit only)
- Haying, silage, and cattle grazing (Mainland/Tenasillahe Island units only)
- Trapping nutria

Julia Butler Hansen Refuge Location

Location: Wahkiakum County Washington and Columbia and Clatsop County, Oregon
Date Established: 1971

Establishing and Acquisition Authorities

- Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544)
- Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended
- Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742d-l)
- Estimated Land Acquisition under the (P.L. 88-578) Land and Water Conservation Fund Act of 1965
- Final Environmental Statement, Proposed Additions to and Operation of the Columbian White-tailed Deer National Wildlife Refuge Oregon and Washington, May 10, 1973
- Draft Environmental Assessment, Proposed Additions to Julia Butler Hansen Refuge for the Columbia White-tailed Deer, Clatsop and Columbia Counties, Oregon, December 1990
- Categorical Exclusion for the Willamette Industries Addition October 1998

Refuge Purpose(s)

- "...to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants..." 16 U.S.C. 1534 (Endangered Species Act of 1973)
- "...suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species..." 16 U.S.C. 460k-1

- "...the Secretary...may accept and use...real...property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors" 16 U.S.C. 460k-2 (Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended).
- "...for the development, advancement, management, conservation, and protection of fish and wildlife resources..." 16 U.S.C. 742f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)
- "The lands proposed for acquisition are essential to the preservation of the endangered Columbia white-tailed deer, Odocoileus virginianus leucurs." Estimated Land Acquisition FY 1967
- "…and management of these lands primarily for the benefit of the endangered Columbian white-tailed deer and public enjoyment derived there from." DOI Final Environmental Statement, May 10, 1973
- "…to secure additional habitat for the benefit of the endangered Columbian White-tailed deer." Draft Environmental Assessment, December 1990
- "...to preserve native spruce swamp habitat for the Endangered CWTD" Categorical Exclusion, October 1998

Compatibility Determinations for Lewis and Clark Refuge

This section contains Compatibility Determinations for the following uses on the Lewis and Clark National Wildlife Refuge:

- Environmental education, interpretation, wildlife observation, and photography
- Waterfowl hunting
- Sport fishing
- Trapping nutria

Lewis and Clark Refuge Location

Location: Clatsop County, Oregon
Date Established: 1972

Establishing and Acquisition Authority(ies):

- Migratory Bird Conservation Act of 1929 (45 Stat.1222), as amended
- Federal Property and Administrative Services Act of 1949 (P.L. 80-537)
- Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended

Refuge Purpose(s):

- "To preserve an important wintering and feeding area for migratory waterfowl in the Pacific Flyway" (Migratory Bird Conservation Commission: Memorandum #2 dated September 21, 1971)
- "Wintering area for migratory waterfowl" (Migratory Bird Conservation Commission: Memorandum #7 dated May 14, 1974)
- "…wildlife conservation purposes" (U.S. Department of Labor, General Services Administration, land transfer documents, 41 acre Tongue Point Unit) March 20, 1979
- "…maintain existing habitat for the threatened bald eagle, as well as support its eventual recovery." (U.S. Department of Labor (GSA) land transfer documents of Emerald Heights and Tongue Point units to the Service) March 15, 1990
- "Public Waterfowl hunting, recreational fishing, and commercial fishing, in accordance with established custom and usage in accordance with State and Federal rules and regulations." Clatsop County, Oregon, Land donation documents; Bargain and Sale of Deed (4,328 acres refuge islands), May 20, 2004

National Wildlife Refuge System Mission

The mission of the National Wildlife Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

B.1 Compatibility Determination for Waterfowl Hunting on Julia Butler Hansen Refuge for the Columbia White-tailed Deer

Use: Hunting (waterfowl)

Refuge Names: Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Description of Use(s): This compatibility determination examines existing and proposed sport hunting for waterfowl on designated units of the refuge. Existing waterfowl hunt areas include the Hunting Island and Wallace Island units of the Julia Butler Hansen Refuge. Proposed waterfowl hunt areas include the Crims Island Unit, which is located in Columbia County, Oregon, and the Service-owned portion of Price Island, which is located in Wahkiakum County, Washington. Maintaining hunting opportunities on Hunting and Wallace islands and opening the Service-owned portions of Crims and Price islands to waterfowl hunting will complement State permitted activities. This will resolve potential problems over the exact position of the refuge boundary that would exist with a waterfowl hunt closure, and associated enforcement of relevant laws and regulations. Hunting is currently permitted on Oregon- and Washington State-owned waters and tidelands surrounding the four islands. These adjacent waters are all tidally influenced submerged lands below mean high water (MHW).

Under this proposal, hunting would be allowed consistent with State regulations except as specifically noted herein. Geese, ducks, coots, and common snipe will be permitted to be taken. Specific species/numbers to be taken and hunting periods will be set by ODFW and WDFW to match adjacent areas open to waterfowl hunting. The shoreline of the islands as well as the interior sloughs and adjacent slough banks will be opened for hunting. Areas interior to the river shoreline and slough banks will be closed as the dense forested interiors provide no real waterfowl hunting opportunities.

Hunters may use dogs to aide in retrieval of birds but dogs will need to be kept under control at all times. Hunters may set up temporary blinds along the shoreline which must be removed at the conclusion of each hunting period. Since this hunt will occur on islands in the Columbia River, access is only available by boat.

Hunting and Price islands are located in Wahkiakum County, Washington, adjacent to the Mainland Unit while both Wallace and Crims islands are located in Columbia County, Oregon. Refuge ownership of the islands is confined to land above MHW with the States of Washington and Oregon owning and regulating use of the surrounding tidal and submerged land.

Recreational hunting (a wildlife-dependent activity) has been identified in the National Wildlife Refuge System Improvement Act of 1997 as a priority public use, provided it is compatible with the purpose for which the refuge was established.

Availability of Resources: The proposed continuation of waterfowl hunting on Hunting and Wallace islands and expansion of waterfowl hunting to include the Service-owned portions of Crims and Price islands would not require any new infrastructure or personnel. Administration of the hunt and annual coordination with the States of Oregon and Washington would be required as would some law enforcement patrols; however refuge staff is in place and capable of conducting these additional duties. Revision and printing of the refuge brochure, updating the refuge website and other outreach information would be required at an estimated cost of $9,000. Base funding is available to cover these costs.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Administration and management:	$0000.00	$2,000.00
Maintenance:	$0000.00	$1,000.00
Monitoring:	$0000.00	$4,000.00
Special equipment, facilities, or improvements:	$500.00	$2,000.00
Offsetting revenues:	$0000.00	$0000.00

Anticipated Impacts of the Use: The primary refuge purpose is to maintain the refuge in optimum condition for the Columbian white-tailed (CWT) deer. Wallace Island currently supports approximately 20 CWT deer, Crims Island supports about 25 CWT deer, and Hunting/Price islands support around 20 CWT deer. This proposed use would not result in any degradation of the islands in terms of their suitability for CWT deer. Due to the limited number of hunters, limited field time, and the activity being confined to essentially the shoreline, no effects to vegetation are anticipated.

While the presence of hunters and dogs would cause some disturbance to CWT deer on the island, this level of disturbance is expected to be minor and inconsequential. There is abundant hiding cover on the islands for CWT deer. Hunters would have no reason to penetrate the island's interior and due to the dense vegetation it is not suitable habitat for waterfowl hunting or walking. Hunters' dogs would be expected to stay at the blind or boat, as they are trained to do, except when retrieving birds.

The number of hunters expected to use the shoreline of each island would be small, probably two to four parties at most per day. Waterfowl hunting already occurs on state-owned waters and tidelands surrounding the islands. Opening the island to hunting is not expected to increase the amount of hunting or boat traffic that occurs in close proximity to the island. A closure of the shoreline would be unenforceable because the refuge boundary is described as the mean high water line, which cannot be precisely determined in many areas.

White-tailed deer in general are quite tolerant of moderate human disturbance. They often live in suburban neighborhoods and city parks, where human presence is nearly constant (Etter et al. 2002; Harveson et al. 2007; Raik et al. 2006). The relatively minor disturbance caused by a few hunters using the shoreline of Wallace Island is not expected to have any measurable negative effect on CWT deer.

Other species which may be affected by the proposed alternative include bald eagles, great blue herons and other birds which reside along island shorelines and in riparian vegetation in the Columbia River. No effects are expected for Columbia River or refuge fish populations.

Nearby resting and feeding areas will be available for use by waterfowl, deer, and other refuge species that are disturbed. These species would likely move to other areas of the refuge that are less accessible to the hunters. The Service is required by the Endangered Species Act of 1973 to complete a Section 7 evaluation of the proposed activity to ensure that the action does not unacceptably affect listed species. The completed Section 7 evaluation determined that the proposed action would not be likely to adversely affect any endangered mammals or birds in the area and would have no effect on bull trout.

Effects on other public uses are expected to be minimal as the islands are accessible only by boat, and due to the time of year waterfowl hunting occurs, other recreational uses such as kayaking or boating in the Columbia River have ceased or are at minimal levels in the fall/winter months.

Although hunting directly impacts individuals, the amount of waterfowl harvest is not expected to change or to have a measurable effect on refuge, lower Columbia River, or Pacific Flyway populations, as waterfowl hunting is already occurring on the shorelines surrounding all three islands below MHW and waterfowl hunting activity is not extremely high. Hunting may be either compensatory or additive to natural mortality (Anderson 1995). Compensatory mortality occurs when hunting substitutes for other forms of mortality (disease, competition, predation, severe weather, etc.). Additive mortality occurs when hunting compounds the total mortality. In some cases, hunting can be used as a management tool to control populations. In concert with Canada, Mexico, and multi-state flyway councils, the Service and State wildlife agencies regulate hunting so that harvest does not reduce populations to unsustainable levels.

Direct effects of hunting on waterfowl are mortality, wounding, and disturbance (DeLong 2002). Hunting can alter behavior (e.g., foraging time), population structure, and distribution patterns of wildlife (Bartelt 1987; Cole and Knight 1990; Madsen 1985; Owens 1977; Raveling 1979; Thomas 1983; White-Robinson 1982). In Denmark, hunting was documented to affect the diversity and number of birds using a site (Madsen 1995). Avian diversity changed from predominantly mute swan and mallard to a more even distribution of a greater number of species when a sanctuary was established. Hence, species diversity increased with the elimination of hunting. There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento Refuge's non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began.

Human disturbance to wintering birds and other wildlife using the open waters of the Columbia River surrounding the islands would occur as a result of hunting activity. Migratory and wintering waterfowl generally attempt to minimize time spent in flight and maximize foraging time because flight requires considerably more energy than any other activity, other than egg laying. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995; Wolder 1993). Disturbance levels from hunting activity outside Chincoteague Refuge were found to be high enough to force wintering black ducks into a pattern of nocturnal feeding within surrounding salt marsh and diurnal resting within refuge impoundments (Morton et al. 1989a, 1989b). Unhunted populations have been documented to behave differently from hunted ones (Wood 1993).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur, and birds can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et. al 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1995; Paulus 1984). In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a five-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased four- to 20-fold within the sanctuary (Madsen 1995). On Julia Butler Hansen Refuge, both the Tenasillahe Island and Mainland units are closed to all public entry and with numerous wetlands and sloughs available, these units act as a sanctuary during the waterfowl season. In addition, two established sanctuaries exist on the adjacent Lewis and Clark Refuge and vast portions of the Columbia River; they act as de facto sanctuaries due to the amount of open water not subject to waterfowl hunting pressure.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for refuges to manage hunt programs with non-hunt days. At Sacramento Refuge, 3 percent to 16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeon, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). However, intermittent hunting may not always greatly reduce hunting impacts. The intermittent hunting program of three hunt days per week at Sacramento Refuge results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). In Germany, several studies reported a range from a few days to approximately three weeks for waterbird numbers to recover to pre-disturbance levels (Fox and Madsen 1997). The proposed hunt will not be intermittent in order to provide consistent management with the existing refuge waterfowl hunt program as well as on adjacent State lands and waters.

Public Review and Comment: Open house style public meetings were held, verbal and written comments were solicited from the public during public scoping for the Draft CCP/EIS. Appendix I of the Draft CCP/EIS further details public involvement undertaken during development of the CCP. Additional public review and comment were solicited during the Draft CCP/EIS comment period.

Determination:

____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Waterfowl hunters would be expected to comply with all current and applicable State and refuge regulations. This will be achieved through a combination of printed information, signing, outreach efforts, and enforcement of regulations by State and refuge law enforcement officers.
- The shorelines of Wallace Island (approximately 5.8 miles of shoreline and the navigable interior sloughs), Crims Island (Service-owned 5.1 miles), Price Island (Service-owned 0.7 mile) and the Hunting Islands (approximately 6.9 miles of shoreline and navigable interior sloughs) under refuge jurisdiction these areas will be opened to public waterfowl hunting.
- The only exception to the open hunting zone is along the shoreline of Hunting Island where it parallels the Lower Elochoman River. Refuge lands in this area would be closed because the hunt zone is directly adjacent to the Steamboat Slough Road Dike. Having a hunt area immediately adjacent to a county road where visitors also come to observe wildlife could lead to conflicting public uses as well as safety issues.
- Geese, ducks, coots, and common snipe will be allowed to be taken. Limits and hunting periods will be set by ODFW and WDFW to match adjacent areas open to waterfowl hunting.
- Refuge staff and ODFW/WDFW staff will consult on issues regarding law enforcement and any significant changes in the number or behavior of wildlife. Refuge regulations will be in accord with state regulations. Refuge and ODFW/WDFW officers will patrol to ensure hunters are complying with all regulations and restrictions.
- Temporary blinds may be constructed, but they must be available to everyone on a first-come, first-served basis.
- Hunters may use dogs to aide in retrieval of birds but dogs will need to be kept under control at all times.
- Only non-toxic shot will be allowed for the hunt.
- Camping, overnight use and fires are prohibited.

Justification:

Hunting is one of the six designated wildlife-dependent public uses of the Refuge System. Refuges grant these six uses special consideration in planning and management. When on a refuge-specific basis one or more of these uses is determined compatible with the refuge purpose(s) and the Refuge System mission, the refuge is to strongly encourage (facilitate) the use(s). Providing a quality hunting program contributes to achieving refuge goals and purposes.

By incorporating Crims ,Wallace, Hunting, and Price islands into an existing waterfowl hunt program, no habitat degradation would be anticipated, disturbance to CWT deer would be temporary and localized, and ample amounts of additional quality habitat for waterfowl and other wetland birds exists on the refuge and in the lower Columbia River. Opening up the refuge-owned portion of Crims, Wallace, Hunting, and Price islands for waterfowl hunting compliments activities permitted by Oregon and Washington on adjacent waters and tidelands and provides distinct, manageable hunt units that can be more easily delineated, posted, and enforced, resulting in less confusion for the waterfowl hunting public. In addition, due to the time of year and the limited access except by boat, no conflicts among refuge user groups are anticipated.

It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the refuge will not be measurably lessened from allowing this use to occur. The relatively limited number of individuals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of affected species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted.

The program as described was determined to be compatible because potential impacts from waterfowl hunting around Wallace Island on CWT deer, other area waterfowl, and wildlife would be minimal and not materially interfere with or detract from achievement of the Refuge System mission or from the Service's ability to achieve refuge wildlife, habitat, or other public-use-related purposes and goals.

Mandatory Re-Evaluation Date (provide month and year for "allowed" uses only):

_2025_ Mandatory 15-year Re-Evaluation Date will be provided in the Final EIS/CCP (for priority public uses)

______ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

__X__ Environmental Impact Statement and Record of Decision

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Signatures approving and concurring with B.1 Compatibility Determination for Waterfowl Hunting on Julia Butler Hansen Refuge (Use is compatible with stipulations)

Refuge Determination:

Prepared by: ________________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ________________________________ ____________
(Signature) (Date)

Concurrence:

Refuge Supervisor: ____________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.2 Compatibility Determination for Elk Hunting on Julia Butler Hansen's Mainland Unit

Use: Elk hunt on the Mainland Unit

Refuge Name: Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Description of Use: This compatibility determination examines the existing elk hunt on the Mainland Unit of the refuge. The elk hunt program originates from the alternative selected in the Refuge Elk Management Plan and Environmental Assessment (EA) developed to manage the over-population and habitat competition of elk on the refuge in 2004.

The elk hunt takes a three-tier approach. The initial tier includes a state regulated limited permit muzzleloader hunt with a maximum of 10 permits issued per designated hunt period with a maximum of two hunt periods per year. The number of permits and type of animals to be taken (cow, spike, bull, etc.) are determined annually by the refuge based on the number of elk found on the refuge, as determined by surveys conducted by refuge staff.

If the limited hunts do not reduce herd numbers to management goals then the refuge proceeds to an "as needed" hunt activity. This hunt draws from the pool of hunters who have applied for a muzzleloader permit but who have not yet been allocated a permit. The number of permits in this "as needed" hunt is limited to a maximum of 10 covered under two hunt periods.

Hunters participating in either type of hunt are required to check in at the refuge headquarters for a pre-hunt briefing. Hunters are also required to sign out at the end of the day, reporting any success at that time.

If management goals are still not met with the "as needed" hunt, then the refuge proceeds to a final tier. The third tier involves either a management cull (elk removed by a professional sharpshooter) or relocation of the elk (elk moved off of the refuge). However, the State has affirmed that it will consider relocation only as an option of last resort. Because the final tier is a Service-authorized management activity, it is not subject to a compatibility determination.

Hunting is considered one of the priority wildlife-dependent public uses of the Refuge System. Hunting on the Mainland Unit would occur only if elk population numbers exceeded population goals for the refuge. Based on the updated elk management plan, the maximum refuge population target is 20 elk, the majority of which should be larger bulls to provide for viewing and photography opportunities. There are presently approximately 20-25 elk on the refuge mainland, but numbers are expected to grow through immigration and reproduction.

Timing of the hunt is targeted for the fall hunting season but depending on success rates, if additional as needed hunts are required; they may be done anytime from September 1 to April 30. Due to safety concerns such as nearby roads and residences, high-powered rifles will not be allowed on the refuge.

Availability of Resources: The proposed elk hunt would not require any new infrastructure or personnel. Hunters would be required to check in at the refuge headquarters for a pre-hunt briefing but this would not create much of an additional load on current staff. Parking would be allowed in the existing headquarters parking area or along existing pullouts at Steamboat Slough Road. Maintenance of these areas already occurs and the additional use by hunters is not expected to create an additional maintenance load. Hunters would have to travel on foot from the parking lot or roadside to the designated hunt area. Once an elk was downed, it would have to be moved without the aide of vehicles to the closest county or state road for retrieval.

Refuge staff would be required to occasionally monitor hunter activities but since the number of hunters and hunt periods is limited in scope, no additional personnel resources are anticipated and the impact on the existing staff should be limited to a few hours a week. It is expected that refuge and WDFW law enforcement personnel will assist with any enforcement related problems.

Maps, printed regulations, and other printed materials would be required to administer the hunt and conduct annual trainings. Annual printing is anticipated to cost approximately $500. Signs designating safety zones may be required in certain areas. Initial signage is expected to cost approximately $500 for signs and posts.

Anticipated Impacts of Described Use: This proposed use would result in temporary displacement of waterfowl in the hunt area. Other species which may be affected by the proposed alternative include Columbian white-tailed deer, bald eagles, great blue herons, and other birds which reside in and near refuge wetlands. Elk hunters can be expected to disturb waterfowl and other species by their movements and shooting activities in the field. The limited number of hunters allowed (maximum of 10 per hunt period), limited duration of the hunt (daylight hours only for no more than five consecutive days), and type of weapon allowed (muzzleloader) should limit the disturbance factor.

Nearby resting and feeding areas will be available for use by waterfowl, deer and other refuge species that are disturbed. These species would likely move to other areas of the refuge which are less accessible to the hunters. The Service has consulted under Section 7 of the Endangered Species Act to ensure that the action does not unacceptably affect listed species.

Due to the limited number of hunters and limited field time, no effects to vegetation are anticipated. In addition, no effects are expected to refuge fish populations because activities will not take place environments used by fish.

Effects to other public uses are expected to be minimal due to the location of the hunt which will be on the interior of the Mainland Unit which is generally closed to public use during the fall and winter. Some noise from the muzzleloaders may be experienced from the public driving around the auto tour road (dike road) and the public may occasionally observe elk or other wildlife species flushed into the open due to hunter activity. Again due to the limited scope and timing of the activity, all effects are expected to be minor and of short duration.

For detailed information concerning: 1) the purpose and need for the proposed action; 2) a description of the proposed action; 3) a description of affected habitats and wildlife; and 4) the environmental consequences of the proposed action, the reader may reference the Environmental Assessment for Control of Elk on the Julia Butler Hansen Refuge for the Columbian White-tailed Deer.

Public Review and Comment

Open house style public meetings were held, verbal and written comments were solicited from the public during public scoping for the Draft CCP/EIS. Appendix I of the Draft CCP/EIS further details public involvement undertaken during development of the CCP. Additional public review were solicited during the Draft CCP/EIS public comment period.

Determination:

___ Use is Not Compatible

_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: In order to ensure that that elk hunting within the designated boundaries of the Mainland Unit is compatible with refuge purposes, the refuge will need to issue specific hunting regulations. The following regulations are required in order for a safe and quality hunt to proceed:

- Hunting of elk will be by permit only.
- Use of muzzleloader only weapons with safety zones established near roads and residences.
- A maximum of ten hunters will be allowed to use the refuge in any one day with one hunt period consisting of five consecutive days (Monday through Friday only).
- A maximum of four hunt periods will be allowed per hunt season; two regular permit and if required two “as needed” permit.
- One person per permitted hunter will be allowed to assist the hunter during the hunt.
- Additional help will be allowed to retrieve an elk.
- Timing will generally coincide with WDFW hunting season.
- The State Second Elk Tag As-Needed hunt program will be used as necessary to control elk numbers in months outside the normal hunting season, except no hunting will be allowed during April–August.
- All refuge elk hunters must attend a refuge-led orientation each year prior to hunting on the refuge.
- Elk hunters must sign in and out each day they hunt.
- Elk hunters must report success/failure and any hit-but-not-retrieved animals when they sign out each day.
- Initial hunts will utilize the Master Hunter Program to help minimize the chances of missed shots and impacts on other species.
- A Section 7 Consultation was conducted for the elk hunt program (August 2004).

Justification: The primary refuge purpose is to maintain the refuge's habitat for the CWT deer. High elk numbers have the potential of causing unacceptable damage to CWT deer habitat through feeding and movement activities. Although a small herd of 20 animals cause a level of damage that is generally tolerable to the CWT deer, larger numbers can cause serious problems for the deer recovery effort. There was an average of 73 elk on the refuge mainland during the period of 1982-2004. To date the elk hunt has had the desired effect of reducing the number o elk on the refuge. During the previous two elk hunts (2005 and 2006) five elk were removed from the refuge. A large group of the remaining cow elk has moved off the refuge due to the hunting pressure. As of October 2007, there are about 20 bull elk and a couple of cow elk on the Mainland Unit; all within the management goals.

Because the refuge's main purpose is to provide high-quality habitat for the CWT deer, and high numbers of elk in a relatively restricted environment can degrade deer browsing and resting areas, elk population numbers must be controlled on the refuge. Controlling elk numbers on the refuge also helps to maintain the biological integrity, diversity, and environmental health of the refuge as whole. Options for controlling the size of the elk herd are limited due to state concerns regarding relocation of animals, limited funds for moving elk, and the lack of effective birth control technologies.

Based on the stipulations noted above designed to limit timing and amount of impact, it is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the refuge will not be measurably lessened from this activity. The relatively limited number of individuals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of this species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, removal of elk through hunting activities is found to be in support of and compatible with the purposes for establishment of the refuge and the mission of the Refuge System. The proposed use is also one of the priority wildlife-dependent uses refuges are required to facilitate, where compatible.

Mandatory 10- or 15-year Re-Evaluation Date:

__2020__ Mandatory 15-year Re-Evaluation Date (for priority public uses)

________ Mandatory 10-year Re-Evaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision: *Place "X" in appropriate space.*

____ Categorical Exclusion without Environmental Action Statement

____ Categorical Exclusion and Environmental Action Statement

____ Environmental Assessment and Finding of No Significant Impact

__X__ Environmental Impact Statement and Record of Decision

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Verme, L.J. and D.E. Ullrey. 1984. Physiology and nutrition. Pages 91-118 in: L.K. Halls, ed. White-tailed deer: ecology and management. Wildlife Management Institute, Stackpole Books. Harrisburg, PA.

Signatures approving and concurring with B.2 Compatibility Determination for Elk Hunting on Julia Butler Hansen's Mainland Unit (Use is Compatible with Stipulations)

Refuge Determination:

Prepared by:	______________________ (Signature)	__________ (Date)
Refuge Manager/ Project Leader Approval:	______________________ (Signature)	__________ (Date)

Concurrence:

Refuge Supervisor:	______________________ (Signature)	__________ (Date)
Regional Chief, National Wildlife Refuge System:	______________________ (Signature)	__________ (Date)

B.3 Compatibility Determination for Sport Fishing on Julia Butler Hansen Refuge

Use: Sport Fishing

Refuge Name: Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Description of Use: Sport fishing is currently permitted in the small pond (less than one acre) at the refuge pumping station on the Mainland Unit from the county road. Anglers gain access to the pond and fish from Brooks Slough Road. The fishing here is generally incidental to fishing the adjacent Brooks Slough from the county road. The pond is generally fished by local anglers and currently there is very little fishing pressure. Fish species caught here are warm water fish (bluegill, bass).

Sport fishing commonly occurs in the State-owned waters adjacent to the refuge boundary from the Mainland and Tenasillahe Island units. The refuge generally has jurisdiction over the land base, including shorelines, but not water in these areas. Access to fishing the Columbia River via the shoreline is gained from the adjacent county road on the mainland and via boat on Tenasillahe Island.

This compatibility determination will reassess and evaluate sport fishing from all shoreline and slough areas on the refuge. Under this use fishing would be allowed consistent with State regulations. Specific species/numbers to be taken and open periods will be set by ODFW and WDFW to match adjacent areas open to fishing.

Establishment of fishing opportunities along the shorelines of the various refuge units—Crims, Hunting, Price, Wallace and Westport—and continuation of fishing along the exterior dikes of the Mainland and Tenasillahe Island units will complement State permitted activities. This will also resolve potential problems over the exact position of the refuge boundary that would exist with a fishery closure, and associated enforcement of relevant laws and regulations. Fishing is currently permitted on Oregon- and Washington State-owned waters and tidelands surrounding all of the refuge units. These adjacent waters are all tidally influenced submerged lands below mean high water (MHW).

Hunting and Price islands are located in Wahkiakum County, Washington, adjacent to the Mainland Unit, while Wallace and Crims islands and the Westport Unit are located in Columbia County, Oregon. Refuge ownership of the islands is confined to land above MHW with the States of Washington and Oregon owning and regulating use of the surrounding tidal and submerged land.

Recreational fishing (a wildlife-dependent activity) has been identified in the Improvement Act as a priority public use, provided it is compatible with the purpose for which the refuge was established.

Availability of Resources: The proposed sport fishery program would not require any new infrastructure or personnel. Administration of a fishing program would require coordination with the States of Oregon and Washington, and require some law enforcement patrols; however refuge staff is in place and capable of conducting these additional duties. Revision and printing of the refuge brochure, updating the refuge web site and other outreach information would be required at an estimated cost of $6,000. Base funding is available to cover these costs.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Administration and management:	$0000.00	$3,000.00
Maintenance:	$0000.00	$1,000.00
Monitoring:	$0000.00	$2,000.00
Special equipment, facilities, or improvements:	$2,500.00	$0000.00
Offsetting revenues:	$0000.00	$0000.00

Anticipated Impacts of Use: Fishing as a solitary and stationary activity tends to be less disturbing to wildlife than hunting or motorized boating (Tuite et al. 1983). It is well recognized that fishing can give many people a deeper appreciation of fish and wildlife and a better understanding of the importance of conserving habitat, which has ultimately contributed to the Refuge System mission. A goal of Julia Butler Hansen Refuge is to provide opportunities for wildlife-dependent recreation. Fishing is one of the six priority public uses in the Refuge System. Of key concern, then, is to manage the activity to keep any potential adverse impacts within acceptable limits.

Any angler activities on the refuge are and will remain consistent with State guidelines. Related impacts for fish stocks associated with sport fishing in the Columbia and Elochoman rivers are estimated annually and taken into consideration by the State in its development of annual fishing agreements and associated regulations. Therefore, impacts to fish populations should be minimized.

Additional disturbance would be caused to birds and other wildlife using the open waters and where fishing would occur. Fishing activities may influence the composition of bird communities, as well as abundance, and productivity of waterbirds (Bell and Austin 1985; Bouffard 1982; Cooke 1987; Edwards and Bell 1985; Tydeman 1977). Anglers often fish in shallow, sheltered bays and creeks that birds prefer, negatively impacting distribution and abundance of waterfowl, grebes, and coots (Cooke 1987). Increases in anglers and associated shoreline activity discouraged waterfowl using otherwise suitable habitat (Jahn and Hunt 1964). Anglers influenced the numbers, behavior, and diurnal distribution of avian scavengers present at sites in Washington, when compared to non-fishing days (Knight et al. 1991). Shoreline activities, such as human noise, would cause some birds to flush and go elsewhere. In addition, trampling of vegetation and deposition of sewage or other chemicals are expected to commonly occur (Liddle and Scorgie 1980). Disturbance and destruction of riparian vegetation, bank stability, and water quality may result from high levels of bank fishing activities.

Boating associated with fishing can alter bird distribution, reduce use of particular habitats or entire areas by waterfowl and other water-birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). Impacts of motorized boating can occur even at low densities, given their noise, speed, and ability to cover extensive areas in a short amount of time. Anglers accessing the refuge shoreline at high tides by boat may fish from the refuge in the state waters.

Despite the potential impacts that fishing and supporting activities (boating) can have on local wildlife, it is anticipated impacts from allowing fishing will be minor. The reason impacts are expected to be minor is that the majority of waterfowl use on the refuge occurs in the winter and spring months, with some birds as early as September and October. Since the majority of the fishing activity occurs in the summer and fall (through mid-October), disturbance to waterfowl species is reduced. In addition, there is more than an adequate amount of undisturbed estuary, open water, and riverine habitat available to the majority of waterfowl, waterbirds, and other wildlife for escape and cover. Lastly, impacts are expected to be minor because there is a large area available for fishing and very small numbers of bank fisherman are expected to use the area.

Public Review and Comment: Open house style public meetings were held, and verbal and written comments were solicited from the public during public scoping for the Draft CCP/EIS. Appendix I of the Draft CCP/EIS further details public involvement undertaken during development of the CCP. Additional public review and comment were solicited during the Draft CCP/EIS comment period.

Determination:

____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: Law enforcement patrols to ensure compliance with fishing regulations will be conducted. State Fish and Wildlife Officers also patrol the refuge. Harvest and season lengths are established by the States of Oregon and Washington. All interior sloughs on the Tenasillahe Island Unit and Mainland Unit, except the pond adjacent to the Brooks Slough Pump station, are closed to prevent disturbance to the CWT deer.

Justification: Recreational fishing is one of the six priority public uses of the Refuge System. Providing a quality fishing program contributes to achieving one of the refuge's goals.

It is anticipated that wildlife, primarily waterbirds, will find sufficient food resources and resting places and their abundance and use of the refuge will not be measurably reduced. The fishing pressure received will not cause fish stocks to decline. The physiological condition and production of waterfowl and other waterbirds will not be impaired, their behavior and activity patterns will not be altered dramatically, and their overall welfare will not be impaired. Thus, allowing fishing to occur as described with stipulations will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

<u>Mandatory Re-Evaluation Date</u> (provide month and year for "allowed" uses only):

__2025__ Mandatory 15-year Re-Evaluation Date will be provided in the Final EIS/CCP (for priority public uses)

______ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____Categorical Exclusion without Environmental Action Statement

_____Categorical Exclusion and Environmental Action Statement

_____Environmental Assessment and Finding of No Significant Impact

__X__Environmental Impact Statement and Record of Decision

Literature Cited

Bell, D.V. and L.W. Austin. 1985. The game-fishing season and its effects on overwintering wildfowl. Biological Conservation 33:65-80.

Bouffard, S.H. 1982 Wildlife values versus human recreation: Ruby Lake National Wildlife Refuge. Pages 553-556 in: K. Sabol, ed. Transactions of the Forty-Seventh North American Wildlife and Natural Resources Conference. Washington, D.C.

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Knight, R.L. and D. Cole. 1995. Wildlife responses to recreationists. Pages 51-69 in: R.L. Knight and D. Cole, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press.

Knight, R.L., D.P. Anderson, and N.V. Marr. 1991. Responses of an avian scavenging guild to anglers. Biological Conservation 56:195-205.

Liddle, M.J. and H.R.A. Scorgie. 1980. The effects of recreation on freshwater plants and animals: a review. Biological Conservation 17:183-206.

Tuite, C.H., M. Owen, and D. Paynther. 1983. Interaction between wildfowl and recreation at Llangorse Lake and Talybont Reservoir, South Wales. Wildfowl 34:48-63.

Tydeman, C.F. 1977. The importance of the close fishing season to breeding bird communities. Journal of Environmental Management 5:289-296.

Signatures approving and concurring with B.3 Compatibility Determination for Sport Fishing on Julia Butler Hansen Refuge for the Columbian White-tailed Deer (Use is compatible with stipulations)

Refuge Determination:

Prepared by: ______________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ____________
(Signature) (Date)

Concurrence:

Refuge Supervisor: ______________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.4 Compatibility Determination for Environmental Education, Wildlife Observation, and Photography on Julia Butler Hansen Refuge

Use: Environmental Education, Wildlife Observation, and Photography

Refuge Name: Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Description of Use(s): This compatibility determination examines existing and proposed non-consumptive wildlife-dependent recreational uses on Julia Butler Hansen Refuge.

Environmental Education: Environmental education comprises those activities which seek to increase the public's knowledge and understanding of wildlife and contribute to the conservation of such wildlife. Activities would include non-staff conducted environmental education, teaching students, teacher workshops, interpretation, and interpretive sites. Environmental education activities generally occur on the Mainland Unit of the refuge.

Wildlife Observation: Wildlife observation is probably the most popular activity on the refuge. The Mainland Unit is completely surrounded by county and state roads which form a 10 mile loop. Visitors drive along the roads and stop to observe wildlife. In the lower estuary, refuge visitors to both refuges travel by either motorized or non-motorized boat for wildlife viewing and other wildlife oriented activities. Only one island, Tenasillahe, has a dike allowing visitors to walk around the periphery of the refuge. Dense vegetation on many of the islands limits observation to the shorelines and accessible slough banks.

Wildlife Photography: Wildlife photography is a popular activity which occurs year round on the refuge. Visitors drive around the Mainland Unit of the refuge using their vehicles as blinds to take advantage of photographic opportunities. Other refuge units including Crims, Wallace and the dike road at Tenasillahe Island, provide more limited photographic opportunities because visitors must use boats to access these Columbia River Islands.

Availability of Resources: Additional funding for operational costs would be needed to fully implement the environmental education, wildlife observation, and photography programs identified in the CCP/EIS. These needs are expected to be added from the CCP/EIS and are tied to funding requests in the form of Refuge Operating Needs System (RONS) and Maintenance Management System (MMS) projects for these activities. Other funding sources would be sought through strengthened partnerships, grants, and donations to administer and manage a safe and quality environmental education, wildlife observation, and photography program as described.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Administration and management:	$0000.00	$2,000.00
Maintenance:	$0000.00	$1,000.00
Monitoring:	$0000.00	$1,000.00
Special equipment, facilities, or improvements:	$500.00	$2,000.00
Offsetting revenues:	$0000.00	$0000.00

Anticipated Impacts of the Use(s): Activities that occur outside of vehicles (e.g., wildlife observation, trail hiking, and environmental education programs) tend to increase disturbance potential for most wildlife species (Klein 1993). Human activities along trails disturb wildlife, often resulting in flushing from roosting, feeding, nesting, or resting areas. Flushing may result in expenditure of energy reserves, abandonment from preferred habitat, and increased exposure to predation during relocation. In riparian habitats, the abundance of bird species requiring shrub cover (e.g., MacGillivray's warbler and lazuli bunting) may be reduced at recreation sites, while species that forage in tree canopies may be unaffected. Trails in riparian areas may encourage the penetration of new animal species, including nest predators, into formerly protected forests (Knutsen and Naef 1997). Wildlife photographers tend to have the largest disturbance impacts because they may remain close to wildlife for prolonged periods (Klein 1993). Casual photographers with low-power lenses may approach wildlife closer than other users.

Most wildlife viewing and photography on the Julia Butler Hansen Refuge would occur at the Mainland Unit along the existing county dike road. Wildlife of primary concern is CWT deer, several species of waterfowl including Canada geese and ducks, wading and shorebirds and raptors. Even with a seasonal closure (October 1 through May 31) continued public use of the Center Road Trail on the Mainland Unit may cause intermittent disturbance impacts to wildlife in adjacent habitat that are within visual or auditory range of the trail.

Public uses on the Mainland Unit are limited to the dike surface road, which is set back from the fields along the outside boundary of the refuge. The dike's elevation above surrounding terrain allows road/trail users to view wildlife at the interior of the refuge at a distance that would not noticeably disturb the wildlife. The dike is sufficiently wide at its base to provide a buffer to wildlife from public use occurring on the dike top (road). Primary foraging areas for CWT deer are sufficiently distant from the road to prevent recurring human disturbance. Further, riparian forest and old field vegetation buffer the managed fields and provide a visual barrier. The shoulders of the dike have minimal value as wildlife habitat. While the dike roads provide excellent viewing and travel opportunities for refuge visitors, it should be noted that the roads surrounding the refuge are managed by Wahkiakum County therefore the Service had no management control over the roads.

Impacts from the general public on the islands of the lower Columbia River are for the most part self limiting. This is because the islands are accessible only by boat which reduces the number of potential visitors. Along with the dense almost impenetrable vegetation on many of the rivers islands and daily tidal changes this makes visitation of the islands a challenge. Most visitor impacts on the lower river come from visitation of the adjacent shorelines and interior sloughs which may cause birds which use riparian habitat to flush. Still, observable numbers of visitors remains low at this point leading to the conclusion that for now, no additional stipulations are needed to protect refuge habitat from the limited amount of public use.

Impacts to wildlife resulting from disturbance from these uses are expected to be minor because there are more than adequate amounts of undisturbed habitats available for escape and cover.

Public Review and Comment: Open house style public meetings were held, verbal and written comments were solicited from the public during public scoping for the Draft CCP/EIS. Appendix I of the Draft CCP/EIS further details public involvement undertaken during development of the CCP. Additional public review and comment were solicited during the Draft CCP/EIS comment period.

Determination:

____ Use is Not Compatible

_X_ Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Wildlife-dependent public uses would be restricted to refuge-specific designated trails, public use facilities, or approved guided events. Unguided recreational activity occurring in closed areas would not be allowed unless operating under provisions of a Special Use Permit and stipulations set by the Refuge Manager.
- The Mainland Unit will serve as the focal point for environmental educational activities for both refuges (Julia Butler Hansen and Lewis and Clark refuges). The wildlife viewing site adjacent to Highway 4 and the refuge headquarters site will serve as the key areas for the general public to learn about and visit the refuge.
- The mainland dike roads that surround the refuge (Steamboat Slough and Brooks Slough) will continue to provide the main opportunity for visitors who wish to view and photograph wildlife and walk around the refuge. .
- The Center Road on the Mainland Unit will remain open seasonally (June through September) until a better solution (as discussed in the preferred) is developed. The dike road surrounding the Tenasillahe Island unit will also remain open for visitor to walk and observe wildlife. All other areas of the mainland and Tenasillahe Island units, inside of the dikes, will remain closed to reduce disturbance to CWT deer. All public use areas managed by the refuge will remain open dawn to dusk.
- Wildlife observation and photographic activities will continue to be available on the refuge islands in the lower estuary of both refuges. Impacts associated with differing levels and types of public use will be evaluated by staff annually. Monitoring information gathered by staff would be critically analyzed and used by the Refuge Manager to develop future modifications, if necessary, to ensure compatibility of wildlife observation and photography in all refuge locations.

Justification: The National Wildlife Refuge System Improvement Act of 1997 identified wildlife observation, photography, interpretation, and environmental education as four of the six, priority, wildlife-dependent recreational uses to be facilitated in the Refuge System, and the Act encouraged the Service to provide opportunities for these uses.

Currently, there are very few places in the surrounding area to view and interpret the region's once-common, now-rare habitat type, the Sitka-spruce swamp. Two developed wildlife viewing sites available on the Mainland Unit, offer viewing opportunities of mostly managed short-grass field habitat. The Highway 4 refuge wildlife viewing site was originally established for safe observation/photography of a large elk herd, which caused unsafe traffic congestion. In recent years, to reduce competition for CWT deer habitat, through the use of fencing and an elk management hunt, the elk have been encouraged to shift their use of the refuge's endangered CWT deer habitats and utilize habitats off the refuge. The Highway 4 viewing site currently lacks adequate interpretive displays and needs updated refuge program and refuge system information. Updating this display to interpret the refuge's mission, natural resources, and programs would provide the public an opportunity to understand the purposes and resources of the refuge.

The refuge currently has one walking trail, the Centerline walking trail, which bisects the refuge Mainland Unit and which has several drawbacks; it doubles as a service road, is closed much of the year to limit disturbance to CWT deer, generally floods in winter months, and is in a poor location to observe/photograph wildlife. The refuge will improve and expand wildlife observation/photography opportunities to provide a quality viewing experience for the public, while limiting potential disturbance to CWT deer. The staff will work with the County to identify and develop where appropriate walking trails along Brooks Slough Road and Steamboat Slough Road.

By developing a new walking trail and viewing area/auto tour pull-out for interpreting these important habitat types; Sitka-spruce swamp and the riparian forests, visitor experiences and knowledge about the resource will be enhanced. Development of a new walking trail and/or view points will be limited to areas that do not create a wildlife or resource disturbance.

The refuge headquarters viewing platform provides a good opportunity to view/photograph wildlife and has an excellent interpretive display. No changes to this area are proposed. Developing additional viewing sites adjacent to other habitat types would provide the public with a more varied wildlife viewing opportunity by highlighting different habitats.

Many members of the public are not familiar with national wildlife refuges and confuse them with other Federal land management systems such as national parks or with state parks. Providing information through programs written materials and interpretive panels helps to build an understanding and appreciation of the unique purposes and activities of national wildlife refuges. Providing information regarding the mission of the Service, the purposes of the refuge, along with specific resource information may alleviate potential negative impacts on wildlife by educating our visitors.

Local teachers are interested in bringing their students out to the refuge, developing curriculum driven learning opportunities for students is one way to increase school visits. Creating and developing specific study sites for classes to utilize on the refuge would reduce potential disturbance issues to wildlife, yet allow for students to get hands on experiences in science and nature.

The Youth Conservation Corps program provides an avenue for high school aged students to work on the refuge and learn more about the refuge resources and careers associated with the field of natural resources. Many students receive credit from their high school for participation in this paid position. Having a crew located on the refuge would provide local high school students with summer employment while assisting the refuge staff with a variety of resource management activities (fencing, tree planting, invasive species removal).

Although all of these activities can result in disturbance to wildlife, disturbance will be intermittent and short term. There are more than adequate amounts of undisturbed habitat available to wildlife for escape and cover. It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the refuge will not be measurably lessened from allowing the above activities to occur. The relatively limited number of individuals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of local wildlife species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing these uses to occur with stipulations will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

Mandatory Re-Evaluation Date:

__2025_ Mandatory 15-year Re-Evaluation Date will be provided in the Final EIS/CCP (for priority public uses)

______ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

______ Categorical Exclusion without Environmental Action Statement

______ Categorical Exclusion and Environmental Action Statement

______ Environmental Assessment and Finding of No Significant Impact

___X___Environmental Impact Statement and Record of Decision

Literature Cited

Klein, M.L. 1993. Waterbird behavior responses to human disturbances. Wildlife Society Bulletin 21:31-39.

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Signatures approving and concurring with B.4 Compatibility Determination for Environmental Education, Wildlife Observation, and Photography on Julia Butler Hansen Refuge (Use is compatible with stipulations)

<u>Refuge Determination:</u>

Prepared by: ______________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ____________
(Signature) (Date)

<u>Concurrence:</u>

Refuge Supervisor: ______________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.5 Compatibility Determination for Haying, Silage Harvest, and Cattle Grazing on Julia Butler Hansen Refuge

Use: Haying, Silage Harvest, and Cattle Grazing

Refuge Names: Julia Butler Hansen Refuge for the Columbian White-tailed Deer

Description of Use(s): This is a reevaluation of the haying, silage harvest, and cattle grazing program that was initially determined to be compatible with refuge purposes in 1994. The purpose of the program is to manage short grass foraging habitat for Columbian white-tailed (CWT) deer along with wintering and migrating Canada geese.

Under the preferred alternative the refuge haying and grazing allotments would total approximately 850 acres of pastures on the Mainland and Tenasillahe Island units. Currently four local permittees graze and hay introduced reed canary grass (*Phalaris arundinacea*), native grasses, tame pasture grasses, sedges (*Carex* spp.) and rushes (*Juncus* spp, *Eleocharis* spp.) on refuge pastures. The haying program is rather minimal at this time and involves only 24 total acres, all on the refuge Mainland Unit.

Cattle grazing and haying are considered refuge management economic activities. These activities have been and are proposed to continue to be conducted under a cooperative land management agreement (CLMA), which have been established between the refuge and the livestock operator (cooperator). The CLMA is an in-kind program, which means that both parties receive benefits from the land. In this case, the cooperator receives grazing and haying privileges, and the Service receives management actions conducted primarily for the benefit of the Columbian white-tailed deer and Canada geese on the Julia Butler Hansen Refuge.

Availability of Resources:

An estimated $6,000 of refuge staff time is needed annually for planning, oversight, and coordination of this use. Before each field season, the Refuge Manager reviews the annual work plan, discusses it with Refuge Complex headquarters staff, and makes necessary changes to the plan. Then the manager identifies changes with the cooperator prior to initiation of grazing.

Periodically, assistance may be required of refuge maintenance staff to maintain the watering and fencing systems. Refuge staff monitor the grazing operations and haying operations, and periodically evaluate habitat conditions before, during and after the grazing season. At the end of the season, refuge staff members review the worksheets provided by the cooperator to determine actual animal unit months grazed, hay removed from the refuge, and work provided by the cooperator, followed by a report to the cooperator outlining the details of their performance in comparison to the work plan. The overall cost to the refuge in terms of labor is considered to be low, considering the benefits provided to the refuge in meeting the previously described goal and objectives.

Anticipated Impacts of the Use: Negative impacts from grazing are mostly associated with difficulties in containing the cattle. Cattle are attracted to water and therefore can damage sensitive wetland areas if they gain access to those sites. They can also cause damage in riparian forest sites by trampling the understory and making the areas undesirable for other wildlife. By fencing off any sensitive areas and focusing the grazing in the pastures, negative impacts from grazing are minimized. Other negative impacts can result from soil compaction and poor water quality from livestock entering sensitive waterways. These impacts are significantly reduced by restricting livestock use to the spring through early fall time period and by development of site specific watering areas.

All three activities can cause some degree of disturbance to the CWT deer. The deer will generally avoid areas where cattle are concentrated and will not enter those pastures until after the cattle have moved. In addition, haying and silage activities may cause deer to move from the immediate area where the farming equipment is operating. However, since these disturbances are short term and localized, the deer can easily moved to an adjacent undisturbed location. Restricting the pasture management activities from spring thorough early fall provides the CWT deer and Canada geese optimum habitat conditions when they most need it, in the fall through winter seasons.

Public Review and Comment: Open house style public meetings were held, verbal and written comments were solicited from the public during public scoping for the Draft CCP/EIS. Appendix I of the Draft CCP/EIS further details public involvement undertaken during development of the CCP. Additional public review and comment were solicited during the Draft CCP/EIS comment period.

Determination:

___ Use is Not Compatible

_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Cooperative Farming Agreements will contain the following special conditions to insure compatibility:

- Special emphasis is applied to fencing wetlands and riparian zones to prevent cattle from trampling/grazing sensitive habitat. Fencing and ditching are used to contain cattle and focus grazing on specific pastures during the dry season.
- Season of use is from mid-April through mid-October to avoid disturbance to Canada geese and avoid grazing under wet soil conditions.
- Permittees are required to leave fields with 2 to 4 inches of grass and forb growth at season's end.
- Cooperative farmers are required to perform habitat maintenance work to sustain the field conditions for the benefit of wildlife. Work may include mechanical weed control, fertilization, and pasture mowing.
- The agreement does not imply or establish a use precedent. Future use of the area will be based on the most satisfactory use of the land for wildlife benefits, cooperator performance, habitat management needs, and administrative needs.

- Cooperative farmers will exercise care to prevent fire and will assume responsibility for fire that may result from farming operations.
- Permittee will exercise extreme caution to avoid hitting young fawns. No hay or silage cutting is allowed during the month of June when newborn fawns are most likely to be concealed in the standing grass.
- Sub-leasing is prohibited. Animals must be the property of the cooperator.
- At the end of the permit period, cooperator is responsible for removing all his equipment and animals from refuge lands.
- Cooperator shall be responsible for repairing damage to refuge facilities or habitat beyond normal wear and tear resulting from his operation.
- The use of firearms or other weapons is prohibited on refuge lands except as authorized by the Refuge Manager.
- Stocking rates of livestock may be altered should pasture conditions warrant, dependent upon judgment of the Refuge Manager.
- The cooperator will notify the Refuge Manager at least three days in advance of the date cattle are to be turned in or removed from the refuge. Any changes in the number of animals shall be immediately reported to the Refuge Manager. Livestock will be contained in assigned units and fences must be maintained by the cooperator.
- Cooperator is responsible for removing dead livestock carcasses from the refuge within three days of discovery.
- The cooperator shall comply with the livestock regulations of the State of Washington relating to health and sanitation requirements.

Justification: The haying, silage and grazing cooperative land management program contributes to achieving refuge purposes and goals as identified in the CCP/EIS and the Refuge System mission by providing valuable foraging areas and conditions for Columbian white-tailed deer and wintering and migrating Canada geese. It also contributes by economically providing weed control and other habitat maintenance functions that are not feasible for limited refuge staff to accomplish.

Grasses and forbs are the primary food sources for the CWT deer on the refuge. Browse is also used, but the deer prefer to feed in fields where the vegetation had been kept short by cattle grazing and mechanical cutting. The new actively growing plants are more succulent and digestible than mature plants, and deer naturally seek out the most nutritious food forages. The short grass pastures complement the marsh habitat on and around the refuge in providing forage and resting habitat for migrating and wintering Canada geese. Many off-refuge pastures are gradually being converted to other uses that exclude goose use. Refuge pastures also provide foraging habitat for ducks, raptors and elk. Grazing and haying are desirable means of maintaining this type of habitat because the climate is too wet for prescribe burning and repeated mowing of the pastures is beyond the capability of the refuge staff.

Prior to the acquisition of the refuge, the native riparian habitat was altered from its original native condition by the creation of a dike to hold back the waters of the Columbia River followed by introduction of non-native grasses and intensive grazing practices. In order to maintain the biological integrity and diversity of the refuge, in a relatively small area, the threatened and endangered species component, mainly CWT deer, needs to be managed more intensively than was found historically in the area. The use of moderate grazing to reduce the build-up of annual introduced grassland biomass is viewed as beneficial to the CWT deer. By restricting the intensity and duration of grazing, and by adhering to the stipulations for this use, the environmental health of the refuge will be maintained.

Although allowing haying, silage harvest, and cattle grazing on the refuge can result in disturbance to wildlife, disturbance will be intermittent and short term. There are more than adequate amounts of undisturbed habitat available to wildlife for escape and cover. The relatively limited number of individuals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus allowing haying, silage harvest, and cattle grazing on the refuge is found to be in support of and compatible with the purposes for establishment of the refuge and the mission of the Refuge System.

Mandatory Re-Evaluation Date :

______ Mandatory 15-year Re-Evaluation Date will be provided in the Final EIS/CCP (for priority public uses)

_2020_ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

__X__ Environmental Impact Statement and Record of Decision

Signatures approving and concurring with B.5 Compatibility Determination for Haying, Silage Harvest, and Cattle Grazing on Julia Butler Hansen Refuge (Use is compatible with stipulations)

Refuge Determination:

Prepared by: ______________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ____________
(Signature) (Date)

Concurrence:

Refuge Supervisor: ______________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.6 Compatibility Determination for Waterfowl Hunting on Lewis and Clark Refuge

Use: Hunting (waterfowl)

Refuge Names: Lewis and Clark National Wildlife Refuge

Description of Use(s): This compatibility determination examines existing sport hunting for waterfowl on designated units of the refuge. Sport hunting for waterfowl is currently allowed on refuge islands. This CD will reassess that program. As proposed, waterfowl hunting would be consistent with State regulations except as specifically noted herein. Geese, ducks, coots, and common snipe will be permitted to be taken. Specific species/numbers to be taken and hunting periods will be set by ODFW to match adjacent areas open to waterfowl hunting. The shoreline of the islands as well as the interior sloughs and adjacent banks will be opened for hunting. Areas interior to the river shoreline and slough banks will be closed as the dense forested interiors provide no real waterfowl hunting opportunities.

Hunters may use dogs to aide in retrieval of birds, but dogs will need to be kept under control at all times. Hunters may set up temporary blinds along the shoreline, which must be removed at the conclusion of each hunting period. Since this hunt will occur on islands in the Columbia River, access is only available by boat.

Maintaining hunting opportunities on the Lewis and Clark Refuge will complement State permitted activities and resolve potential problems over the exact position of the refuge boundary that would exist with a waterfowl hunt closure, and associated enforcement of relevant laws and regulations. Hunting is currently permitted on Oregon's state-owned waters and tidelands surrounding refuge islands. These adjacent waters are all tidally influenced submerged lands below mean high water (MHW).

The refuge islands are located in Clatsop County, Oregon. Refuge ownership of the islands is confined to land above MHW with the State of Oregon owning and regulating use of the surrounding tidal and submerged land.

Recreational hunting (a wildlife-dependent activity) has been identified in the National Wildlife Refuge System Improvement Act of 1997 as a priority public use, provided it is compatible with the purpose for which the refuge was established.

Availability of Resources: The proposed continuation of waterfowl hunting on refuge islands would not require any new infrastructure or personnel. Administration of the hunt and annual coordination with the State of Oregon would be required as would some law enforcement patrols; however, refuge staff is in place and capable of conducting these additional duties. Revision and printing of the refuge brochure, updating the refuge web site and other outreach information would be required at an estimated cost of $9,000. Base funding is available to cover these costs.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Administration and management:	$0000.00	$2,000.00
Maintenance:	$0000.00	$2,000.00
Monitoring:	$0000.00	$3,000.00
Special equipment, facilities, or improvements:	$0000.00	$2,000.00
Offsetting revenues:	$0000.00	$0000.00

Anticipated Impacts of the Use: The primary refuge purpose is to "to preserve an important wintering and feeding area for migratory waterfowl in the Pacific Flyway" as "a Wintering area for migratory waterfowl" and "to help maintain existing habitat for the threatened bald eagle, as well as support it's eventual recovery." The proposed use would not result in any degradation of the islands in terms of its suitability for those purposes. Due to the limited number of hunters, limited field time, and the activity being confined to essentially the shoreline, no effects to vegetation are anticipated.

While the presence of hunters and dogs would cause some disturbance to wildlife on the islands, this level of disturbance is expected to be minor and inconsequential. Hunters would have no reason to penetrate the island's interior because of the thick brush, which is not suitable habitat for waterfowl hunting or walking. Hunters' dogs would be expected to stay at the blind or boat, as they are trained to do, except when retrieving birds.

The number of hunters expected to use the shoreline of each island would be small, probably two to four parties at most per day. Waterfowl hunting already occurs on state-owned waters and tidelands surrounding the islands. Opening the island to hunting is not expected to increase the amount of hunting or boat traffic that occurs in close proximity to the islands. A closure of the shoreline would be unenforceable because the refuge boundary is described as the mean high water line, which cannot be precisely determined in many areas.

Species that may be affected by the proposed alternative include bald eagles, great blue herons and other birds that reside along island shorelines and in riparian vegetation in the Columbia River. No effects are expected for Columbia River or refuge fish populations. Nearby resting and feeding areas will be available for use by waterfowl, eagles, and other refuge species that are disturbed. These species would likely move to other areas of the refuge, which are less accessible to the hunters. The Service is required by the Endangered Species Act of 1973 to complete a Section 7 evaluation of the proposed activity to ensure that the action does not unacceptably affect any listed species. The completed Section 7 evaluation determined that the proposed action would not be likely to adversely affect any endangered mammals or birds in the area and would have no effect on bull trout.

Effects on other public uses are expected to be minimal as the refuge islands are accessible only by boat and due to the time of year waterfowl hunting occurs, other recreational uses such as kayaking or boating in the Columbia River have ceased or are at minimal levels.

Although hunting directly impacts individuals, the amount of waterfowl harvest is not expected to change or to have a measurable effect on refuge, lower Columbia River, or Pacific Flyway populations, as waterfowl hunting is already occurring on the shorelines surrounding all three islands below MHW and waterfowl hunting activity is not extremely high. Hunting may be either compensatory or additive to natural mortality (Anderson 1995). Compensatory mortality occurs when hunting substitutes for other forms of mortality (disease, competition, predation, severe weather, etc.). Additive mortality occurs when hunting compounds the total mortality. In some cases, hunting can be used as a management tool to control populations. In concert with Canada, Mexico, and multi-state Flyway councils, the Service and State wildlife agencies regulate hunting so that harvest does not reduce populations to unsustainable levels.

Direct effects of hunting on waterfowl are mortality, wounding, and disturbance (DeLong 2002). Hunting can alter behavior (e.g., foraging time), population structure, and distribution patterns of wildlife (Bartelt 1987; Cole and Knight 1990; Madsen 1985; Owens 1977; Raveling 1979; Thomas 1983; White-Robinson 1982). In Denmark, hunting was documented to affect the diversity and number of birds using a site (Madsen 1995). Avian diversity changed from predominantly mute swan and mallard to a more even distribution of a greater number of species when a sanctuary was established. Hence, species diversity increased with the elimination of hunting. There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento Refuges non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began.

Human disturbance to wintering birds and other wildlife using the open waters of the Columbia River surrounding the islands would occur as a result of hunting activity. Migratory and wintering waterfowl generally attempt to minimize time spent in flight and maximize foraging time because flight requires considerably more energy than any other activity, other than egg laying. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995; Wolder 1993). Disturbance levels from hunting activity outside Chincoteague Refuge were found to be high enough to force wintering black ducks into a pattern of nocturnal feeding within surrounding salt marsh and diurnal resting within refuge impoundments (Morton et al. 1989a, 1989b). Unhunted populations have been documented to behave differently from hunted ones (Wood 1993).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur, and birds can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et. al 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave areas and migrate elsewhere (Madsen 1995; Paulus 1984). In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a five-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased four- to 20-fold within the sanctuary (Madsen 1995). On Julia Butler Hansen Refuge, both the Tenasillahe Island and Mainland units are closed to all public entry and with numerous wetlands and sloughs available, acts as a sanctuary during the waterfowl season. In addition, two established sanctuaries exist on adjacent Lewis and Clark Refuge and vast portions of the Columbia River act as de facto sanctuaries due to the amount of open water not subject to waterfowl hunting pressure.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for refuges to manage hunt programs with non-hunt days. At Sacramento Refuge, 3 percent to 16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeon, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). However, intermittent hunting may not always greatly reduce hunting impacts. The intermittent hunting program of three hunt days per week at Sacramento Refuge results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). In Germany, several studies reported a range from a few days to approximately three weeks for waterbird numbers to recover to pre-disturbance levels (Fox and Madsen 1997).

Public Review and Comment: Open house style public meetings were held, verbal and written comments were solicited from the public during public scoping for the Draft CCP/EIS. Appendix I of the Draft CCP/EIS further details public involvement undertaken during development of the CCP. Additional public review and comment were solicited during the Draft CCP/EIS comment period.

Determination:

____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Waterfowl hunters would be expected to comply with all current and applicable State and refuge regulations. This will be achieved through a combination of printed information, signing, outreach efforts, and enforcement of regulations by State and refuge law enforcement officers.
- The shorelines of and interior sloughs of the refuge islands under refuge jurisdiction will be opened to public waterfowl hunting.
- The exceptions to the open hunting zones are the diked portion of Karlson Island and the interior embayment of Miller Sands Island, which are closed to hunting because 60 percent of the land purchased with duck stamp money is required to be closed to hunting. In addition, all other refuge lands outside the designated portions of the refuge islands are also closed to waterfowl hunting. These include Tongue Point, Emerald Heights, and Brownsmead.
- Geese, ducks, coots, and common snipe will be allowed to be taken. Limits and hunting periods will be set by ODFW to match adjacent areas open to waterfowl hunting.

- Refuge staff and ODFW staff will consult on issues regarding law enforcement and any significant changes in the number or behavior of wildlife. Refuge regulations will be in accord with state regulations. Refuge and ODFW officers will patrol to ensure hunters are complying with all regulations and restrictions.
- Temporary blinds may be constructed, but they must be available to everyone on a first-come, first-served basis.
- Hunters may use dogs to aide in retrieval of birds but dogs will need to be kept under control at all times.
- Only nontoxic shot will be allowed for the hunt.
- Camping, overnight use and fires are prohibited.

Justification: Hunting is one of the six designated wildlife-dependent public uses of the Refuge System. Refuges grant these six uses special consideration in planning and management. When on a refuge-specific basis one or more of these uses is determined compatible with the refuge purpose(s) and the Refuge System mission, the refuge is to strongly encourage (facilitate) the use(s). Providing a quality hunting program contributes to achieving refuge goals and purposes.

Maintaining a waterfowl hunting program on the refuge owned islands compliments activities permitted by Oregon on adjacent State-owned waters and tidelands and provides a distinct, manageable unit that can be more easily delineated, posted, and enforced, resulting in less confusion for the waterfowl hunting public. In addition, due to the time of year and the limited access except by boat, no conflicts among refuge user groups is anticipated.

It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the refuge will not be measurably lessened from allowing this use to occur. The relatively limited number of individuals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of affected species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted.

The program as described was determined to be compatible, as potential impacts from waterfowl hunting on area waterfowl and other wildlife would be minimal and not materially interfere with or detract from achievement of the Refuge System mission or from the Service's ability to achieve refuge wildlife, habitat, or other public-use-related purposes and goals.

<u>Mandatory Re-Evaluation Date</u> (provide month and year for "allowed" uses only):

<u> 2025 </u> Mandatory 15-year Re-Evaluation Date will be provided in the Final EIS/CCP (for priority public uses)

______ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

<u>NEPA Compliance for Refuge Use Decision (check one below):</u>

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

__X__ Environmental Impact Statement and Record of Decision

Literature Cited

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Signatures approving and concurring with B.6 Compatibility Determination for Waterfowl Hunting on Lewis and Clark Refuge (Use is compatible with stipulations.)

Refuge Determination:

Prepared by: ________________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ________________________________ ____________
(Signature) (Date)

Concurrence:

Refuge Supervisor: ____________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.7 Compatibility Determination for Sport Fishing at Lewis and Clark Refuge

Use: Sport Fishing

Refuge Name: Lewis and Clark National Wildlife Refuge.

Description of Use: Sport fishing is currently allowed from the shorelines and in the waters immediately adjacent to the refuge islands. This CD will reassess this program to determine if it is currently compatible with refuge purposes. This use would allow fishing on refuge-owned lands and waters consistent with State regulations. Specific species/numbers to be taken and open periods will be set by ODFW and WDFW to match adjacent areas open to fishing.

Establishment of fishing opportunities from the shorelines of the various refuge islands in the lower Columbia River Estuary will complement State permitted activities. Allowing fishing may also resolve potential problems over the exact position of the refuge boundary that would exist with a fishery closure, and associated enforcement of relevant laws and regulations. Fishing is currently permitted on Oregon and Washington state-owned waters and tidelands surrounding all of the refuge units. These adjacent waters are all tidally influenced submerged lands below mean high water (MHW).

Recreational fishing (a wildlife-dependent activity) has been identified in the Improvement Act as a priority public use, provided it is compatible with the purpose for which the refuge was established.

Availability of Resources: The proposed sport fishery program would not require any new infrastructure or personnel. Administration of the hunt and annual coordination with the States of Oregon and Washington would be required as would some law enforcement patrols; however refuge staff is in place and capable of conducting these additional duties. Revision and printing of the refuge brochure, updating the refuge web site and other outreach information would be required at an estimated cost of $3,000. Base funding is available to cover these costs.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Administration and management:	$0000.00	$1,000.00
Maintenance:	$0000.00	$0000.00
Monitoring:	$0000.00	$1,000.00
Special equipment, facilities, or improvements:	$0000.00	$1,000.00
Offsetting revenues:	$0000.00	$0000.00

Anticipated Impacts of Use: Fishing as a solitary and stationary activity tends to be less disturbing to wildlife than hunting or motorized boating (Tuite et al. 1983). It is well recognized that fishing can give many people a deeper appreciation of fish and wildlife and a better understanding of the importance of conserving habitat, which has ultimately contributed to the Refuge System mission despite the potential impacts of fishing. A major goal of the Lewis and Clark Refuge is to provide opportunities for wildlife-dependent recreation. Fishing is one of the six priority public uses of the Refuge System. Of key concern, then, is to manage the activity to keep adverse impacts to within acceptable limits. Angler activities on the refuge are and will remain consistent with State guidelines. Related impacts for fish stocks associated with sport fishing in the lower Columbia River are estimated annually and taken into consideration by the State in its development of annual fishing agreements and associated regulations. Therefore, impacts to fish populations should be minimized.

Additional disturbance would be caused to birds and other wildlife using the open waters and where fishing would occur. Fishing activities may influence the composition of bird communities, as well as abundance, and productivity of waterbirds (Bell and Austin 1985; Bouffard 1982; Cooke 1987; Edwards and Bell 1985; Tydeman 1977). Anglers often fish in shallow, sheltered bays and creeks that birds prefer, negatively impacting distribution and abundance of waterfowl, grebes, and coots (Cooke 1987). Increases in anglers and associated shoreline activity discouraged waterfowl using otherwise suitable habitat (Jahn and Hunt 1964). Anglers influenced the numbers, behavior, and diurnal distribution of avian scavengers present at sites in Washington, when compared to non-fishing days (Knight et al. 1991). Shoreline activities, such as human noise, would cause some birds to flush and go elsewhere. In addition, trampling of vegetation and deposition of sewage or other chemicals are expected to commonly occur (Liddle and Scorgie 1980). Disturbance and destruction of riparian vegetation, bank stability, and water quality may result from high levels of bank fishing activities.

Boating associated with fishing can alter bird distribution, reduce use of particular habitats or entire areas by waterfowl and other waterbirds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). Impacts of motorized boating can occur even at low densities, given their noise, speed, and ability to cover extensive areas in a short amount of time.

Because fishing success is generally much better using a boat that on the shoreline, it is anticipated that this program will be very small, likely generating less than 100 visits per year. However, because fishing is one of the priority public uses of the refuge system refuge visitors will be given the opportunity to fish from refuge lands and waters.

Despite the potential impacts that fishing and supporting activities (boating) can have on local wildlife, it is anticipated impacts from allowing fishing will be minor. The reason impacts are expected to be minor is that the majority of waterfowl use on the refuge occurs in the winter and spring months, with some birds as early as September and October. Since the majority of the fishing activity occurs in the summer and fall (through mid-October), disturbance to waterfowl species is reduced. In addition, there is more than an adequate amount of undisturbed estuary, open water, and riverine habitat available to the majority of waterfowl, waterbirds, and other wildlife for escape and cover. Lastly, impacts are expected to be minor because there is a large area available for fishing and very small numbers of bank fisherman are expected to use the area.

Public Review and Comment: Open house style public meetings were held, verbal and written comments were solicited from the public during public scoping. Appendix I of the Draft CCP/EIS further details public involvement during development of the CCP. Additional public review and comment were solicited during the Draft CCP/EIS comment period.

Determination:

____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: Federal law enforcement patrols to ensure compliance with fishing regulations will be conducted. State Fish and Wildlife Officers also patrol the refuge. Harvest and season lengths are established by the States of Oregon and Washington. Bank fishing is only allowed during daylight hours.

Justification: Recreational fishing is one of the six priority public uses of the Refuge System. Providing a quality fishing program contributes to achieving one of the refuge's goals.

It is anticipated that wildlife, primarily waterbirds, will find sufficient food and resting places such that their abundance and refuge use will not be measurably reduced. Fishing pressure in this location will not cause fish stocks to decline. The physiological condition and production of waterfowl and other waterbirds will not be impaired, their behavior and activity patterns will not be altered dramatically, and their overall welfare will not be impaired. Thus, allowing fishing to occur as described with stipulations will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

Mandatory Re-Evaluation Date (provide month and year for "allowed" uses only):

__2025__ Mandatory 15-year Re-Evaluation Date will be provided in the Final EIS/CCP (for priority public uses)

________ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

__X__ Environmental Impact Statement and Record of Decision

Literature Cited

Bell, D.V. and L.W. Austin. 1985. The game-fishing season and its effects on overwintering wildfowl. Biological Conservation 33:65-80.

Bouffard, S.H. 1982 Wildlife values versus human recreation: Ruby Lake National Wildlife Refuge. Pages 553-556 in: K. Sabol, ed. Transactions of the Forty-Seventh North American Wildlife and Natural Resources Conference. Washington, D.C.

Cooke, A.S. 1987. Disturbance by anglers of birds at GrafamWater. ITE Symposium 19:15-22.
Edwards, R.W. and D.V. Bell. 1985. Fishing in troubled waters. New Science 1446(7 March):19-21.

Jahn, L.R. and R.A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Wisconsin Conservation Department Technical Bulletin No.33. 212 pp.

Knight, R.L. and D. Cole. 1995. Wildlife responses to recreationists. Pages 51-69 in: R.L. Knight and D. Cole, eds. Wildlife and recreationists: coexistence through management and research. Washington, D.C.: Island Press.

Knight, R.L., D.P. Anderson, and N.V. Marr. 1991. Responses of an avian scavenging guild to anglers. Biological Conservation 56:195-205.

Liddle, M.J. and H.R.A. Scorgie. 1980. The effects of recreation on freshwater plants and animals: a review. Biological Conservation 17:183-206.

Tuite, C.H., M. Owen, and D. Paynther. 1983. Interaction between wildfowl and recreation at Llangorse Lake and Talybont Reservoir, South Wales. Wildfowl 34:48-63.

Tydeman, C.F. 1977. The importance of the close fishing season to breeding bird communities. Journal of Environmental Management 5:289-296**.**

Signatures approving and concurring with B.7 Compatibility Determination for Sport Fishing at Lewis and Clark Refuge (Use is compatible with stipulations.)

Refuge Determination:

Prepared by: ____ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ____ ____________
(Signature) (Date)

Concurrence:

Refuge Supervisor: ___________________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________________ ____________
(Signature) (Date)

B.8 Compatibility Determination for Environmental Education, Wildlife Observation, and Photography at Lewis and Clark Refuge

Use: Environmental Education, Wildlife Observation, and Photography

Refuge Name: Lewis and Clark National Wildlife Refuge

Description of Use(s): This compatibility determination examines existing and proposed non-consumptive wildlife-dependent recreational uses on the Lewis and Clark National Wildlife Refuge.

Environmental Education: Environmental education comprises those activities which seek to increase the public's knowledge and understanding of wildlife and contribute to the conservation of such wildlife. Activities would include staff and non-staff conducted environmental education, teaching students, teacher workshops, interpretation, and interpretive sites. Environmental education activities could occur on the on refuge islands but because of access problems will generally be focused on the refuge's Mainland Unit.

Wildlife Observation: Wildlife observation is probably the most popular activity on the refuge. In the lower estuary, refuge visitors to both refuges travel by either motorized or non-motorized boat for wildlife viewing and other wildlife oriented activities. Access to refuge islands is limited due to mode of transportation. Dense vegetation on many of the islands limits observation to the shorelines and accessible slough banks.

Wildlife Photography: Wildlife photography is a popular activity but is somewhat limited in scope because visitors must use boats to access the refuge islands. As with wildlife observation, access to refuge islands is limited due to lack of visitor facilities. In addition, in most cases, dense vegetation limits photography to the shorelines and accessible slough banks on the islands

Availability of Resources: Additional funding for operational costs would be needed to fully implement the environmental education, wildlife observation, and photography programs identified in the CCP. These needs are expected to be added from the CCP/EIS and are tied to funding requests in the form of Refuge Operating Needs System (RONS) and Maintenance Management System (MMS) projects for these activities. Other funding sources would be sought through strengthened partnerships, grants, and donations to administer and manage safe and quality environmental education, wildlife observation, and photography programs as described above.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Administration and management:	$2,000.00	$6,000.00
Maintenance:	$0000.00	$5,000.00
Monitoring:	$0000.00	$3,000.00
Special equipment, facilities, or improvements:	$2,500.00	$3,000.00
Offsetting revenues:	$0000.00	$0000.00

Anticipated Impacts of the Use(s): Activities that occur outside of vehicles (e.g., wildlife observation, trail hiking, and environmental education tours) tend to increase disturbance potential for most wildlife species (Klein 1993). Human activities along trails disturb wildlife, often resulting in flushing from roosting, feeding, nesting, or resting areas. Flushing may result in expenditure of energy reserves, abandonment from preferred habitat, and increased exposure to predation during relocation. In riparian habitats, the abundance of bird species requiring shrub cover (e.g., MacGillivray's warbler and lazuli bunting) may be reduced at recreation sites, while species that forage in tree canopies may be unaffected. Trails in riparian areas may encourage the penetration of new animal species, including nest predators, into formerly protected forests (Knutsen and Naef 1997). Wildlife photographers tend to have the largest disturbance impacts because they may remain close to wildlife for prolonged periods (Klein 1993). Casual photographers with low-power lenses may approach wildlife closer than other users.

Most wildlife viewing and photography on the Lewis and Clark Refuge would occur on the Columbia River with visitor activities occurring from recreational boaters including motorboats, kayaks and canoes. Waterfowl species are considered wildlife of primary concern, including Canada geese and ducks, wading and shorebirds raptors and neotropical migrants. Because of the lack of public facilities and access difficulties, the Mainland Unit of the Julia Butler Hansen Refuge will serve as the focal point for environmental education activities for both refuges.

Impacts from the general public on the islands of the lower Columbia River are for the most part self limiting. This is because the islands are accessible only by boat, which reduces the number of potential visitors. Along with the dense, almost impenetrable vegetation on many of the rivers islands and daily tidal changes this makes visitation of the islands a challenge. Most visitor impacts on the lower river come from visitation of the adjacent shorelines and interior sloughs, which may cause birds which use riparian habitat to flush. Still, observable numbers of visitors remains low at this point leading to the conclusion that for now impacts to refuge wildlife are intermittent and very limited in scope. Thus at the current level of public use no additional stipulations are needed to protect refuge habitat and wildlife.

Impacts to wildlife resulting from disturbance from these uses are expected to be minor because there are more than adequate amounts of undisturbed habitats available for escape and cover.

Public Review and Comment: Open house style public meetings were held, verbal and written comments were solicited from the public during public scoping for the Draft CCP/EIS. Appendix I of the Draft CCP/EIS further details public involvement undertaken during development of the CCP. Additional public review and comment were solicited during the Draft CCP/EIS comment period.

Determination:

____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The Mainland Unit will serve as the focal point for environmental educational activities for both the Lewis and Clark and Julia Butler Hansen Refuges. The wildlife viewing site adjacent to Highway 4 and the refuge headquarters site will serve as the key areas for the general public to learn about and visit the refuge. All public use areas managed by the refuge will remain open dawn to dusk. Wildlife observation and photographic activities will continue to be available on the refuge islands in the lower estuary of both refuges. To ensure disturbance to lower estuary wildlife remains minimal, monitoring protocols would be developed to examine the impacts associated with differing levels and types of public use. Monitoring data would be critically analyzed and used by the Refuge Manager to develop future modifications, if necessary, to ensure compatibility of wildlife observation and photography in all refuge locations.

Justification: The National Wildlife Refuge System Improvement Act of 1997 identified wildlife observation, photography, interpretation, and environmental education as four of the six, priority, wildlife-dependent recreational uses to be facilitated in the Refuge System, and the Act encouraged the Service to provide opportunities for these uses.

Currently, there are very few places in the surrounding area to view and interpret the region’s once-common, now-rare habitat type (the Sitka-spruce swamp) and the lower Columbia River estuary. Opportunities to view the lower river sloughs and islands using kayaks, canoes, and motorboats provide a unique perspective for the refuge visitor to view and appreciate the areas unique wildlife and habitat.

Many members of the public are not familiar with refuges and confuse them with other federal land management systems such as National Parks or with State Parks. Providing information through programs written materials and interpretive panels helps to build an understanding and appreciation of refuge’s unique purposes and activities. Providing information regarding the mission of the Service and the purposes of the refuge, along with specific resource information, may alleviate potential negative impacts on wildlife by educating our visitors.

Although all of these activities can result in disturbance to wildlife, disturbance will be intermittent and short term. There are more than adequate amounts of undisturbed habitat available to wildlife for escape and cover. It is anticipated that wildlife populations will find sufficient food resources and resting places such that their abundance and use of the refuge will not be measurably lessened from allowing the above activities to occur. The relatively limited number of individuals expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of local wildlife species will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing these uses to occur with stipulations will not materially detract or interfere with the purposes for which the refuge was established or the refuge mission.

<u>Mandatory Re-Evaluation Date</u> (provide month and year for “allowed” uses only):

__2025__ Mandatory 15-year Re-Evaluation Date will be provided in the Final EIS/CCP (for priority public uses)

________ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

__X__ Environmental Impact Statement and Record of Decision

Literature Cited

Klein, M.L. 1993. Waterbird behavior responses to human disturbances. Wildlife Society Bulletin 21:31-39.

Knutsen, K.L. and V.L. Naef. 1997. Management recommendations for Washington's priority habitats: riparian. Washington Department of Fish and Wildlife. Olympia, WA. 181 pp.

Signatures approving and concurring with B.8 Compatibility Determination for Environmental Education, Wildlife Observation, and Photography at Lewis and Clark Refuge (Use is compatible with stipulations.)

<u>Refuge Determination:</u>

Prepared by: ______________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ____________
(Signature) (Date)

<u>Concurrence:</u>

Refuge Supervisor: ______________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

Appendix C. Statement of Compliance

The following executive orders and legislative acts have been reviewed as they apply to the implementation of the Comprehensive Conservation Plan (CCP) for Lewis and Clark National Wildlife Refuge and the Julia Butler Hansen Refuge for the Columbian White-tailed Deer, located in Oregon and Washington states.

National Environmental Policy Act (1969) (42 U.S.C. 4321 et seq.). The planning process has been conducted in accordance with National Environmental Policy Act Implementing Procedures, Department of the Interior and Service procedures, and has been performed in coordination with the affected public. The requirements of the National Environmental Policy Act (NEPA)(42 U.S.C. 4321 et seq.) and its implementing regulations in 40 CFR Parts 1500-1508 have been satisfied in the procedures used to reach this decision. These procedures included: the development of a range of alternatives for the CCP; analysis of the likely effects of each alternative; and public involvement throughout the planning process. An environmental impact statement (EIS) was prepared for the project that integrated the Draft CCP management objectives and alternatives into the EIS and NEPA process. The Draft CCP and EIS were released for a 60-day public comment period. The affected public shall be notified of the availability of these documents through a Federal Register notice, news releases to local newspapers, the Service’s refuge planning website, and a planning update. Copies of the Draft CCP/EIS and/or planning updates were distributed to an extensive mailing list. The CCP was revised based on public comment received on the draft documents.

National Historic Preservation Act (1966) (16 U.S.C.470 et seq.). The management of archaeological and cultural resources of the refuge will comply with the regulations of Section 106 of the National Historic Preservation Act. No historic properties are known to be affected by the proposed action based on the criteria of an effect or adverse effect as an undertaking defined in 36 CFR 800.9 and Service Manual 614 FW2; however, determining whether a particular action has the potential to affect cultural resources is an ongoing process that occurs as step-down and site-specific project plans are developed. Should historic properties be identified or acquired in the future, the Service will comply with the National Historic Preservation Act if any management actions have the potential to affect any these properties.

Endangered Species Act (16 U.S.C. 1531-1544). This Act provides for the conservation of threatened and endangered species of fish, wildlife, and plants by Federal action and by encouraging the establishment of state programs. Section 7 of the Act requires consultation before initiating projects which affect or may affect endangered species; consultation on specific projects will be conducted prior to implementation.

National Wildlife Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-668ee). The National Wildlife Refuge System Improvement Act (Public Law 105-57, Improvement Act) requires the Service to develop and implement a CCP for each refuge. The CCP identifies and describes refuge purposes; refuge vision and goals; fish, wildlife, and plant populations and related habitats; archaeological and cultural values of the refuge; issues that may affect populations and habitats of fish, wildlife, and plants; actions necessary to restore and improve biological diversity on the refuge; and opportunities for wildlife-dependent recreation, as required by the Act.

During the CCP process the Refuge Manager evaluated all existing and proposed refuge uses at both Julia Butler Hansen and Lewis and Clark refuges. Priority wildlife-dependent uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation) are considered automatically appropriate under Service policy and thus exempt from appropriate uses review.

The following other uses were found to be Appropriate on the refuges: haying, silage harvest, and cattle grazing. Uses that were found Not Appropriate are also addressed and include camping and dog training (Appendix A).

Compatibility determinations have been prepared for the following uses: environmental education, interpretation, wildlife observation, and photography; waterfowl hunting; elk hunting; sport fishing; trapping nutria; and haying, silage harvest, and cattle grazing. All of these were found to be compatible with refuge purposes and the System mission with stipulations specified in each of the compatibility determinations.

Wilderness Preservation Act of 1964. The Service has evaluated the suitability of the refuges for wilderness designation. We conducted a wilderness review for each refuge (Appendices E and F) and identified islands on both refuges that are suitable for consideration as wilderness.

Executive Order 11988 Floodplain Management. Under this order 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." Dams effectively preclude natural flooding in the Columbia River system. The CCP is consistent with Executive Order 11988, however, because CCP implementation would assist in restoring natural ecological values in the historic Columbia River floodplain.

Executive Order 11990 Protection of Wetlands. The CCP is consistent with Executive Order 11990 because CCP implementation would potentially enhance and restore wetland resources on the refuge.

Executive Order 12372 Intergovernmental Review. Coordination and consultation with affected Tribal, local and State governments, other Federal agencies, and local interested persons has been completed through personal contact by the Project Leader, Refuge Manager and refuge staff members.

Executive Order 12898 Federal Actions to Address Environmental Justice in Minority and Low Income Populations. All Federal actions must address and identify, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Indian Tribes in the United States. The CCP was evaluated and no adverse human health or environmental effects were identified for minority or low-income populations, Indian Tribes, or anyone else.

Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds. This order directs departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act. A provision of the order directs Federal agencies to consider the impacts of their activities, especially in reference to birds on the Fish and Wildlife Service's list of Birds of Conservation (Management) Concern. It also directs agencies to incorporate conservation recommendations and objectives in the North American Waterbird Conservation Plan and bird conservation plans developed by Partners in Flight into agency planning. The effects of all alternatives to refuge habitats used by migratory birds were assessed within the CCP and EIS.

____________________________________ _________________________

Chief, Division of Planning, Date
Visitor Services, and Transportation

Appendix D. Integrated Pest Management Program

D.1 Background

Integrated pest management (IPM) is an interdisciplinary approach utilizing methods to prevent, eliminate, contain, and/or control pest species in concert with other management activities on refuge lands and waters to achieve wildlife and habitat management goals and objectives. It is also a scientifically based, adaptive management process where available scientific information and best professional judgment of the refuge staff as well as other resource experts would be used to identify appropriate management strategies that can be modified and/or changed over time for effective, site-specific management of pest species. After a pest population threshold is determined, considering the achievement of resource objectives and ecology of pest species, one or more methods or combinations thereof would be selected that are feasible, efficacious, and protective of nontarget resources, including native species (fish, wildlife, and plants) and Service personnel, Service authorized agents, volunteers, and the public. Staff time and available funding would be considered when determining feasibility/practicality of various treatments.

The IPM techniques to address pests are presented as CCP strategies (see Chapter 2 of this CCP/EIS) in an adaptive management context to achieve refuge resource objectives. In order to satisfy requirements for IPM planning as identified in the Director's Memo (dated September 9 2004) entitled "Integrated Pest Management Plans and Pesticide Use Proposals: Updates, Guidance, and an Online Database," the following elements of an IPM program have been incorporated into this CCP/EIS:

- Habitat and/or wildlife objectives that identify pest species and appropriate thresholds to indicate the need for and successful implementation of IPM techniques; and
- Monitoring before and/or after treatment to assess progress toward achieving objectives including pest thresholds.

Where pesticides would be necessary to address pests, this appendix provides a structured procedure to evaluate potential effects of proposed uses involving ground-based applications to refuge biological resources and environmental quality in accordance with effects analyses presented in Chapter 6 (Environmental Effects) of this CCP/EIS. Only pesticide uses that likely would cause minor, temporary, or localized effects to refuge biological resources and environmental quality with appropriate best management practices (BMPs), where necessary, would be allowed for use on the refuge.

This appendix does not describe the more detailed process to evaluate potential effects associated with aerial applications of pesticides. Moreover, it does not address effects of mosquito control with pesticides (larvicides, pupacides, or adulticides) based upon identified human health threats and presence of disease-carrying mosquitoes in sufficient numbers from monitoring conducted on a refuge. However, the basic framework to assess potential effects to refuge biological resources and environmental quality from aerial application of pesticides or use of insecticides for mosquito management would be similar to the process described in this appendix for ground-based treatments of other pesticides.

D.2 Pest Management Policies

In accordance with Service policy 7 RM 14 (Pest Control), wildlife and plant pests on units of the National Wildlife Refuge System can be controlled to ensure balanced wildlife and fish populations in support of refuge specific wildlife and habitat management objectives. Pest control on Federal (refuge) lands and waters also is authorized under the following legal mandates:

- National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-668ee);
- Plant Protection Act of 2000 (7 U.S.C. 7701 *et seq*.);
- Noxious Weed Control and Eradication Act of 2004 (7 U.S.C. 7781-7786, Subtitle E);
- Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (7 U.S.C. 136-136y);
- National Invasive Species Act of 1996 (16 U.S.C. 4701);
- Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 U.S.C. 4701);
- Food Quality Protection Act of 1996 (7 U.S.C. 136);
- Executive Order 13148, Section 601(a);
- Executive Order 13112; and
- Animal Damage Control Act of 1931 (7 U.S.C. 426-426c, 46 Stat. 1468).

In Department policy 517 DM 1 (Integrated Pest Management Policy), pests are defined as "…living organisms that may interfere with the site-specific purposes, operations, or management objectives or that jeopardize human health or safety.". Similarly, this policy defines an invasive species as "a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health." Throughout the remainder of this CCP/EIS, the terms pest and invasive species are used interchangeably because they both can prevent/impede achievement of refuge wildlife and habitat objectives and/or degrade environmental quality.

In general, control of pests (vertebrate or invertebrate) on the refuge would conserve and protect the nation's fish, wildlife, and plant resources as well as maintain environmental quality. From 7 RM 14, animal or plant species that are considered pests may be managed if the following criteria are met:

- Threat to human health and well being or private property, the acceptable level of damage by the pest has been exceeded, or State or local government has designated the pest as noxious;
- Detrimental to resource objectives as specified in a refuge resource management plan (e.g., comprehensive conservation plan, habitat management plan), if available; and
- Control would not conflict with attainment of resource objectives or the purposes for which the refuge was established.

From 7 RM 14, the specific justifications for pest management activities on the refuge are the following:

- Protect human health and well being;
- Prevent substantial damage to important to refuge resources;
- Protect newly introduced or reestablish native species;

- Control non-native (exotic) species in order to support existence for populations of native species;
- Prevent damage to private property; and
- Provide the public with quality, compatible wildlife-dependent recreational opportunities.

Based upon 50 CFR 31.14 (Official Animal Control Operations), animal species that are surplus or detrimental to the management program of a refuge area may be taken in accordance with Federal and state laws and regulations by Federal or state personnel or by permit issued to private individuals. In addition, animal species that are damaging or destroying Federal property within a refuge area may be taken or destroyed by Federal personnel. Within 7 RM 15.3, the following are more specific justifications for management of furbearing animals using trapping on a refuge:

- "To maintain furbearer populations at levels compatible with refuge and surrounding habitat and with refuge objectives which may involve habitat manipulations.
- To contribute to the attainment of national migratory bird, mammal, nonmigratory bird, and endangered species objectives or goals.
- To minimize furbearer damage to physical facilities (e.g., dikes and water control structures).
- To minimize competition with or interaction among wildlife populations and species which conflict with refuge objectives.
- To minimize the occurrence of high population densities which have the potential to transmit contagious diseases [to] humans, among furbearer populations, or other wildlife species, or domestic animals.
- To provide authorized individuals with quality wildlife-oriented recreational experiences, education opportunities, and opportunities to utilize a renewable natural resource."

In accordance with Service policy 620 FW 1 (Habitat Management Plans), there are additional management directives regarding invasive species found on the refuge:

- "We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."
- "Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species..."

D.3 Strategies

To fully embrace IPM, the following strategies, where applicable, would be carefully considered on the refuge for each pest species:

D.3.1 Prevention

This would be the most effective and least expensive long-term management option for pests. It encompasses methods to prevent new introductions or the spread of the established pests to uninfested areas. It requires identifying potential routes of invasion to reduce the likelihood of infestation. Hazard Analysis and Critical Control Points (HACCP) planning can be used determine if current management activities on a refuge may introduce and/or spread invasive species in order to identify appropriate BMPs for prevention. See http://www.haccp-nrm.org/ for more information about HACCP planning.

Prevention may include source reduction, using pathogen-free or weed-free seeds or fill; exclusion methods (e.g., barriers) and/or sanitation methods (e.g., wash stations) to prevent reintroductions by various mechanisms including vehicles, personnel, livestock, and horses. Because invasive species are frequently the first to establish in newly disturbed sites, prevention would require a reporting mechanism for early detection of new pest occurrences with quick response to eliminate any new satellite pest populations. Prevention would require consideration of the scale and scope of land management activities that may promote pest establishment within uninfested areas or promote reproduction and spread of existing populations. Along with preventing initial introduction, prevention would involve halting the spread of existing infestations to new sites (Mullin et al. 2000). The primary reason for prevention would be to keep pest-free lands or waters from becoming infested. Executive Order 11312 emphasizes the priority for prevention with respect to managing pests.

The following would be methods to prevent the introduction and/or spread of pests on refuge lands:

- Before beginning ground-disturbing activities (e.g., disking, scraping), inventory and prioritize pest infestations in project operating areas and along access routes. Refuge staff would identify pest species on-site or within reasonably expected potential invasion vicinity. Where possible, the refuge staff would begin project activities in uninfested areas before working in pest infested areas.
- The refuge staff would locate and use pest-free project staging areas. They would avoid or minimize travel through pest infested areas, or restrict to those periods when spread of seed or propagules of invasive plants would be least likely.
- The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned of pests. The refuge staff would clean equipment before entering lands at on-refuge approved cleaning site(s). This practice does not pertain to vehicles traveling frequently in and out of the project area that will remain on roadways. Seeds and plant parts of pest plants would need to be collected, where practical. The refuge staff would remove mud, dirt, and plant parts from project equipment before moving it into a project area.
- The refuge staff would clean all equipment, before leaving the project site, if operating in areas infested with pests. The refuge staff would determine the need for, and when appropriate, identify sanitation sites where equipment can be cleaned.
- Refuge staffs, their authorized agents, and refuge volunteers would, where possible, inspect, remove, and properly dispose of seed and parts of invasive plants found on their clothing and equipment. Proper disposal means bagging the seeds and plant parts and then properly discarding of them (e.g., incinerating).
- The refuge staff would evaluate options, including closure, to restrict the traffic on sites with ongoing restoration of desired vegetation. The refuge staff would revegetate disturbed soil (except travel ways on surfaced projects) to optimize plant establishment

for each specific site. Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching as necessary. The refuge staff would use native material, where appropriate and feasible. The refuge staff would use certified weed-free or weed-seed-free hay or straw where certified materials are required and/or are reasonably available.
- The refuge staff would provide information, training and appropriate pest identification materials to refuge staffs, permit holders, and recreational visitors. The refuge staff would educate them about pest identification, biology, impacts, and effective prevention measures.
- The refuge staff would require grazing permittees to utilize preventative measures for their livestock while on refuge lands.
- The refuge staff would inspect borrow material for invasive plants prior to use and transport onto and/or within refuge lands.
- The refuge staff would consider invasive plants in planning for road maintenance activities.
- The refuge staff would restrict off-road travel to designated routes.

The following would be methods to prevent the introduction and/or spread of pests into refuge waters:
- The refuge staff would inspect boats (including air boats), trailers, and other boating equipment. Where possible, the refuge staff would remove any visible plants, animals, or mud before leaving any waters or boat launching facilities. The refuge staff would drain water from motor, live well, bilge, and transom wells while on land before leaving the site. The refuge staff would wash and dry boats, downriggers, anchors, nets, floors of boats, propellers, axles, trailers, and other boating equipment to kill pests not visible at the boat launch.
- Before transporting to new waters, the refuge staff would rinse boat and boating equipment with hot (40°C or 104°F) clean water, spray boat or trailer with high pressure water, or dry boat and equipment for at least five days, where possible.
- The refuge staff would maintain a l00-foot buffer of aquatic pest-free clearance around boat launches and docks or quarantine areas when cleaning around culverts, canals, or irrigation sites. The refuge staff would clean equipment before moving to new sites. Inspect and clean equipment before moving from one project area to another.

These prevention methods to minimize/eliminate the introduction and/or spread of pests were taken verbatim or slightly modified from Appendix E of U.S. Forest Service (2005).

D.3.2 Mechanical/Physical Methods

These methods would remove and destroy, disrupt the growth of, or interfere with the reproduction of pest species. For plant species, these treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical) and include pulling, grubbing, digging, tilling/disking, cutting, swathing, grinding, sheering, girdling, mowing, and mulching of the pest plants. Thermal techniques such as steaming, super-heated water, and hot foam may also be viable treatments.

For animal species, the refuge staff could use mechanical/physical methods that can include trapping. In some cases, non-lethally trapped animals would be relocated to off-refuge sites with prior approval from the state. Lethal trapping also can occur on a refuge as a wildlife management tool, but these activities would require a trapping plan and annual trapping proposals with prior approval and coordination with the state as specified in 7 RM 15. In accordance with 7 RM 15.8E, a refuge with a current furbearer management plan or programmatic management documents (e.g., CCP) with the required information (7 RM 15.8B) would fulfill refuge trapping plan requirements.

Each of these tools would be efficacious to some degree and applicable to specific situations. In general, mechanical controls can effectively control annual and biennial pest plants. However, to control perennial plants, the root system has to be destroyed or it would resprout and continue to grow and develop. Mechanical controls are typically not capable of destroying a perennial plant's root system. Although some mechanical tools (e.g., disking, plowing) may damage root systems, they may stimulate regrowth producing a denser plant population that may aid in the spread depending upon the target species (e.g., Canada thistle). In addition, steep terrain and soil conditions would be major factors that can limit the use of many mechanical control methods.

Some mechanical control methods (e.g., mowing), which would be used in combination with herbicides, can be a very effective technique to control perennial species. For example, mowing perennial plants followed sequentially by treating the plant regrowth with a systemic herbicide often would improve the efficacy of the herbicide compared to herbicide treatment only.

D.3.3 Cultural Methods

These methods would involve manipulating habitat to increase pest mortality by reducing its suitability to the pest. Cultural methods would include water-level manipulation, mulching, winter cover crops, changing planting dates to minimize pest impact, prescribed burning (facilitate revegetation, increase herbicide efficacy, and remove litter to assist in emergence of desirable species), flaming with propane torches, trap crops, crop rotations that would include nonsusceptible crops, moisture management, addition of beneficial insect habitat, reducing clutter, vacuuming, proper trash disposal, planting or seeding desirable species to shade or outcompete invasive plants, applying fertilizer to enhance desirable vegetation, prescriptive grazing, and other habitat alterations.

D.3.4 Biological Control Agents

Classical biological control would involve the deliberate introduction and management of natural enemies (parasites, predators, or pathogens) to reduce pest populations. Many of the most ecologically or economically damaging pest species in the United States originated in foreign countries. These newly introduced pests, which are free from natural enemies found in their country or region of origin, may have a competitive advantage over cultivated and native species. This competitive advantage often allows introduced species to flourish, and they may cause widespread economic damage to crops or out compete and displace native vegetation. Once the introduced pest species population reaches a certain level, traditional methods of pest management may be cost prohibitive or impractical. Biological controls typically are used when these pest populations have become so widespread that eradication or effective control would be difficult or no longer practical.

Biological control has advantages as well as disadvantages. Benefits would include reducing pesticide usage, host specificity for target pests, long-term self-perpetuating control, low cost per acre, capacity for searching and locating hosts, synchronizing biological control agents to hosts' life cycles, and the unlikelihood that hosts will develop resistance to agents. Disadvantages would include the following: limited availability of agents from their native lands, the dependence of control on target species density, slow rate at which control occurs, biotype matching, the difficulty and expense of conflicts over control of the target pest, and host specificity when host populations are low.

A reduction in target species populations from biological controls is typically a slow process, and efficacy can be highly variable. It may not work well in a particular area although it does work well in other areas. Biological control agents would require specific environmental conditions to survive over time. Some of these conditions are understood, whereas others are only partially understood or not at all.

Biological control agents would not eradicate a target pest. When using biological control agents, residual levels of the target pest typically are expected; the agent population level or survival would be dependent upon the density of its host. After the pest population decreases, the population of the biological control agent would decrease correspondingly. This is a natural cycle. Some pest populations (e.g., invasive plants) would tend to persist for several years after a biological control agent becomes established due to seed reserves in the soil, inefficiencies in the agents search behavior, and the natural lag in population buildup of the agent.

The full range of pest groups potentially found on refuge lands and waters would include diseases, invertebrates (insects, mollusks), vertebrates, and invasive plants (most common group). Often it is assumed that biological control would address many if not most of these pest problems. There are several well documented success stories of biological control of invasive weed species in the Pacific Northwest including Mediterranean sage, St. Johnswort (Klamath weed), and tansy ragwort. Emerging success stories include the control of Dalmatian toadflax, diffuse knapweed, leafy spurge, purple loosestrife, and yellow star thistle. However, historically, each new introduction of a biological control agent in the United States has only about a 30 percent success rate (Coombs et al. 2004). Refer to Coombs et. al (2004) for the status of biological control agents for invasive plants in the Pacific Northwest.

Introduced species without desirable close relatives in the United States would generally be selected as biological controls. Natural enemies that are restricted to one or a few closely related plants in their country of origin are targeted as biological controls (Center et al. 1997; Hasan and Ayres 1990).

The refuge staff would ensure introduced agents are approved by the applicable authorities. Except for a small number of formulated biological control products registered by the EPA under FIFRA, most biological control agents are regulated by the USDA Animal Plant Health Inspection Service, Plant Protection and Quarantine (APHIS-PPQ). State departments of agriculture and, in some cases, county agricultural commissioners or weed districts, have additional approval authority.

Federal permits (USDA-APHIS-PPQ Form 526) are required to import biocontrols agents from another state. Form 526 may be obtained by writing:

> USDA-APHIS-PPQ
> Biological Assessment and Taxonomic Support
> 4700 River Road, Unit 113
> Riverdale, MD 20737

Or through the internet at this address:

> http://www.aphis.usda.gov/ppq/permits/bioligical/weedbio.html

The Service strongly supports the development, and legal and responsible use of appropriate, safe, and effective biological control agents for nuisance and nonindigenous or pest species.

State and county agriculture departments may also be sources for biological control agents or they may have information about where biological control agents may be obtained. Commercial sources should have an Application and Permit to Move Live Plant Pests and Noxious Weeds (USDA-PPQ Form 226, USDA-APHIS-PPQ, Biological Assessment and Taxonomic Support, 4700 River Road, Unit 113, Riverdale, MD 20737) to release specific biological control agents in a state and/or county. Furthermore, certification regarding the biological control agent's identity (genus, specific epithet, subspecies and variety) and purity (e.g., parasite free, pathogen free, and biotic and abiotic contaminants) should be specified in purchase orders.

Biological control agents are subject to 7 RM 8 (Exotic Species Introduction and Management). In addition, the refuge staff would follow the International Code of Best Practice for Classical Biological Control of Weeds (http://sric.ucdavis.edu/exotic /exotic.htm) as ratified by delegates to the X International Symposium on Biological Control of Weeds, Bozeman, Montana, July 9, 1999. This code identifies the following:

- Release only approved biological control agents,
- Use the most effective agents,
- Document releases, and
- Monitor for impact to the target pest, nontarget species and the environment.

Biological control agents formulated as pesticide products and registered by the EPA (e.g., *Bti*) are also subject to PUP review and approval (see below).

A record of all releases would be maintained with date(s), location(s), and environmental conditions of the release site(s); the identity, quantity, and condition of the biological control agents released; and other relevant data and comments such as weather conditions. Systematic monitoring to determine the establishment and effectiveness of the release is also recommended.

NEPA documents regarding biological and other environmental effects of biological control agents prepared by another Federal agency, where the scope is relevant to evaluation of releases on refuge lands, would be reviewed. Possible source agencies for such NEPA documents include the Bureau of Land Management, U.S. Forest Service, National Park Service, USDA-APHIS-PPQ, and the military services. It might be appropriate to incorporate by reference parts or all of existing document(s) from the review. Incorporating by reference (40 CFR 1502.21) is a technique used to avoid redundancies in analysis. It also can reduce the bulk of a Service NEPA document, which only must identify the documents that are incorporated by reference. In addition, relevant portions must be summarized in the Service's NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

D.3.5 Pesticides

The selective use of pesticides would be based upon pest ecology (including mode of reproduction), the size and distribution of its populations, site-specific conditions (e.g., soils, topography), known efficacy under similar site conditions, and the capability to utilize BMPs to reduce/eliminate potential effects to nontarget species, sensitive habitats, and potential to contaminate surface and groundwater. All pesticide usage (pesticide, target species, application rate, and method of application) would comply with the applicable Federal (FIFRA) and state regulations pertaining to pesticide use, safety, storage, disposal, and reporting. Before pesticides can be used to eradicate, control, or contain pests on refuge lands and waters, pesticide use proposals (PUPs) would be prepared and approved in accordance with 7 RM 14. PUP records would provide a detailed, time-, site-, and target-specific description of the proposed use of pesticides on the refuge. All PUPs would be created, approved, or disapproved, and stored in the Pesticide Use Proposal System (PUPS), which is a centralized database only accessible on the Service's intranet (https://sds.fws.gov/pups). Only Service employees would be authorized to access PUP records for the refuge in this database.

Application equipment would be selected to provide site-specific delivery to target pests while minimizing/eliminating direct or indirect (e.g., drift) exposure to nontarget areas and degradation of surface and groundwater quality. Where possible, target-specific equipment (e.g., backpack sprayer, wiper) would be used to treat target pests. Other target-specific equipment to apply pesticides would include soaked wicks or paint brushes for wiping vegetation and lances, hatchets, or syringes for direct injection into stems. Granular pesticides may be applied using seeders or other specialized dispensers. In contrast, aerial spraying (e.g., fixed wing or helicopter) would only be used where access is difficult (remoteness) and/or the size/distribution of infestations precludes practical use of ground-based methods.

Because repeated use of one pesticide may allow resistant organisms to survive and reproduce, multiple pesticides with variable modes of action would be considered for treatments on refuge lands and waters. This is especially important if multiple applications within years and/or over a growing season likely would be necessary for habitat maintenance and restoration activities to achieve resource objectives. Integrated chemical and non-chemical controls also are highly effective, where practical, because pesticide resistant organisms can be removed from the site.

Cost may not be the primary factor in selecting a pesticide for use on the refuge. If the least expensive pesticide would potentially harm natural resources or people, then a different product would be selected, if available. The most efficacious pesticide available with the least potential to degrade environment quality (soils, surface water, and groundwater) as well as least potential effect to native species and communities of fish, wildlife, plants, and their habitats would be acceptable for use on the refuge in the context of an IPM approach.

D.3.6 Habitat Restoration/Maintenance

Restoration and/or proper maintenance of refuge habitats associated with achieving wildlife and habitat objectives would be essential for long-term prevention, eradication, or control (at or below threshold levels) of pests. Promoting desirable plant communities through the manipulation of species composition, plant density, and growth rate is an essential component of invasive plant management (Brooks et al. 2004; Masters and Sheley 2001; Masters et al. 1996). The following three components of succession could be manipulated through habitat maintenance and restoration: site availability, species availability, and species performance (Cox and Anderson 2004). Although a single method (e.g., herbicide treatment) may eliminate or suppress pest species in the short term, the resulting gaps and bare soil create niches that are conducive to further invasion by the species and/or other invasive plants. On degraded sites where desirable species are absent or in low abundance, revegetation with native/desirable grasses, forbs, and legumes may be necessary to direct and accelerate plant community recovery, and achieve site-specific objectives in a reasonable timeframe. The selection of appropriate species for revegetation would be dependent on a number of factors including resource objectives and site-specific, abiotic factors (e.g., soil texture, precipitation/temperature regimes, and shade conditions). Seed availability and cost, ease of establishment, seed production, and competitive ability also would be important considerations.

D.4 Priorities for Treatments

For many refuges, the magnitude (number, distribution, and sizes of infestations) for pest problems is too extensive and beyond the available capital resources to effectively address during any single field season. To manage pests in the refuge, it would be essential to prioritize treatment of infestations. Highest priority treatments would be focused on early detection and rapid response to eliminate infestations of new pests, if possible. This would be especially important for aggressive pests potentially impacting species, species groups, communities, and/or habitats associated refuge purpose(s), Refuge System resources of concern (federally listed species, migratory birds, selected marine mammals, and interjurisdictional fish), and native species for maintaining/restoring biological integrity, diversity, and environmental health. The next priority would be treating established pests that appear in one or more previously uninfested areas.

Moody and Mack (1988) demonstrated through modeling that small, new outbreaks of invasive plants eventually would infest an area larger than the established, source population. They also found that control efforts focusing on the large, main infestation rather than the new, small satellites reduced the chances of overall success. The lowest priority would be treating large infestations (sometimes monotypic stands) of well-established pests. In this case, initial efforts would focus upon containment of the perimeter followed by work to control/eradicate the established infested area. If containment and/or control of a large infestation is not effective, then efforts would focus upon halting pest reproduction as the lowest priority.

Although state-listed noxious weeds would always be of high priority for management, other pest species known to cause substantial ecological impact would also be considered. For example, cheatgrass may not be listed by a state as noxious, but it can greatly alter fire regimes in shrub steppe habitats resulting in large monotypic stands that displace native bunch grasses, forbs, and shrubs. Pest control would likely require a multi-year commitment from the refuge staff. Essential to the long-term success of pest management would be pre- and post-treatment monitoring, assessment of the successes and failures of treatments, and development of new approaches when proposed methods do not achieve desired outcomes.

D.5 Best Management Practices

Best management practices (BMPs) can minimize or eliminate possible effects associated with pesticide usage to nontarget species and/or sensitive habitats as well as degradation of water quality from drift, surface runoff, or leaching. Based upon the Department of the Interior's Pesticide Use Policy (517 DM 1) and the Service's Pest Management Policy and Responsibilities (30 AM 12), the use of applicable BMPs (where feasible) would likely ensure that pesticide uses may not adversely affect federally listed species and/or their critical habitats through determinations made using the process described in 50 CFR part 402.

The following are BMPs pertaining to mixing/handling and applying pesticides for all ground-based treatments of pesticides, which would be considered and utilized, where feasible, based upon target- and site-specific factors and time-specific environmental conditions. Although not listed below, the most important BMP to eliminate/reduce potential impacts to nontarget resources would be an IPM approach to prevent, control, eradicate, and contain pests.

D.5.1 Pesticide Handling and Mixing

- As a precaution against spilling, spray tanks would not be left unattended during filling.
- All pesticide containers would be triple rinsed and the rinsate would be used as water in the sprayer tank and applied to treatment areas.
- All pesticide spray equipment would be properly cleaned. Where possible, rinsate would be used as part of the make up water in the sprayer tank and applied to treatment areas.
- The refuge staff would empty rinsed pesticide containers for recycling at local herbicide container collection facilities.
- All unused pesticides would be properly discarded at a local "safe send" collection facility.
- Pesticides and pesticide containers would be lawfully stored, handled, and disposed of in accordance with the label and in a manner safeguarding human health, fish, and wildlife and preventing soil and water contaminant.
- The refuge staff would consider the water quality parameters (e.g., pH, hardness) that are important to ensure greatest efficacy where specified on the pesticide label.

- All pesticide spills would be addressed immediately using procedures identified in the refuge spill response plan.

D.5.2 Applying Pesticides

- Pesticide treatments would only be conducted by or under the supervision of Service personnel and non-Service applicators with the appropriate state or Bureau of Land Management (BLM) certification to safely and effectively conduct these activities on refuge lands and waters.
- The refuge staff would comply with all Federal, state, and local pesticide use laws and regulations as well as Departmental, Service, and Refuge System pesticide-related policies. For example, the refuge staff would use application equipment and apply rates for the specific pest(s) identified on the pesticide label as required under FIFRA.
- Before each treatment season and prior to mixing or applying any product for the first time each season, all applicators would review the labels, Material Safety Data Sheets (MSDSs), and PUPs for each pesticide, determining the target pest, appropriate mix rate(s), personal protective equipment (PPE), and other requirements listed on the pesticide label.
- A 1-foot no-spray buffer from the water's edge would be used, where applicable, and it does not detrimentally influence effective control of pest species.
- Spot treatment would be used rather than broadcast applications of pesticides, where practical.
- Applicators would use and adjust spray equipment to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift.
- Applicators would use the largest droplet size that results in uniform coverage.
- Applicators would use drift reduction technologies such as low-drift nozzles, where possible.
- Where possible, spraying would occur during low (average less than 7 mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically lower than 85^{o}F).
- Where possible, applicators would avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to nontarget areas.
- Equipment would be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications would be made at the lowest height for uniform coverage of target pests to minimize/eliminate potential drift.
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) would typically be conducted during early morning hours.
- Spray applications would not be conducted on days with more than a 30 percent forecast for rain within six hours, except for pesticides that are rapidly rain-fast (e.g., glyphosate in one hour) to minimize/eliminate potential runoff.
- Where possible, applicators would use drift retardant adjuvants during spray applications, especially adjacent to sensitive areas.

- Where possible, applicators would use a nontoxic dye to aid in identifying target area treated as well as potential over spray or drift. A dye can also aid in detecting equipment leaks. If a leak is discovered, the application would be stopped until repairs can be made to the sprayer.
- For pesticide uses associated with cropland and facilities management, buffers, as appropriate, would be used to protect sensitive habitats, especially wetlands and other aquatic habitats.
- When drift cannot be sufficiently reduced through altering equipment set up and application techniques, buffer zones may be identified to protect sensitive areas downwind of applications. The refuge staff would only apply adjacent to sensitive areas when the wind is blowing the opposite direction.
- Applicators would utilize scouting for early detection of pests to eliminate unnecessary pesticide applications.
- The refuge staff would consider timing of application so native plants are protected (e.g., senescence) while effectively treating invasive plants.
- Rinsate from cleaning spray equipment after application would be recaptured and reused or applied to an appropriate pest plant infestation.
- Application equipment (e.g., sprayer, ATV, tractor) would be thoroughly cleaned and PPE would be removed/disposed of onsite by applicators after treatments to eliminate the potential spread of pests to uninfested areas.

D.6 Safety

D.6.1 Personal Protective Equipment

All applicators would wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE will be worn at all times during handling, mixing, and applying. PPE can include the following disposable (e.g., Tyvek) or laundered coveralls; gloves (latex, rubber, or nitrile); rubber boots; and/or a respirator approved by the National Institute for Occupational Safety and Health (NIOSH). Because exposure to concentrated product is usually greatest during mixing, extra care should be taken while preparing pesticide solutions. Persons mixing these solutions can be best protected if they wear long gloves, an apron, footwear, and a face shield.

Coveralls and other protective clothing used during an application would be laundered separately from other laundry items. Transporting, storing, handling, mixing and disposing of pesticide containers will be consistent with label requirements, EPA and Occupational Safety and Health Administration (OSHA) requirements, and Service policy.

If a respirator is necessary for a pesticide use, then the following requirements would be met in accordance with Service safety policy: a written Respirator Program, fit testing, physical examination (including pulmonary function and blood work for contaminants), and proper storage of the respirator.

D.6.2 Notification

The restricted entry interval (REI) is the waiting period required after pesticide application. Once the REI ends, individuals may safely enter a treated area without PPE. Refuge staff, authorized management agents of the Service, volunteers, and members of the public who could be in or near a pesticide-treated area within the stated reentry time period on the label would be notified about treatment areas. Posting would occur at any site where individuals might inadvertently become exposed to a pesticide during other activities on the refuge. Where required by the label and/or state-specific regulations, sites would also be posted on its perimeter and at other likely locations of entry. The refuge staff would also notify appropriate private property owners of an intended application, including any private individuals have requested notification. Special efforts would be made to contact nearby individuals who are beekeepers or who have expressed chemical sensitivities.

D.6.3 Medical Surveillance

Medical surveillance may be required for Service personnel who mix, apply, and/or monitor use of pesticides (see 242 FW 7 [Pesiticide Users] and 242 FW 4 [Medical Surveillance]). In accordance with draft Service policy (242 FW 7 [Pesticide Users Safety]), medical monitoring would be necessary for Service personnel and approved volunteers engaged in "frequent pesticide use" that is defined as a "pesticide applicator handling, mixing, and applying pesticides for 8 or more hours in any week or 16 or more hours in any 30 day period." However, refuge cooperators (e.g., cooperative farmers) and other authorized agents (e.g., state and county employees) would be responsible for their own medical monitoring needs and costs. Standard examinations (at refuge expense) of appropriate refuge staff would be provided by the nearest certified occupational health and safety physician as determined by Federal Occupational Health.

D.6.4 Certification and Supervision of Pesticide Applicators

Appropriate refuge staff handling, mixing, and/or applying or supervising others engaged in pesticide use activities would be trained and state or Federal (BLM) licensed to apply pesticides to refuge lands or waters (242 FW 7). Preferably, all refuge staff participating in pest management activities involving pesticide usage would attend appropriate training. New staff unfamiliar with proper procedures for storing, mixing, handling, applying, and disposing of herbicides and containers would receive orientation and training before handling or using any products. Documentation of training would be kept in the files at the refuge office.

D.6.5 Recordkeeping

D.6.5.1 Labels and Material Safety Data Sheets

Pesticide labels and MSDSs would be maintained at the refuge shop with laminated copies located in the mixing area. These documents would be carried by field applicators where possible. A written reference (e.g., note pad, chalk board, dry erase board) for each tank to be mixed would be kept in the mixing area for quick reference during mixing. In addition, approved PUPs stored in the Pesticide Use Proposal System (PUPS) database typically contain website links to pesticide labels and MSDSs.

D.6.5.2 Pesticide Use Proposals

A PUP would be prepared for each proposed pesticide use associated with annual pest management on refuge lands and waters. A PUP would include specific information about the proposed pesticide use including the common and chemical names of the pesticide(s), target pest species, size and location of treatment site(s), application rate(s) and method(s), and federally listed species determinations, where applicable.

In accordance with 30 AM 12 and 7 RM 14, PUPs would be required for the following:

- Uses of pesticides on lands and facilities owned or managed by the Service, including properties managed by Service personnel as a result of the Food Security Act of 1985;
- Service projects by non-Service personnel on Service owned or controlled lands and facilities and other pest management activities that would be conducted by Service personnel; and
- Where the Service would be responsible or provides funds for pest management identified in protective covenants, easements, contracts, or agreements off Service lands.

In accordance with Service guidelines (Director's memo [December 12, 2007]), a refuge staff may receive up to five-year approvals for Washington Office and field reviewed proposed pesticide uses based upon meeting identified criteria including an approved IPM plan, where necessary (see http://www.fws.gov/contaminants/Issues/IPM.cfm). For a refuge, an IPM plan (requirements described herein) can be completed independently or in association with a CCP or HMP if IPM strategies and potential environmental effects are adequately addressed within appropriate NEPA documentation.

PUPs would be created, approved or disapproved, and stored as records in the Pesticide Use Proposal System (PUPS), which is centralized database on the Service's intranet (https://sds.fws.gov/pups). Only Service employees can access PUP records in this database.

D.6.5.3 Pesticide Usage

In accordance with 30 AM 12 and 7 RM 14, the refuge Project Leader would be required to maintain records of all pesticides annually applied on lands or waters under refuge jurisdiction. This would encompass pesticides applied by other Federal agencies, state and county governments, nongovernment applicators including cooperators and their pest management service providers with Service permission. For clarification, pesticide means all insecticides, insect and plant growth regulators, dessicants, herbicides, fungicides, rodenticides, acaricides, nematicides, fumigants, avicides, and piscicides.

The following usage information can be reported for approved PUPs in the PUPS database:

- Pesticide trade name(s)
- Active ingredient(s)
- Total acres treated

- Total amount of pesticides used (pounds [lbs] or gallons)
- Total amount of active ingredient(s) used (lbs)
- Target pest(s)
- Efficacy (percent control)

To determine whether treatments are efficacious (eradicating, controlling, or containing the target pest) and achieving resource objectives, habitat and/or wildlife response would be monitored both pre- and post-treatment, where possible. Considering available annual funding and staffing, appropriate monitoring data regarding characteristics (attributes) of pest infestations (e.g., area, perimeter, degree of infestation-density, percent cover, density) as well as habitat and/or wildlife response to treatments may be collected and stored in a relational database, preferably a geo-referenced data management system (e.g., Refuge Lands GIS [RLGIS]) to facilitate data analyses. In accordance with adaptive management, data analysis and interpretation would allow treatments to be modified or changed over time, as necessary, to achieve resource objectives considering site-specific conditions in conjunction with habitat and/or wildlife responses.

D.7 Evaluating Pesticide Use Proposals

Pesticides would only be used on the refuge for habitat management as well as croplands/facilities maintenance after approval of a PUP. Proposed pesticide uses on the refuge would only be approved where there would likely be minor, temporary, or localized effects to fish and wildlife species as well as minimal potential to degrade environmental quality. Potential effects to listed and non-listed species would be evaluated with quantitative ecological risk assessments. Potential effects to environmental quality would be based upon pesticide characteristics of environmental fate (water solubility, soil mobility, soil persistence, and volatilization) and a quantitative screening tool for potential to move to groundwater. Risk assessments as well as characteristics of environmental fate and potential to degrade water quality for pesticides would be documented in Chemical Profiles (see Section D.7.5). These profiles would include threshold values for quantitative measures of ecological risk assessments and screening tools for environmental fate that represent minimal potential effects to species and environmental quality. Only pesticide uses with appropriate BMPs (see Section D.4) for habitat management and cropland/facilities maintenance on the refuge that would potentially have minor, temporary, or localized effects on refuge biological and environmental quality (threshold values not exceeded) would be approved.

D.7.1 Overview of Ecological Risk Assessment

An ecological risk assessment process would be used to evaluate potential adverse effects to biological resources as a result of a pesticide(s) proposed for use on the refuge. It is an established quantitative and qualitative methodology for comparing and prioritizing risks of pesticides and conveying an estimate of the potential risk for an adverse effect. The quantitative methodology would be an efficient way to integrate best available scientific information regarding hazard, patterns of use (exposure), and dose-response relationships in a manner that is useful for ecological risk decision-making. It would provide an effective way to evaluate potential effects where there is missing or unavailable scientific information (data gaps) to address reasonable, foreseeable adverse effects as required under 40 CFR Part 1502.22. Protocols for ecological risk assessment of pesticide uses on the refuge were developed through research and established by the EPA (2004). Assumptions for these risk assessments are presented in Section D.6.2.3.

The toxicological data used in ecological risk assessments are typically results of standardized laboratory studies provided by pesticide registrants to the EPA to meet regulatory requirements under FIFRA. These studies assess the acute (lethality) and chronic (reproductive) effects associated with short- and long-term exposure to pesticides on representative species of birds, mammals, freshwater fish, aquatic invertebrates, and terrestrial and aquatic plants, respectively (Table D.1). Other effects data publicly available would also be utilized for risk assessment protocols described herein. Toxicity endpoint and environmental fate data are available from a variety of resources. Some of the more useful resources can be found in Section D.7.5.

Table D.1 Ecotoxicity Tests Used to Evaluate Potential Effects to Birds, Fish, and Mammals to Establish Toxicity Endpoints for Risk Quotient Calculations

Species Group	Exposure	Measurement endpoint
Bird	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[1]
Fish	Acute	Median Lethal Concentration (LC_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[2]
Mammal	Acute	Oral Lethal Dose (LD_{50})
	Chronic	No Observed Effect Concentration (NOEC) or No Observed Adverse Effect Concentration (NOAEC)[3]

[1]Measurement endpoints typically include a variety of reproductive parameters (e.g., number of eggs, number of offspring, eggshell thickness, and number of cracked eggs).
[2]Measurement endpoints for early life stage/life cycle typically include embryo hatch rates, time to hatch, growth, and time to swim-up.
[3]Measurement endpoints include maternal toxicity, teratogenic effects or developmental anomalies, evidence of mutagenicity or genotoxicity, and interference with cellular mechanisms such as DNA synthesis and DNA repair.

D.7.2 Determining Ecological Risk to Fish and Wildlife

The potential for pesticides used on the refuge to cause direct adverse effects to fish and wildlife would be evaluated using EPA's Ecological Risk Assessment Process (EPA 2004). This deterministic approach, which is based upon a two-phase process involving estimation of environmental concentrations and then characterization of risk, would be used for ecological risk assessments. This method integrates exposure estimates—estimated environmental concentration (EEC)—and toxicological endpoints (e.g., LC_{50} and oral LD_{50}) to evaluate the potential for adverse effects to species groups (birds, mammals, and fish) representative of legal mandates for managing units of the Refuge System. This integration is achieved through risk quotients (RQs) calculated by dividing the EEC by acute and chronic toxicity values selected from standardized toxicological endpoints or published effect (Table D.1).

$$RQ = EEC/Toxicological\ Endpoint$$

The level of risk associated with direct effects of pesticide use would be characterized by comparing calculated RQs to the appropriate Level of Concern (LOC) established by EPA (1998) (Table D.2). The LOC represents a quantitative threshold value for screening potential adverse effects to fish and wildlife resources associated with pesticide use. The following are four exposure-species group scenarios that would be examined to characterize ecological risk to fish and wildlife on the refuge: acute-listed species, acute-nonlisted species, chronic-listed species, and chronic-nonlisted species.

Acute risk would indicate the potential for mortality associated with short-term dietary exposure to pesticides immediately after an application. For characterization of acute risks, median values from LC_{50} and LD_{50} tests would be used as toxicological endpoints for RQ calculations. In contrast, chronic risks would indicate the potential for adverse effects associated with long-term dietary exposure to pesticides from a single application or multiple applications over time (within a season and over years).

For characterization of chronic risks, the no observed concentration (NOAEC) or no observed effect concentration (NOEC) for reproduction would be used as toxicological endpoints for RQ calculations. Where available, the NOAEC would be preferred over a NOEC value. Listed species are those federally designated as threatened, endangered, or proposed in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884, as amended, Public Law 93-205). For listed species, potential adverse effects would be assessed at the individual level because loss of individuals from a population could detrimentally impact a species. In contrast, risks to nonlisted species would consider effects at the population level. An RQ less than LOC for a taxonomic group would indicate the proposed pesticide use is “may affect, not likely to adversely effect” individuals (listed species) or populations (nonlisted species) of the taxonomic group (Table D.2). In contrast, an RQ greater than LOC would indicate an unacceptable ecological risk considering the potential for adverse effects.

Table D.2 Presumption of Unacceptable Risk for Birds, Fish, and Mammals (EPA 1998)

Risk Presumption		Level of Concern	
		Listed Species	**Non-listed Species**
Acute	Birds	0.1	0.5
	Fish	0.05	0.5
	Mammals	0.1	0.5
Chronic	Birds	1.0	1.0
	Fish	1.0	1.0
	Mammals	1.0	1.0

D.7.2.1 Environmental Exposure

Following release into the environment through application, pesticides would experience several different routes of environmental fate. Pesticides that would be sprayed can move through the air (e.g., particle or vapor drift) and may eventually end up in other parts of the environment such as nontarget vegetation, soil, or water. Pesticides applied directly to the soil may be washed off the soil into nearby bodies of surface water (e.g., surface runoff) or may percolate through the soil to lower soil layers and groundwater (e.g., leaching) (Baker and Miller 1999; Butler et. al.

1998; EXTOXNET 1993; Pope et. al. 1999; Ramsay et. al. 1995). Pesticides that would be injected into the soil may also be subject to the latter two fates.

The aforementioned possibilities are by no means complete, but they do indicate movement of pesticides in the environment is very complex with transfers occurring continually among different environmental compartments. In some cases, these exchanges occur not only between areas that are close together, but it also may involve transportation of pesticides over long distances (Barry 2004; Woods 2004).

Terrestrial Exposure

The ECC for exposure to terrestrial wildlife would be quantified using an EPA screening level approach (EPA 2004). This screening-level approach is not affected by product formulation because it evaluates a pesticide's active ingredient(s). This approach would vary depending upon the proposed pesticide application method, spray or granular.

Terrestrial-spray Application

For spray applications, exposure would be determined using the Kanaga nomogram method (EPA 2004, 2005; Pfleeger et al. 1996) through the EPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3 (EPA 2005b). To estimate the maximum (initial) pesticide residue on short grass (shorter than 20 cm tall) as a general food item category for terrestrial vertebrate species, T-REX input variables would include the following from the pesticide label: maximum pesticide application rate (pounds active ingredient acid equivalent/acre) and pesticide half-life (days) in soil. Although there are other food item categories (tall grasses; broadleaf plants and small insects; and fruits, pods, seeds and large insects), short grass was selected because it would yield maximum EECs (240 ppm per pound active ingredient/acre) for worst-case risk assessments. Short grass is not representative of forage for carnivorous species (e.g., raptors), but it would characterize the maximum potential exposure through the diet of avian and mammalian prey items. Consequently, this approach would provide a conservative screening tool for pesticides that do not biomagnify.

For RQ calculations in T-REX, the model would require the weight of surrogate species and Mineau scaling factors (Mineau et al. 1996). Body weights of bobwhite quail and mallard are included in T-REX by default, but body weights of other organisms (Table D.3) would be entered manually. The Mineau scaling factor accounts for small-bodied bird species that may be more sensitive to pesticide exposure than would be predicted only by body weight. Mineau scaling factors would be entered manually with values ranging from 1 to 1.55 that are unique to a particular pesticide or group of pesticides. If specific information to select a scaling factor is not available, then a value of 1.15 would be used as a default. Alternatively, 0 would be entered if it is known that body weight does not influence toxicity of pesticide(s) being assessed. The upper bound estimate output from the T-REX Kanaga nomogram would be used as an EEC for calculation of RQs. This approach would yield a conservative estimate of ecological risk.

Table D.3 Average Body Weight of Selected Terrestrial Wildlife Species Frequently Used in Research to Establish Toxicological Endpoints (Dunning 1984)

Species	Body Weight (kg)
Mammal (15 g)	0.015
House Sparrow	0.0277
Mammal (35 g)	0.035
Starling	0.0823
Red-winged Blackbird	0.0526
Common Grackle	0.114
Japanese Quail	0.178
Bobwhite Quail	0.178
Rat	0.200
Rock Dove (aka Pigeon)	0.542
Mammal (1,000 g)	1.000
Mallard	1.082
Ring-necked Pheasant	1.135

Terrestrial – Granular Application

Granular pesticide formulations and pesticide-treated seed would pose a unique route of exposure for avian and mammalian species. The pesticide is applied in discrete units which birds or mammals might ingest accidentally with food items or intentionally as in the case of some bird species actively seeking and picking up gravel or grit to aid digestion or seed as a food source. Granules may also be consumed by wildlife foraging on earthworms, slugs or other soft-bodied soil organisms to which the granules may adhere.

Terrestrial wildlife RQs for granular formulations or seed treatments would be calculated by dividing the maximum milligrams of active ingredient (ai) exposed (e.g., EEC) on the surface of an area equal to 1 square foot by the appropriate LD_{50} value multiplied by the surrogate's body weight (Table D.3). An adjustment to surface area calculations would be made for broadcast, banded, and in-furrow applications. An adjustment also would be made for applications with and without incorporation of the granules. Without incorporation, it would be assumed that 100 percent of the granules remain on the soil surface available to foraging birds and mammals. Press wheels push granules flat with the soil surface, but they are not incorporated into the soil. If granules are incorporated in the soil during band or T-band applications or after broadcast applications, it would be assumed only 15 percent of the applied granules remain available to wildlife. It would be assumed that only 1 percent of the granules are available on the soil surface following in-furrow applications.

The EECs for pesticides applied in granular form and as seed treatments would be determined considering potential ingestion rates of avian or mammalian species (e.g., 10-30 percent body weight per day). This would provide an estimate of maximum exposure that may occur as a result of granule or seed treatment spills such as those that commonly occur at end rows during application and planting. The availability of granules and seed treatments to terrestrial vertebrates would also be considered by calculating the loading per unit area (LD_{50} per square foot) for comparison to EPA Levels of Concern (EPA 1998). The T-REX version 1.2.3 (EPA

2005b) contains a submodel which automates Kanaga exposure calculations for granular pesticides and treated seed.

The following formulas will be used to calculate EECs depending upon the type of granular pesticide application:

- In-furrow applications assume a typical value of 1 percent granules, bait, or seed remain unincorporated.

$$mg\ ai/ft^2 = [(lbs\ product/acre)(\%\ ai)(453{,}580\ mg/lbs)(1\%\ exposed))] / \{[(43{,}560\ ft^2/acre)/(row\ spacing\ (ft))] / (row\ spacing\ (ft)\}$$

or

$$mg\ ai/ft^2 = [(lbs\ product/1000\ ft\ row)(\%\ ai)(1000\ ft\ row)(453{,}580\ mg/lb)(1\%\ exposed)$$

$$EEC = [(mg\ ai/ft^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Incorporated banded treatments assume that 15 percent of granules, bait, or seeds are unincorporated.

$$mg\ ai/ft^2 = [(lbs\ product/1000\ row\ ft)(\%\ ai)(453{,}580\ mg/lb)(1\text{-}\%\ incorporated)] / (1{,}000\ ft)(band\ width\ (ft))$$

$$EEC = [(mg\ ai/ft^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Broadcast treatment without incorporation assumes 100 percent of granules, bait, seeds are unincorporated.

$$mg\ ai/ft^2 = [(lbs\ product/acre)(\%\ ai)(453{,}590\ mg/lb)] / (43{,}560\ ft^2/acre)$$

$$EEC = [(mg\ ai/ft^2)(\%\ of\ pesticide\ biologically\ available)]$$

Where:

- *% of pesticide biologically available = 100% without species specific ingestion rates*
- *Conversion for calculating mg ai/ft^2 using ounces: 453,580 mg/lb / 16 = 28,349 mg/oz*

The following equation would used to calculate a RQ based on the EEC calculated by one of the above equations. The EEC would be divided by the surrogate LD_{50} toxicological endpoint multiplied by the body weight (Table D.3) of the surrogate.

$$RQ = EEC / [LD_{50}\ (mg/kg) * body\ weight\ (kg)]$$

As with other risk assessments, an RQ greater than LOC, would be a presumption of unacceptable ecological risk. An RQ less than LOC would be a presumption of acceptable risk with only minor, temporary, or localized effects to species.

Aquatic Exposure

Exposures to aquatic habitats (e.g., wetlands, meadows, ephemeral pools, water delivery ditches) would be evaluated separately for ground-based pesticide treatments of habitats managed for fish and wildlife compared with cropland/facilities maintenance. The primary exposure pathway for aquatic organisms from any ground-based treatments likely would be particle drift during the pesticide application. However, different exposure scenarios would be necessary as a result of contrasting application equipment and techniques as well as pesticides used to control pests on agricultural lands (especially those cultivated by cooperative farmers for economic return from crop yields) and facilities maintenance (e.g., roadsides, parking lots, trails) compared with other managed habitats on the refuge. In addition, pesticide applications may be done less than 25 feet from the high water mark of aquatic habitats for habitat management treatments; whereas, no-spray buffers (25 feet or more) would be used for croplands/facilities maintenance treatments.

Habitat Treatments

For the worst-case exposure scenario to nontarget aquatic habitats, EECs (Table D.4) would be would be derived from Urban and Cook (1986) that assume an intentional overspray to an entire, nontarget water body (1-foot depth) from a treatment less than 25 feet from the high water mark using the max application rate (acid basis [see above]). However, use of BMPs for applying pesticides (see Section D.4.2) would likely minimize/eliminate potential drift to nontarget aquatic habitats during actual treatments. If there would be unacceptable (acute or chronic) risk to fish and wildlife with the simulated 100 percent overspray (RQ greater than LOC), then the proposed pesticide use may be disapproved or the PUP would be approved at a lower application rate to minimize/eliminate unacceptable risk to aquatic organisms (RQ=LOC).

Table D.4 Estimated Environmental Concentrations (ppb) of Pesticides in Aquatic Habitats (1-foot Depth) Immediately after Direct Application (Urban and Cook 1986)

Pounds/acre	EEC (parts per billion)
0.10	36.7
0.20	73.5
0.25	91.9
0.30	110.2
0.40	147.0
0.50	183.7
0.75	275.6
1.00	367.5
1.25	459.7
1.50	551.6
1.75	643.5
2.00	735.7
2.25	827.6
2.50	919.4
3.00	1,103.5
4.00	1,471.4
5.00	1,839
6.00	2,207

Pounds/acre	EEC (parts per billion)
7.00	2,575
8.00	2,943
9.00	3,311
10.00	3,678

Cropland/Facilities Maintenance Treatments

Field drift studies conducted by the Spray Drift Task Force, which is a joint project of several agricultural chemical businesses, were used to develop a generic spray drift database. From this database, the AgDRIFT computer model was created to satisfy EPA's pesticide registration spray drift data requirements and as a scientific basis to evaluate off-target movement of pesticides from particle drift and assess potential effects of exposure to wildlife. Several versions of the computer model have been developed (i.e., v2.01 through v2.10). The Spray Drift Task Force AgDRIFT® model version 2.01 (AgDRIFT 2001; SDTF 2003) would be used to derive EECs resulting from drift of pesticides to refuge aquatic resources from ground-based pesticide applications greater than 25 feet from the high water mark. The Spray Drift Task Force AgDRIFT model is publicly available at http://www.agridrift.com. At this website, click "AgDRIFT 2.0" and then click "Download Now" and follow the instructions to obtain the computer model.

The AgDRIFT model is composed of submodels called tiers. Tier I Ground submodel would be used to assess ground-based applications of pesticides. Tier outputs (EECs) would be calculated with AgDRIFT using the following input variables: Max application rate (acid basis [see above]), low boom (20 inches), fine to medium/coarse droplet size, 20 swaths, EPA-defined wetland, and a buffer of 25 feet or more from the treated area to water.

D.7.2.2 Use of Information on Effects of Biological Control Agents, Pesticides, Degradates, and Adjuvants

The NEPA documents regarding biological and other environmental effects of biological control agents, pesticides, degradates, and adjuvants prepared by another Federal agency, where the scope would be relevant to evaluation of effects from pesticide uses on refuge lands, would be reviewed. Possible source agencies for such NEPA documents would include the BLM, U.S. Forest Service, National Park Service, USDA-APHIS, and the U.S. military services. It might be appropriate to incorporate by reference parts or all of existing document(s). Incorporating by reference (40 CFR 1502.21) is a technique used to avoid redundancies in analysis. It would also reduce the bulk of a Service NEPA document, which would only identify the documents that are incorporated by reference. In addition, relevant portions would be summarized in the Service's NEPA document to the extent necessary to provide the decision maker and public with an understanding of relevance of the referenced material to the current analysis.

In accordance with the requirements set forth in 40 CFR 1506.3, the Service would specifically adopt and incorporate through reference ecological risk assessments prepared by the U.S. Forest Service (http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm) and the BLM (http://www.blm.gov/wo/st/en/prog/more/ veg_eis.html). These risk assessments and associated documentation also are available in total with the administrative record for the Final Environmental Impact Statement entitled Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants (U.S. Forest Service 2005) and Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic EIS (PEIS) (BLM 2007).

As a basis for completing “Chemical Profiles” for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide and adjuvant uses prepared by the U.S. Forest Service would be adopted and incorporated by reference:

- 2,4-D
- Chlorosulfuron
- Clopyralid
- Dicamba
- Glyphosate
- Imazapic
- Imazapyr
- Metsulfuron methyl
- Picloram
- Sethoxydim
- Sulfometuron methyl
- Triclopyr
- Nonylphenol polyethylate (NPE)–based surfactants

As a basis for completing “Chemical Profiles” for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide uses as well as evaluation of risks associated with pesticide degradates and adjuvants prepared by the BLM would be adopted and incorporated by reference:

- Bromacil
- Chlorsulfuron
- Diflufenzopyr
- Diquat
- Diuron
- Fluridone
- Imazapic
- Overdrive
- Sulfometuron methyl
- Tebuthiuron
- Pesticide degradates and adjuvants (Appendix D – Evaluation of risks from degradates, polyoxyethylene-amine (POEA) and R-11, and endocrine disrupting chemicals)

D.7.2.3 Assumptions for Ecological Risk Assessments

There are a number of assumptions involved with the ecological risk assessment process for terrestrial and aquatic organisms associated with utilization of the EPA's (2004) process. These assumptions may be risk neutral or may lead to an over- or under-estimation of risk from pesticide exposure depending upon site-specific conditions. The following describes these assumptions, their application to the conditions typically encountered, and whether or not they may lead to recommendations that are risk neutral or that underestimate or overestimate ecological risk from potential pesticide exposure.

- Indirect effects would not be evaluated by ecological risk assessments. These effects include the mechanisms of indirect exposure to pesticides: consuming prey items (fish, birds, or small mammals); reductions in the availability of prey items; and disturbance associated with pesticide application activities.
- Exposure to a pesticide product can be assessed based upon the active ingredient. However, exposure to a chemical mixture (pesticide formulation) may result in effects that are similar or substantially different compared to only the active ingredient. Nontarget organisms may be exposed directly to the pesticide formulation or only various constituents of the formulation as they dissipate and partition in the environment. If toxicological information for both the active ingredient and formulated product are available, then data representing the greatest potential toxicity would be selected for use in the risk assessment process (EPA 2004). As a result, this conservative approach may lead to an overestimation of risk characterization from pesticide exposure.
- Because toxicity tests with listed or candidate species or closely related species are not available, data for surrogate species would be most often used for risk assessments. Specifically, bobwhite quail and mallard duck are the most frequently used surrogates for evaluating potential toxicity to federally listed avian species. Bluegill sunfish, rainbow trout, and fathead minnow are the most common surrogates for evaluating toxicity for freshwater fishes. However, sheep's head minnow can be an appropriate surrogate marine species for coastal environments. Rats and mice are the most common surrogates for evaluating toxicity for mammals. Interspecies sensitivity is a major source of uncertainty in pesticide assessments. As a result of this uncertainty, data is selected for the most sensitive species tested within a taxonomic group (birds, fish, and mammals) given the quality of the data is acceptable. If additional toxicity data for more species of organisms in a particular group are available, the selected data will not be limited to the species previously listed as common surrogates.
- The Kanaga nomogram outputs maximum EEC values that may be used to calculate an average daily concentration over a specified interval of time, which is referred to as a time-weighted average (TWA). The maximum EEC would be selected as the exposure input for both acute and chronic risk assessments in the screening-level evaluations. The initial or maximum EEC derived from the Kanaga nomogram represents the maximum expected instantaneous or acute exposure to a pesticide. Acute toxicity endpoints are determined using a single exposure to a known pesticide concentration typically for 48 to 96 hours. This value is assumed to represent ecological risk from acute exposure to a pesticide. On the other hand, chronic risk to pesticide exposure is a function of pesticide concentration and duration of exposure to the pesticide. An organism's response to

chronic pesticide exposure may result from either the concentration of the pesticide, length of exposure, or some combination of both factors. Standardized tests for chronic toxicity typically involve exposing an organism to several different pesticide concentrations for a specified length of time (days, weeks, months, years, or generations). For example, avian reproduction tests include a 10-week exposure phase. Because a single length of time is used in the test, time response data is usually not available for inclusion into risk assessments. Without time response data it is difficult to determine the concentration which elicited a toxicological response.

- Using maximum EECs for chronic risk estimates may result in an overestimate of risk, particularly for compounds that dissipate rapidly. Conversely, using TWAs for chronic risk estimates may underestimate risk if it is the concentration rather than the duration of exposure that is primarily responsible for the observed adverse effect. The maximum EEC would be used for chronic risk assessments although it may result in an overestimate of risk. TWAs may be used for chronic risk assessments, but they will be applied judiciously considering the potential for an underestimate or overestimate of risk. For example, the number of days that exposure exceeds an LOC may influence the suitability of a pesticide use. The greater the number of days the EEC exceeds the LOC translates into greater ecological risk. This is a qualitative assessment and is subject to reviewer's expertise in ecological risk assessment and tolerance for risk.
- The length of time used to calculate the TWA can have a substantial effect on the exposure estimates and there is no standard method for determining the appropriate duration for this estimate. The T-REX model assumes a 21-week exposure period, which is equivalent to avian reproductive studies designed to establish a steady-state concentration for bioaccumulative compounds. However, this does not necessarily define the true exposure duration needed to elicit a toxicological response. Pesticides, which do not bioaccumulate, may achieve a steady-state concentration earlier than 21 weeks. The duration of time for calculating TWAs will require justification and it will not exceed the duration of exposure in the chronic toxicity test (approximately 70 days for the standard avian reproduction study). An alternative to using the duration of the chronic toxicity study is to base the TWA on the application interval. In this case, increasing the application interval would suppress both the estimated peak pesticide concentration and the TWA. Another alternative to using TWAs would be to consider the number of days that a chemical is predicted to exceed the LOC.
- Pesticide dissipation is assumed to be first-order in the absence of data suggesting alternative dissipation patterns such as bi-phasic. Field dissipation data would generally be the most pertinent for assessing exposure in terrestrial species that forage on vegetation. However, these data are often not available and can be misleading particularly if the compound is prone to "wash-off." Soil half-life is the most common degradation data available. Dissipation or degradation data that would reflect the environmental conditions typical of refuge lands would be utilized, if available.
- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column.
- Actual habitat requirements of any particular terrestrial species are not considered, and it is assumed that species exclusively and permanently occupy the treated area, or adjacent areas receiving pesticide at rates commensurate with the treatment rate. This assumption

would produce a maximum estimate of exposure for risk characterization. This assumption would likely lead to an overestimation of exposure for species that do not permanently and exclusively occupy the treated area (EPA 2004).

- Exposure through incidental ingestion of pesticide contaminated soil is not considered in the EPA risk assessment protocols. Research suggests less than 15 percent of the diet can consist of incidentally ingested soil depending upon species and feeding strategy (Beyer et al. 1994). An assessment of pesticide concentrations in soil compared to food item categories in the Kanaga nomogram indicates incidental soil ingestion will not likely increase dietary exposure to pesticides. Inclusion of soil into the diet would effectively reduce the overall dietary concentration compared to the present assumption that the entire diet consists of a contaminated food source (Fletcher et al. 1994). An exception to this may be soil-applied pesticides in which exposure from incidental ingestion of soil may increase. Potential for pesticide exposure under this assumption may be underestimated for soil-applied pesticides and overestimated for foliar-applied pesticides. The concentration of a pesticide in soil would likely be less than predicted on food items.
- Exposure through inhalation of pesticides is not considered in the EPA risk assessment protocols. Such exposure may occur through three potential sources: spray material in droplet form at time of application, vapor phase with the pesticide volatilizing from treated surfaces, and airborne particulates (soil, vegetative matter, and pesticide dusts). The EPA (1990) reported exposure from inhaling spray droplets at the time of application is not an appreciable route of exposure for birds. According to research on mallards and bobwhite quail, respirable particle size (particles reaching the lung) in birds is limited to maximum diameter of 2 to 5 microns. The spray droplet spectra covering the majority of pesticide application scenarios indicate that less than 1 percent of the applied material is within the respirable particle size. This route of exposure is further limited because the permissible spray drop size distribution for ground pesticide applications is restricted to ASAE medium or coarser drop size distribution.
- Inhalation of a pesticide in the vapor phase may be another source of exposure for some pesticides under certain conditions. This mechanism of exposure to pesticides occurs post application and it would pertain to those pesticides with a high vapor pressure. The EPA is currently evaluating protocols for modeling inhalation exposure from pesticides including near-field and near-ground air concentrations based upon equilibrium and kinetics-based models. Risk characterization for exposure with this mechanism is unavailable.
- The effect from exposure to dusts contaminated with the pesticide cannot be assessed generically as partitioning issues related to application site soils and chemical properties of the applied pesticides render the exposure potential from this route highly situation specific.
- Dermal exposure may occur through three potential sources: Direct application of spray to terrestrial wildlife in the treated area or within the drift footprint, incidental contact with contaminated vegetation, or contact with contaminated water or soil. Interception of spray and incidental contact with treated substrates may pose risks to avian wildlife (Driver et al. 1991). However, available research related to wildlife dermal contact with pesticides is extremely limited, except dermal toxicity values are common for some mammals used as human surrogates (rats and mice). The EPA is currently evaluating protocols for modeling dermal exposure. Risk characterization may be underestimated

for this route of exposure, particularly with high risk pesticides such as some organophosphates or carbamate insecticides. If protocols are established by the EPA for assessing dermal exposure to pesticides, they will be considered for incorporation into pesticide assessment protocols.

- Exposure to a pesticide may occur from consuming surface water, dew, or other water on treated surfaces. Water soluble pesticides have potential to dissolve in surface runoff, and puddles in a treated area may contain pesticide residues. Similarly, pesticides with lower organic carbon partitioning characteristics and higher solubility in water have a greater potential to dissolve in dew and other water associated with plant surfaces. Estimating the extent to which such pesticide loadings to drinking water occurs is complex and would depend upon the partitioning characteristics of the active ingredient, soils types in the treatment area, and the meteorology of the treatment area. In addition, the use of various water sources by wildlife is highly species specific. Currently, risk characterization for this exposure mechanism is not available. The EPA is actively developing protocols to quantify drinking water exposures from puddles and dew. If and when protocols are formally established by the EPA for assessing exposure to pesticides through drinking water, these protocols will be incorporated into pesticide risk assessment protocols.
- Risk assessments are based upon the assumption that the entire treatment area would be subject to pesticide application at the rates specified on the label. In most cases, there is potential for uneven application of pesticides through such plausible incidents such as changes in calibration of application equipment, spillage, and localized releases at specific areas in or near the treated field that are associated with mixing and handling and application equipment as well as applicator skill. Inappropriate use of pesticides and the occurrence of spills represent a potential underestimate of risk. It is likely not an important factor for risk characterization. All pesticide applicators are required to be certified by the state in which they apply pesticides. Certification training includes the safe storage, transport, handling, and mixing of pesticides, equipment calibration and proper application with annual continuing education.
- The EPA relies on Fletcher et al. (1994) for setting the assumed pesticide residues in wildlife dietary items. The EPA (2004) "believes that these residue assumptions reflect a realistic upper-bound residue estimate, although the degree to which this assumption reflects a specific percentile estimate is difficult to quantify." Fletcher's (1994) research suggests that the pesticide active ingredient residue assumptions used by the EPA represent a 95th percentile estimate. However, research conducted by Pfleeger et al. (1996) indicates EPA residue assumptions for short grass were not exceeded. Baehr and Habig (2000) compared EPA residue assumptions with distributions of measured pesticide residues for the EPA's UTAB (Uptake, Translocation, Accumulation, and Biotransformation) database. Overall residue selection level will tend to overestimate risk characterization. This is particularly evident when wildlife individuals are likely to have selected a variety of food items acquired from multiple locations. Some food items may be contaminated with pesticide residues whereas others are not contaminated. However, it is important to recognize differences in species feeding behavior. Some species may consume whole aboveground plant material, but others will preferentially select different plant structures. Also, species may preferentially select a food item although multiple food items may be present. Without species specific knowledge

regarding foraging behavior characterizing ecological risk other than in general terms is not possible.

- Acute and chronic risk assessments rely on comparisons of wildlife dietary residues with LC_{50} or NOEC values expressed as concentrations of pesticides in laboratory feed. These comparisons assume that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. Although the screening assessment process adjusts dry-weight estimates of food intake to reflect the increased mass in fresh-weight wildlife food intake estimates, it does not allow for gross energy and assimilative efficiency differences between wildlife food items and laboratory feed. Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods are not accounting for a potentially important aspect of food requirements.
- There are several other assumptions that can affect nontarget species not considered in the risk assessment process. These include possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic and biotic factors) and behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse affects to nontarget species, but they are usually characterized in the published literature in only a general manner limiting their value in the risk assessment process.
- It is assumed that aquatic species exclusively and permanently occupy the water body being assessed. Actual habitat requirements of aquatic species are not considered. With the possible exception of scenarios where pesticides are directly applied to water, it is assumed that no habitat use considerations specific for any species would place the organisms in closer proximity to pesticide use sites. This assumption produces a maximum estimate of exposure or risk characterization. It would likely be realistic for many aquatic species that may be found in aquatic habitats within or in close proximity to treated terrestrial habitats. However, the spatial distribution of wildlife is usually not random because wildlife distributions are often related to habitat requirements of species. Clumped distributions of wildlife may result in an under- or over-estimation of risk depending upon where the initial pesticide concentration occurs relative to the species or species habitat.
- For species found in the water column, it would be assumed that the greatest bioavailable fraction of the pesticide active ingredient in surface waters is freely dissolved in the water column. Additional chemical exposure from materials associated with suspended solids or food items is not considered because partitioning onto sediments likely is minimal. Adsorption and bioconcentration occurs at lower levels for many newer pesticides compared with older more persistent bioaccumulative compounds. Pesticides with RQs close to the listed species LOC, the potential for additional exposure from these routes may be a limitation of risk assessments, where potential pesticide exposure or risk may be underestimated.
- Mass transport losses of pesticide from a water body (except for losses by volatilization, degradation and sediment partitioning) would not be considered for ecological risk assessment. The water body would be assumed to capture all pesticide active ingredients entering as runoff, drift, and adsorbed to eroded soil particles. It would also be assumed

that pesticide active ingredient is not lost from the water body by overtopping or flow-through, nor is concentration reduced by dilution. In total, these assumptions would lead to a near maximum possible water-borne concentration. However, this assumption would not account for potential to concentrate pesticide through the evaporative loss. This limitation may have the greatest impact on water bodies with high surface-to-volume ratios such as ephemeral wetlands, where evaporative losses are accentuated and applied pesticides have low rates of degradation and volatilization.

- For acute risk assessments, there would be no averaging time for exposure. An instantaneous peak concentration would be assumed, where instantaneous exposure is sufficient in duration to elicit acute effects comparable to those observed over more protracted exposure periods (typically 48 to 96 hours) tested in the laboratory. In the absence of data regarding time-to-toxic event, analyses and latent responses to instantaneous exposure, risk would likely be overestimated.
- For chronic exposure risk assessments, the averaging times considered for exposure are commensurate with the duration of invertebrate life-cycle or fish-early life stage tests (e.g., 21-28 days and 56-60 days, respectively). Response profiles (time to effect and latency of effect) to pesticides likely vary widely with mode of action and species and should be evaluated on a case-by-case basis as available data allow. Nevertheless, because the EPA relies on chronic exposure toxicity endpoints based on a finding of no observed effect, the potential for any latent toxicity effects or averaging time assumptions to alter the results of an acceptable chronic risk assessment prediction is limited. The extent to which duration of exposure from water-borne concentrations overestimate or underestimate actual exposure depends on several factors. These include the following: localized meteorological conditions, runoff characteristics of the watershed (e.g., soils, topography), the hydrological characteristics of receiving waters, environmental fate of the pesticide active ingredient, and the method of pesticide application. It should also be understood that chronic effects studies are performed using a method that holds water concentration in a steady state. This method is not likely to reflect conditions associated with pesticide runoff. Pesticide concentrations in the field increase and decrease in surface water on a cycle influenced by rainfall, pesticide use patterns, and degradation rates. As a result of the dependency of this assumption on several undefined variables, risk associated with chronic exposure may in some situations underestimate risk and overestimate risk in others.
- There are several other factors that can affect nontarget species not considered in the risk assessment process. These would include the following: possible additive or synergistic effects from applying two or more pesticides or additives in a single application, co-location of pesticides in the environment, cumulative effects from pesticides with the same mode of action, effects of multiple stressors (e.g., combination of pesticide exposure, adverse abiotic [not pesticides] and biotic factors), and sub-lethal effects such as behavioral changes induced by exposure to a pesticide. These factors may exist at some level contributing to adverse affects to nontarget species, but they are not routinely assessed by regulatory agencies. Therefore, information on the factors is not extensive limiting their value for the risk assessment process. As this type of information becomes available, it would be included, either quantitatively or qualitatively, in this risk assessment process.

- The EPA is required by the Food Quality Protection Act to assess the cumulative risks of pesticides that share common mechanisms of toxicity, or act the same within an organism. Currently, EPA has identified four groups of pesticides that have a common mechanism of toxicity requiring cumulative risk assessments. These four groups are the organophosphate insecticides, N-methyl carbamate insecticides, triazine herbicides, and chloroacetanilide herbicides.

D.7.3 Pesticide Mixtures and Degradates

Pesticide products are usually a formulation of several components generally categorized as active ingredients and inert or other ingredients. The term active ingredient is defined by the FIFRA as preventing, destroying, repelling, or mitigating the effects of a pest, or it is a plant regulator, defoliant, desiccant, or nitrogen stabilizer. In accordance with FIFRA, the active ingredient(s) must be identified by name(s) on the pesticide label along with its relative composition expressed in percentage(s) by weight. In contrast, inert ingredient(s) are not intended to affect a target pest. Their role in the pesticide formulation is to act as a solvent (keep the active ingredient in a liquid phase), an emulsifying or suspending agent (keep the active ingredient from separating out of solution), or a carrier such as clay in which the active ingredient is impregnated on the clay particle in dry formulations. For example, if isopropyl alcohol were used as a solvent in a pesticide formulation, then it would be considered an inert ingredient. FIFRA only requires that inert ingredients identified as hazardous and associated percent composition, and the total percentage of all inert ingredients must be declared on a product label. Inert ingredients that are not classified as hazardous are not required to be identified.

The EPA (September 1997) issued Pesticide Regulation Notice 97-6 which encouraged manufacturers, formulators, producers, and registrants of pesticide products to voluntarily substitute the term “other ingredients” for “inert ingredients” in the ingredient statement. This change recognized that all components in a pesticide formulation potentially could elicit or contribute to an adverse effect on nontarget organisms and, therefore, are not necessarily inert. Whether referred to as “inerts” or “other ingredients,” these constituents within a pesticide product have the potential to affect species or environmental quality. The EPA categorizes regulated inert ingredients into the following four lists (http://www.epa.gov/opprd001/inerts/index.html):

- List 1 – Inert Ingredients of Toxicological Concern
- List 2 – Potentially Toxic Inert Ingredients
- List 3 – Inerts of Unknown Toxicity
- List 4 – Inerts of Minimal Toxicity

Several of the List 4 compounds are naturally occurring earthen materials (e.g., clay materials, simple salts) that would not elicit toxicological response at applied concentrations. However, some of the inerts (particularly the List 3 compounds and unlisted compounds) may have moderate to high potential toxicity to aquatic species based on MSDSs or published data.

Comprehensively assessing potential effects to nontarget fish, wildlife, plants, and/or their habitats from pesticide use is a complex task. It would be preferable to assess the cumulative effects from exposure to the active ingredient, its degradates, and inert ingredients as well as other active ingredients in the spray mixture. However, it would only be feasible to conduct deterministic risk assessments for each component in the spray mixture singly. Limited scientific information is available regarding ecological effects (additive or synergistic) from chemical mixtures that typically rely upon broadly encompassing assumptions. For example, the U.S. Forest Service (2005) found that mixtures of pesticides used in land (forest) management likely would not cause additive or synergistic effects to nontarget species based upon a review of scientific literature regarding toxicological effects and interactions of agricultural chemicals (ATSDR 2004). Moreover, information on inert ingredients, adjuvants, and degradates is often limited by the availability of and access to reliable toxicological data for these constituents.

Toxicological information regarding “other ingredients” may be available from sources such as the following:

- TOMES (a proprietary toxicological database including EPA’s IRIS, the Hazardous Substance Data Bank, the Registry of Toxic Effects of Chemical Substances [RTECS]).
- EPA’s ECOTOX database, which includes AQUIRE (a database containing scientific papers published on the toxic effects of chemicals to aquatic organisms).
- TOXLINE (a literature searching tool).
- MSDSs from pesticide suppliers.
- Other sources such as the Farm Chemicals Handbook.

Because there is a lack of specific inert toxicological data, inert(s) in a pesticide may cause adverse ecological effects. However, inert ingredients typically represent only a small percentage of the pesticide spray mixture, it would be assumed that negligible effects would be expected to result from inert ingredient(s).

Although the potential effects of degradates should be considered when selecting a pesticide, it is beyond the scope of this assessment process to consider all possible breakdown chemicals of the various product formulations containing an active ingredient. Degradates may be more or less mobile and more or less hazardous in the environment than their parent pesticides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent pesticides and degradates would make assessing potential degradate effects extremely difficult. For example, a less toxic and more mobile, bioaccumulative, or persistent degradate may have potentially greater effects on species and/or degrade environmental quality. The lack of data on the toxicity of degradates for many pesticides would represent a source of uncertainty for assessing risk.

An EPA-approved label specifies whether a product can be mixed with one or more pesticides. Without product-specific toxicological data, it would not possible to quantify the potential effects of these mixtures. In addition, a quantitative analysis could only be conducted if reliable scientific information allowed a determination of whether the joint action of a mixture would be additive, synergistic, or antagonistic. Such information would not likely exist unless the mode of action would be common among the chemicals and receptors. Moreover, the composition of and exposure to mixtures would be highly site- and/or time-specific and, therefore, it would be nearly impossible to assess potential effects to species and environmental quality.

To minimize or eliminate potential negative effects associated with applying two or more pesticides as a mixture, the use would be conducted in accordance with the labeling requirements. Labels for two or more pesticides applied as a mixture should be completely reviewed, where products with the least potential for negative effects would be selected for use on the refuge. This is especially relevant when a mixture would be applied in a manner that may already have the potential for an effect(s) associated with an individual pesticide (e.g., runoff to ponds in sandy watersheds). Use of a tank mix under these conditions would increase the level of uncertainty in terms of risk to species or potential to degrade environmental quality.

Adjuvants generally function to enhance or prolong the activity of pesticide. For terrestrial herbicides, adjuvants aid in the absorption into plant tissue. Adjuvant is a broad term that generally applies to surfactants, selected oils, anti-foaming agents, buffering compounds, drift control agents, compatibility agents, stickers, and spreaders. Adjuvants are not under the same registration requirements as pesticides and the EPA does not register or approve the labeling of spray adjuvants. Individual pesticide labels identify types of adjuvants approved for use with it. In general, adjuvants compose a relatively small portion of the volume of pesticides applied. Selection of adjuvants with limited toxicity and low volumes would be recommended to reduce the potential for the adjuvant to influence the toxicity of the pesticide.

D.7.4 Determining Effects to Soil and Water Quality

The approval process for pesticide uses would consider potential to degrade water quality on and off the refuge. A pesticide can only affect water quality through movement away from the treatment site. After application, pesticide mobilization can be characterized by one or more of the following (Kerle et al. 1996):

- Attach (sorb) to soil, vegetation, or other surfaces and remain at or near the treated area;
- Attach to soil and move off-site through erosion from runoff or wind;
- Dissolve in water that can be subjected to runoff or leaching.

As an initial screening tool, selected chemical characteristics and rating criteria for a pesticide can be evaluated to assess potential to enter ground and/or surface waters.
These would include the following: persistence, sorption coefficient (K_{oc}), groundwater ubiquity score (GUS), and solubility.

Persistence, which is expressed as half-life ($t_{½}$), represents the length of time required for 50 percent of the deposited pesticide to degrade (completely or partially). Persistence in the soil can be categorized as the following: Non-persistent less than 30 days, moderately persistent 30 to 100 days, and persistent less than 100 days (Kerle et. al. 1996). Half-life data is usually available for aquatic and terrestrial environments.

Another measure of pesticide persistence is dissipation time (DT_{50}). It represents the time required for 50 percent of the deposited pesticide to degrade and move from a treated site; whereas, half-life describes the rate for degradation only. As for half-life, units of dissipation time are usually expressed in days. Field or foliar dissipation time is the preferred data for use to estimate pesticide concentrations in the environment. However, soil half-life is the most common persistence data cited in the published literature. If field or foliar dissipation data is not available, soil half-life data may be used. The average or representative half-life value of most important degradation mechanism will be selected for quantitative analysis for both terrestrial and aquatic environments.

Mobility of a pesticide is a function of how strongly it is adsorbed to soil particles and organic matter, its solubility in water, and its persistence in the environment. Pesticides strongly adsorbed to soil particles, relatively insoluble in water, and not environmentally persistent wound be less likely to move across the soil surface into surface waters or to leach through the soil profile and contaminate groundwater. Conversely, pesticides that are not strongly adsorbed to soil particles, are highly water soluble, and are persistent in the environment would have greater potential to move from the application site (off-site movement).

The degree of pesticide adsorption to soil particles and organic matter (Kerle et al. 1996) is expressed as the soil adsorption coefficient (K_{oc}). The soil adsorption coefficient is measured as micrograms of pesticide per gram of soil (μg/g) that can range from near zero to the thousands. Pesticides with higher K_{oc} values are strongly sorbed to soil and, therefore, would be less subject to movement.

Water solubility describes the amount of pesticide that will dissolve in a known quantity of water. The water solubility of a pesticide is expressed as milligrams of pesticide dissolved in a liter of water (mg/L or ppm). Pesticides with solubility less than 0.1 ppm are virtually insoluble in water, 100-1,000 ppm are moderately soluble, and greater than 10,000 ppm highly soluble (U.S. Geological Survey 2000). As pesticide solubility increases, there would be greater potential for off-site movement.

The GUS is a quantitative screening tool to estimate a pesticide's potential to move in the environment. It utilizes soil persistence and adsorption coefficients in the following formula.

$$GUS = \log 10 (t_{½}) \times [4 - \log 10 (K_{oc})]$$

The potential pesticide movement rating would be based upon its GUS value. Pesticides with a GUS less than 0.1 would be considered to have an extremely low potential to move toward groundwater. Values of 1.0-2.0 would be low, 2.0-3.0 would be moderate, 3.0-4.0 would be high, and greater than 4.0 would have a very high potential to move toward groundwater.

Water solubility describes the amount of pesticide dissolving in a specific quantity of water, where it is usually measured as mg/l or ppm. Solubility is useful as a comparative measure because pesticides with higher values are more likely to move by runoff or leaching. The GUS, water solubility, $t_{½}$, and K_{oc} values are available for selected pesticides from the Oregon State University Extension Pesticide Properties Database at http://npic.orst.edu/ppdmove.htm. Many of the values in this database were derived from the SCS/ARS/CES Pesticide Properties Database for Environmental Decision Making (Wauchope et al. 1992).

Soil properties influence the fate of pesticides in the environment. The following six properties are mostly likely to affect pesticide degradation and the potential for pesticides to move off-site by leaching (vertical movement through the soil) or runoff (lateral movement across the soil surface).

- Permeability is the rate of water movement vertically through the soil. It is affected by soil texture and structure. Coarse textured soils (e.g., high sand content) have a larger pore size and they are generally more permeable than fine textured soils (i.e., high clay content). The more permeable soils would have a greater potential for pesticides to move vertically down through the soil profile. Soil permeability rates (inches per hour) are usually available in county soil survey reports.
- Soil texture describes the relative percentage of sand, silt, and clay. In general, greater clay content with smaller the pore size would lower the likelihood and rate water that would move through the soil profile. Clay also serves to adsorb (bind) pesticides to soil particles. Soils with high clay content would adsorb more pesticide than soils with relatively low clay content. In contrast, sandy soils with coarser texture and lower water holding capacity would have a greater potential for water to leach through them.
- Soil structure describes soil aggregation. Soils with a well developed soil structure have looser, more aggregated, structure that would be less likely to be compacted. Both characteristics would allow for less restricted flow of water through the soil profile resulting in greater infiltration.
- Organic matter would be the single most important factor affecting pesticide adsorption in soils. Many pesticides are adsorbed to organic matter which would reduce their rate of downward movement through the soil profile. Also, soils high in organic matter would tend to hold more water, which may make less water available for leaching.
- Soil moisture affects how fast water would move through the soil. If soils are already wet or saturated before rainfall or irrigation, excess moisture would runoff rather than infiltrate into the soil profile. Soil moisture also would influence microbial and chemical activity in soil, which effects pesticide degradation.
- Soil pH would influence chemical reactions that occur in the soil which in turn determines whether or not a pesticide will degrade, rate of degradation, and, in some instances, which degradation products are produced.

Based upon the aforementioned properties, soils most vulnerable to groundwater contamination would be sandy soils with low organic matter. In contrast, the least vulnerable soils would be well-drained clayey soils with high organic matter. Consequently, pesticides with the lowest potential for movement in conjunction with appropriate BMPs (see below) would be used in an IPM framework to treat pests while minimizing effects to nontarget biota and protecting environmental quality.

Along with soil properties, the potential for a pesticide to affect water quality through runoff and leaching would consider site-specific environmental and abiotic conditions including rainfall, water table conditions, and topography (Huddleston 1996).

- Water is necessary to separate pesticides from soil. This can occur in two basic ways. Pesticides that are soluble move easily with runoff water. Pesticide-laden soil particles can be dislodged and transported from the application site in runoff. The concentration of pesticides in the surface runoff would be greatest for the first runoff event following treatment. The rainfall intensity and route of water infiltration into soil, to a large extent, determine pesticide concentrations and losses in surface runoff. The timing of the rainfall after application also would have an effect. Rainfall interacts with pesticides at a shallow soil depth (¼ to ½ inch), which is called the mixing zone (Baker and Miller 1999). The pesticide/water mixture in the mixing zone would tend to leach down into the soil or runoff depending upon how quickly the soil surface becomes saturated and how rapidly water can infiltrate into the soil. Leaching would decrease the amount of pesticide available near the soil surface (mixing zone) to runoff during the initial rainfall event following application and subsequent rainfall events.

- Terrain slope would affect the potential for surface runoff and the intensity of runoff. Steeper slopes would have greater potential for runoff following a rainfall event. In contrast, soils that are relatively flat would have little potential for runoff, except during intense rainfall events. In addition, soils in lower areas would be more susceptible to leaching as a result of receiving excessive water from surrounding higher elevations.
- Depth to groundwater would be an important factor affecting the potential for pesticides to leach into groundwater. If the distance from the soil surface to the top of the water table is shallow, pesticides would have less distance to travel to reach groundwater. Shallower water tables that persist for longer periods would be more likely to experience groundwater contamination. Soil survey reports are available for individual counties. These reports provide data in tabular format regarding the water table depths and the months during which it is persists. In some situations, a hard pan exists above the water table that would prevent pesticide contamination from leaching.

D.7.5 Determining Effects to Air Quality

Pesticides may volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide's vapor pressure which would be affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these numbers easier to compare, vapor pressure may be expressed in exponent form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with I less than10 would have a low potential to volatilize, whereas pesticides with I greater than 1,000 would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA Agricultural Research Service (ARS) pesticide database.

D.7.6 Preparing a Chemical Profile

The following instructions would be used by Service personnel to complete Chemical Profiles for pesticides. Specifically, profiles would be prepared for pesticide active ingredients (e.g., glyphosate, imazapic) that would be contained in one or more trade name products that are registered and labeled with EPA. All information fields under each category (e.g., Toxicological Endpoints, Environmental Fate) would be completed for a Chemical Profile. If no information is available for a specific field, then "No data is available in references" would be recorded in the profile. Available scientific information would be used to complete Chemical Profiles. Each entry of scientific information would be shown with applicable references.

Completed Chemical Profiles would provide a structured decision-making process utilizing quantitative assessment/screening tools with threshold values (where appropriate) that would be used to evaluate potential biological and other environmental effects to refuge resources. For ecological risk assessments presented in these profiles, the “worst-case scenario” would be evaluated to determine whether a pesticide could be approved for use considering the maximum single application rate specified on pesticide labels for habitat management and croplands/ facilities maintenance treatments pertaining to refuges. Where the “worst-case scenario” likely would only result in minor, temporary, and localized effects to listed and non-listed species with appropriate BMPs (see Section D.5.0), the proposed pesticide’s use in a PUP would have a scientific basis for approval under any application rate specified on the label that is at or below rates evaluated in a Chemical Profile. In some cases, the Chemical Profile would include a lower application rate than the maximum labeled rate in order to protect refuge resources. As necessary, Chemical Profiles would be periodically updated with new scientific information or as pesticides with the same active ingredient are proposed for use on the refuge in PUPs.

Throughout this section, threshold values (to prevent or minimize potential biological and environmental effects) would be clearly identified for specific information presented in a completed Chemical Profile. Comparison with these threshold values provides an explicit scientific basis to approve or disapprove PUPs for habitat management and cropland/facilities maintenance on the refuge. In general, PUPs would be approved for pesticides with Chemical Profiles where there would be no exceedances of threshold values. However, BMPs are identified for some screening tools that would minimize/eliminate potential effects (exceedance of the threshold value) as a basis for approving PUPs.

D.7.6.1 Date

Service personnel would record the date when the Chemical Profile is completed or updated. Chemical Profiles (e.g., currently approved pesticide use patterns) would be periodically reviewed and updated, as necessary. The most recent review date would be recorded on a profile to document when it was last updated.

D.7.6.2 Trade Name(s)

Service personnel would accurately and completely record the trade name(s) from the pesticide label, which includes a suffix that describes the formulation (e.g., WP, DG, EC, L, SP, I, II or 64). The suffix often distinguishes a specific product among several pesticides with the same active ingredient. Service personnel would record a trade name for each pesticide product with the same active ingredient.

D.7.6.3 Common Chemical Name(s)

Service personnel would record the common name(s) listed on the pesticide label or MSDS for an active ingredient. The common name of a pesticide is listed as the active ingredient on the title page of the product label immediately following the trade name, and the MSDS, Section 2: Composition/Information on Ingredients. A Chemical Profile is completed for each active ingredient.

D.7.6.4 Pesticide Type

Service personnel would record the type of pesticide for an active ingredient as one of the following: herbicide, dessicant, fungicide, fumigant, growth regulator, insecticide, pisicide, or rodenticide.

D.7.6.5 EPA Registration Number(s)

This number (EPA Reg. No.) appears on the title page of the label and MSDS, Section 1: Chemical Product and Company Description. It is not the EPA Establishment Number that is usually located near it. Service personnel would record the EPA Reg. No. for each trade name product with an active ingredient based upon PUPs.

D.7.6.6 Pesticide Class

Service personnel would list the general chemical class for the pesticide (active ingredient). For example, malathion is an organophosphate and carbaryl is a carbamate.

D.7.6.7 CAS (Chemical Abstract Service) Number

This number is often located in the second section (Composition/Information on Ingredients) of the MSDS. The MSDS table listing components usually contains this number immediately prior to or following the percent composition.

D.7.6.8 Other Ingredients

From the most recent MSDS for the proposed pesticide product(s), Service personnel would include any chemicals in the pesticide formulation not listed as an active ingredient that are described as toxic or hazardous, or regulated under the Superfund Amendments and Reauthorization Act (SARA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substances Control Act (TSCA), OSHA, State Right-to-Know, or other listed authorities. These are usually found in MSDS sections titled Hazardous Identifications, Exposure Control/Personal Protection, and Regulatory Information. If concentrations of other ingredients are available for any compounds identified as toxic or hazardous, then Service personnel would record this information in the Chemical Profile by trade name. MSDSs may be obtained from the manufacturer, manufacturer’s website or from an online database maintained by Crop Data Management Systems, Inc. (see list below).

D.7.6.9 Toxicological Endpoints

Toxicological endpoint data would be collected for acute and chronic tests with mammals, birds, and fish. Data would be recorded for species available in the scientific literature. If no data are found for a particular taxonomic group, then “No data available is references” would be recorded as the data entry. Throughout the Chemical Profile, references (including toxicological endpoint data) would be cited using parentheses (#) following the recorded data.

D.7.6.10 Mammalian LD_{50}

For test species in the scientific literature, Service personnel would record available data for oral lethal dose (LD_{50}) in mg/kg-bw (body weight) or ppm-bw. Most common test species in scientific literature are the rat and mouse. The lowest LD_{50} value found for a rat would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk to mammals (see Table D.1 in Section D.7.1).

D.7.6.11 Mammalian LC_{50}

For test species in the scientific literature, Service personnel would record available data for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species in scientific literature are the rat and mouse. The lowest LC_{50} value found for a rat would be used as a toxicological endpoint for diet-based RQ calculations to assess acute risk (see Table D.1 in Section D.7.1).

D.7.6.12 Mammalian Reproduction

For test species listed in the scientific literature, Service personnel would record the test results (e.g., lowest observed effect concentration [LOEC], lowest observed effect level [LOEL], no observed adverse effect level [NOAEL], no observed adverse effect concentration [NOAEC]) in mg/kg-bw or mg/kg-diet for reproductive test procedure(s) (e.g., generational studies [preferred], fertility, newborn weight). Most common test species available in scientific literature are rats and mice. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for a rat would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table D.1 in Section D.7.1).

D.7.6.13 Avian LD_{50}

For test species available in the scientific literature, Service personnel would record values for oral lethal dose (LD_{50}) in mg/kg-bw or ppm-bw. Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LD_{50} value found for an avian species would be used as a toxicological endpoint for dose-based RQ calculations to assess acute risk (see Table D.1 in Section D.7.1).

D.7.6.14 Avian LC_{50}

For test species available in the scientific literature, Service personnel would record values for dietary lethal concentration (LC_{50}) as reported (e.g., mg/kg-diet or ppm-diet). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest LC_{50} value found for an avian species would be used as a toxicological endpoint for dietary-based RQ calculations to assess acute risk (see Table D.1 in Section D.7.1).

D.7.6.15 Avian Reproduction

For test species available in the scientific literature, Service personnel would record test results (e.g., LOEC, LOEL, NOAEC, NOAEL) in mg/kg-bw or mg/kg-diet consumed for reproductive test procedure(s) (e.g., early life cycle, reproductive). Most common test species available in scientific literature are the bobwhite quail and mallard. The lowest NOEC, NOAEC, NOEL, or NOAEL test results found for an avian species would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table D.1 in Section D.7.1).

D.7.6.16 Fish LC_{50}

For test freshwater or marine species listed in the scientific literature, Service personnel would record a LC_{50} in ppm or mg/L. Most common test species available in the scientific literature are bluegill, rainbow trout, and fathead minnow (marine). Test results for many game species may also be available. The lowest LC_{50} value found for a freshwater fish species would be used as a toxicological endpoint for RQ calculations to assess acute risk (see Table D.1 in Section D.7.1).

D.7.6.17 Fish Early Life Stage (ELS)/Life Cycle

For test freshwater or marine species available in the scientific literature, Service personnel would record test results (e.g., LOEC, NOAEL, NOAEC, LOAEC) in ppm for test procedure(s) (e.g., early life cycle, life cycle). Most common test species available in the scientific literature are bluegill, rainbow trout, and fathead minnow. Test results for other game species may also be available. The lowest test value found for a fish species (preferably freshwater) would be used as a toxicological endpoint for RQ calculations to assess chronic risk (see Table D.1 in Section D.7.1).

D.7.6.18 Other

For test invertebrate as well as non-vascular and vascular plant species available in the scientific literature, Service personnel would record LC_{50}, LD_{50}, LOEC, LOEL, NOAEC, NOAEL, or EC_{50} (environmental concentration) values in ppm or mg/L. Most common test invertebrate species available in scientific literature are the honey bee and the water flea (*Daphnia magna*). Green algae (*Selenastrum capricornutum*) and pondweed (*Lemna minor*) are frequently available test species for aquatic nonvascular and vascular plants, respectively.

D.7.7 Ecological Incident Reports

After a site has been treated with pesticide(s), wildlife may be exposed to these chemical(s). When exposure is high relative to the toxicity of the pesticides, wildlife may be killed or visibly harmed (incapacitated). Such events are called ecological incidents. The EPA maintains a database (Ecological Incident Information System) of ecological incidents. This database stores information extracted from incident reports submitted by various Federal and state agencies and non-government organizations. Information included in an incident report is date and location of the incident, type and magnitude of affects observed in various species, use(s) of pesticides known or suspected of contributing to the incident, and results of any chemical residue and cholinesterase activity analyses conducted during the investigation.

Incident reports can play an important role in evaluating the effects of pesticides by supplementing quantitative risk assessments. All incident reports for pesticide(s) with the active ingredient and associated information would be recorded.

D.7.8 Environmental Fate

D.7.8.1 Water Solubility

Service personnel would record values for water solubility (Sw), which describes the amount of pesticide that dissolves in a known quantity of water. Sw is expressed as mg/L (ppm). Pesticide Sw values would be categorized as one of the following: insoluble (less than 0.1 ppm), moderately soluble (100 to 1,000 ppm), or highly soluble (greater than 10,000 ppm) (U.S. Geological Survey 2000). As pesticide Sw increases, there would be greater potential to degrade water quality through runoff and leaching. Sw would be used to evaluate potential for bioaccumulation in aquatic species [see Octanol-Water Partition Coefficient (K_{ow}) below].

D.7.8.2 Soil Mobility

Service personnel would record available values for soil adsorption coefficient (K_{oc} [μg/g]). It provides a measure of a chemical's mobility and leaching potential in soil. K_{oc} values are directly proportional to organic content, clay content, and surface area of the soil. K_{oc} data for a pesticide may be available for a variety of soil types (e.g., clay, loam, sand). K_{oc} values would be used in evaluating the potential to degrade groundwater by leaching (see Potential to Move to Groundwater below).

D.7.8.3 Soil Persistence

Service personnel would record values for soil half-life ($t_{½}$), which represents the length of time (days) required for 50 percent of the deposited pesticide to degrade (completely or partially) in the soil. Based upon the $t_{½}$ value, soil persistence would be categorized as one of the following: non-persistent less than 30 days, moderately persistent 30 to 100 days, and persistent greater than 100 days (Kerle et al. 1996).

Threshold for Approving PUPs:

If soil $t_{½}$ 100 days or less, then a PUP would be approved without additional BMPs to protect water quality.
If soil $t_{½}$ is greater than 100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the Specific Best Management Practices (BMPs) section *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*

- *Do not use on coarse-textured soils where the groundwater table is less than 10 feet and average annual precipitation greater than 12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil $t_{½}$ values would be used in evaluating the potential to degrade groundwater by leaching (see Potential to Move to Groundwater below).

D.7.8.4 Soil Dissipation

Dissipation time (DT_{50}) represents the time required for 50 percent of the deposited pesticide to degrade and move from a treated site, whereas soil $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Field dissipation time would be the preferred data for use to estimate pesticide concentrations in the environment because it is based upon field studies compared to soil $t_{½}$, which is derived in a laboratory. However, soil $t_{½}$ is the most common persistence data available in the published literature. If field dissipation data are not available, soil half-life data would be used in a Chemical Profile. The average or representative half-life value of most important degradation mechanism would be selected for quantitative analysis for both terrestrial and aquatic environments.

Based upon the DT_{50} value, environmental persistence in the soil also would be categorized as one of the following: Non-persistent less than 30 days, moderately persistent 30 to 100 days, and persistent more than 100 days.

Threshold for Approving PUPs:

If soil DT_{50} is 100 days or less, then a PUP would be approved without additional BMPs to protect water quality.
If soil DT_{50} is greater than 100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the Specific Best Management Practices (BMPs) section *to minimize potential surface runoff and leaching that can degrade water quality:*
- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the groundwater table is less than 10 feet and average annual precipitation is greater than 12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Along with K_{oc}, soil DT_{50} values (preferred over soil $t_{½}$) would be used in evaluating the potential to degrade groundwater by leaching (see Potential to Move to Groundwater below), if available.

D.7.8.5 Aquatic Persistence

Service personnel would record values for aquatic $t_{½}$, which represents the length of time required for 50 percent of the deposited pesticide to degrade (completely or partially) in water.

Based upon the $t_{½}$ value, aquatic persistence would be categorized as one of the following: non-persistent (less than 30 days), moderately (persistent 30 to 100 days), and persistent (more than 100 days) (Kerle et. al. 1996).

Threshold for Approving PUPs:

If aquatic $t_{½}$ is 100 days or less, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic $t_{½}$ is more than 100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the Specific Best Management Practices (BMPs) section *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the groundwater table is less than 10 feet and average annual precipitation is more than 12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

D.7.8.6 Aquatic Dissipation

Dissipation time (DT_{50}) represents the time required for 50 percent of the deposited pesticide to degrade or move (dissipate), whereas aquatic $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Based upon the DT_{50} value, environmental persistence in aquatic habitats also would be categorized as one of the following: Non-persistent less than 30 days, moderately persistent 30 to 100 days, and persistent more than 100 days.

Threshold for Approving PUPs:

If aquatic DT_{50} is 100 days or less, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic DT_{50} is more than 100 days, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the Specific Best Management Practices (BMPs) section *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the groundwater table is less than 10 feet and average annual precipitation is greater than 12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

D.7.8.7 Potential to Move to Groundwater

Groundwater Ubiquity Score (GUS) = $\log_{10}(\text{soil } t_{½}) \times [4 - \log_{10}(K_{oc})]$. If a DT_{50} value is available, it would be used rather than a $t_{½}$ value to calculate a GUS score. Based upon the GUS value, the potential to move toward groundwater would be recorded as one of the following categories: extremely low potential (less than 1.0), low (1.0 to 2.0), moderate (2.0 to 3.0), high (3.0 to 4.0), or very high (more than 4.0).

Threshold for Approving PUPs:

If GUS is 4.0 or less, then a PUP would be approved without additional BMPs to protect water quality.
If GUS is more than 4.0, then a PUP would only be approved with additional BMPs specifically to protect water quality. One or more BMPs such as the following would be included in the Specific Best Management Practices (BMPs) section *to minimize potential surface runoff and leaching that can degrade water quality:*

- *Do not exceed one application per site per year.*
- *Do not use on coarse-textured soils where the groundwater table is less than 10 feet and average annual precipitation is greater than 12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

D.7.8.8 Volatilization

Pesticides may volatilize (evaporate) from soil and plant surfaces and move off-target into the atmosphere. The potential for a pesticide to volatilize is a function of its vapor pressure that is affected by temperature, sorption, soil moisture, and the pesticide's water solubility. Vapor pressure is often expressed in mm Hg. To make these values easier to compare, vapor pressure would be recorded by Service personnel in exponential form ($I \times 10^{-7}$), where I represents a vapor pressure index. In general, pesticides with I less than 10 would have low potential to volatilize; whereas, pesticides with I greater than 1,000 would have a high potential to volatilize (Oregon State University 1996). Vapor pressure values for pesticides are usually available in the pesticide product MSDS or the USDA ARS pesticide database (see References).

Threshold for Approving PUPs:

If I is 1,000 or less, then a PUP would be approved without additional BMPs to minimize drift and protect air quality.
If I is more than 1,000, then a PUP would only be approved with additional BMPs specifically to minimize drift and protect air quality. One or more BMPs such as the following would be included in the Specific Best Management Practices (BMPs) section *to reduce volatilization and potential to drift and degrade air quality:*

- *Do not treat when wind velocities are less than 2 mph or more than 10 mph with existing or potential inversion conditions.*
- *Apply the large-diameter droplets possible for spray treatments.*
- *Avoid spraying when air temperatures are higher than 85^{o}F.*
- *Use the lowest spray height possible above target canopy.*

D.7.8.9 Octanol-Water Partition Coefficient (K_{ow})

The octanol-water partition coefficient (K_{ow}) is the concentration of a pesticide in octanol and water at equilibrium at a specific temperature. Because octanol is an organic solvent, it is considered a surrogate for natural organic matter. Therefore, K_{ow} would be used to assess potential for a pesticide to bioaccumulate in tissues of aquatic species (e.g., fish). If K_{ow} is greater than 1,000 or Sw is less than 1 mg/L and soil $t_{½}$ is greater than 30 days, then there would be high potential for a pesticide to bioaccumulate in aquatic species such as fish (U.S. Geological Survey 2000).

Threshold for Approving PUPs:

If there is not a high potential for a pesticide to bioaccumulate in aquatic species, then the PUP would be approved.
If there is a high potential to bioaccumulate in aquatic species (K_{ow} greater than 1,000 or Sw less than 1 mg/L and soil $t_{½}$ is greater than 30 days), then the PUP would not be approved, except under unusual circumstances where approval would only be granted by the Washington Office.

D.7.8.10 Bioaccumulation/Bioconcentration

Bioconcentration is the physiological process where pesticide concentrations in tissue would increase in biota because they are taken and stored at a faster rate than they are metabolized or excreted. The potential for bioaccumulation would be evaluated through bioaccumulation factors (BAFs) or bioconcentration factors (BCFs). Based upon BAF or BCF values, the potential to bioaccumulate would be recorded as one of the following: low (0 to 300), moderate (300 to 1,000), or high (greater than 1,000) (Calabrese and Baldwin 1993).

Threshold for Approving PUPs:

If BAF or BCF is 1,000 or less, then a PUP would be approved without additional BMPs.
If BAF or BCF is greater than 1,000, then a PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

D.7.9 Worst-Case Ecological Risk Assessment

D.7.9.1 Max Application Rates (Acid Equivalent)

Service personnel would record the highest application rate of an active ingredient (ae basis) for habitat management and cropland/facilities maintenance treatments in this data field of a Chemical Profile. These rates can be found in Table CP.1 under the column heading "Max Product Rate–Single Application (lbs/acre–AI on acid equiv basis)". This table would be prepared for a chemical profile from information specified in labels for trade name products identified in PUPs. If these data are not available in pesticide labels, then "NS" for "not specified on label" would be written in this table.

D.7.9.2 EECs

An estimated environmental concentration (ECC) represents potential exposure to fish and wildlife (birds and mammals) from using a pesticide. EECs would be derived by Service personnel using an EPA screening-level approach (EPA 2004). For each max application rate [see description under Max Application Rates (acid equivalent)], Service personnel would record two EEC values in a Chemical Profile; these would represent the worst-case terrestrial and aquatic exposures for habitat management and croplands/facilities maintenance treatments. For terrestrial and aquatic EEC calculations, see description for data entry under Presumption of Unacceptable Risk/Risk Quotients, which is the next field for a Chemical Profile.

D.7.9.3 Presumption of Unacceptable Risk/Risk Quotients

Service personnel would calculate and record acute and chronic RQs for birds, mammals, and fish using the provided tabular formats for habitat management and/or cropland/facilities maintenance treatments. RQs recorded in a Chemical Profile would represent the worst-case assessment for ecological risk. See Section D.7.2 for discussion regarding the calculations of RQs.

For aquatic assessments associated with habitat management treatments, RQ calculations would be based upon selected acute and chronic toxicological endpoints for fish and the EEC would be derived from Urban and Cook (1986) assuming 100 percent overspray to an entire 1-foot deep water body using the max application rate (ae basis [see above]).

For aquatic assessments associated with cropland/facilities maintenance treatments, RQ calculations would be done by Service personnel based upon selected acute and chronic toxicological endpoints for fish and an EEC would be derived from the aquatic assessment in AgDRIFT® model version 2.01 under Tier I ground-based application with the following input variables: max application rate (acid basis [see above]), low boom (20 inches), fine to medium/coarse droplet size, 20 swaths, EPA-defined wetland, and 25-foot distance (buffer) from treated area to water.

See Section D.7.2.1 for more details regarding the calculation of EECs for aquatic habitats for habitat management and cropland/facilities maintenance treatments.

For terrestrial avian and mammalian assessments, RQ calculations would be done by Service personnel based upon dietary exposure, where the “short grass” food item category would represent the worst-case scenario. For terrestrial spray applications associated with habitat management and cropland/facilities maintenance treatments, exposure (EECs and RQs) would be determined using the Kanaga nomogram method through the EPA’s T-REX version 1.2.3. T-REX input variables would include the following: max application rate (acid basis [see above]) and pesticide half-life (days) in soil to estimate the initial, maximum pesticide residue concentration on general food items for terrestrial vertebrate species in short (shorter than 20 cm tall) grass.

For granular pesticide formulations and pesticide-treated seed with a unique route of exposure for terrestrial avian and mammalian wildlife, see Section D.7.2.1 for the procedure that would be used to calculate RQs.

All calculated RQs in both tables would be compared with LOCs established by the EPA (see Table D.2 in Section D.7.2). If a calculated RQ exceeds an established LOC value (in brackets inside the table), then there would be a potential for an acute or chronic effect (unacceptable risk) to federally listed (T&E) species and nonlisted species. See Section D.7.2 for detailed descriptions of acute and chronic RQ calculations and comparison to LOCs to assess risk.

Threshold for approving PUPs:

If RQs are less than or equal to LOCs, then a PUP would be approved without additional BMPs. If RQs are greater than LOCs, then a PUP would only be approved with additional BMPs specifically to minimize exposure (ecological risk) to bird, mammal, and/or fish species. One or more BMPs such as the following would be included in the Specific Best Management Practices (BMPs) section *to reduce potential risk to nonlisted or listed species:*

- *Lower application rate and/or fewer number of applications to RQs less than or equal to LOCs*
- *For aquatic assessments (fish) associated with cropland/facilities maintenance, increase the buffer distance beyond 25 feet so RQs less than or equal to LOCs.*

D.7.9.4 Justification for Use

Service personnel would describe the reason for using the pesticide based control of specific pests or groups of pests. In most cases, the pesticide label will provide the appropriate information regarding control of pests to describe in the section.

D.7.9.5 Specific Best Management Practices

Service personnel would record specific BMPs necessary to minimize or eliminate potential effects to nontarget species and/or degradation of water quality from drift, surface runoff, or leaching. These BMPs would be based upon scientific information documented in previous data fields of a Chemical Profile. Where necessary and feasible, these specific practices would be included in PUPs as a basis for approval.

If there are no specific BMPs that are appropriate, Service personnel would describe why the potential effects to refuge resources and/or degradation of environmental quality is outweighed by the overall resource benefit(s) from the proposed pesticide use in the BMP section of the PUP. See Section D.4 of this document for a complete list of BMPs associated with mixing and applying pesticides appropriate for all PUPs with ground-based treatments that would be additive to any necessary, chemical-specific BMPs.

D.7.9.6 Data Resources

Service personnel would record scientific resources used to provide data/information for a chemical profile. The number sequence below would be used to uniquely reference data in a chemical profile. The following online data resources are readily available for toxicological endpoint and environmental fate data for pesticides:

1. California Product/Label Database. Department of Pesticide Regulation, California Environmental Protection Agency. (http://www.cdpr.ca.gov/docs/label/labelque.htm#regprods)

2. ECOTOX database. Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C. (http://cfpub.epa.gov/ecotox/)

3. Extension Toxicology Network (EXTOXNET) Pesticide Information Profiles. Cooperative effort of University of California-Davis, Oregon State University, Michigan State University, Cornell University, and University of Idaho through Oregon State University, Corvallis, Oregon. (http://extoxnet.orst.edu/pips/ghindex.html)

4. FAO specifications and evaluations for plant protection products. Pesticide Management Unit, Plant Protection Services, Food and Agriculture Organization, United Nations. (http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/Pesticid/)

5. Human health and ecological risk assessments. Pesticide Management and Coordination, Forest Health Protection, USDA, U.S. Forest Service. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm)

6. Pesticide Chemical Fact Sheets. Clemson University Pesticide Information Center. (http://entweb.clemson.edu/pesticid/Document/Labels/factshee.htm)

7. Pesticide Fact Sheets. Published by Information Ventures, Inc. for Bureau of Land Management, Deptartment of Interior; Bonneville Power Administration, U.S. Dept. of Energy; and U.S. Forest Service, USDA. (http://infoventures.com/e-hlth/pesticide/pest-fac.html)

8. Pesticide Fact Sheets. National Pesticide Information Center. (http://npic.orst.edu/npicfact.htm)

9. Pesticide Fate Database. U.S. Environmental Protection Agency, Washington, D.C. (http://cfpub.epa.gov/pfate/home.cfm).

10. Pesticide product labels and material safety data sheets. Crop Data Management Systems, Inc. (CDMS) (http://www.cdms.net/pfa/LUpdateMsg.asp) or multiple websites maintained by agrichemical companies.

11. Registered Pesticide Products (Oregon database). Oregon Department of Agriculture. (http://www.oda.state.or.us/dbs/pest_products/search.lasso)

12. Regulatory notes. Pest Management Regulatory Agency, Health Canada, Ontario, Canada. (http://www.hc-sc.gc.ca/pmra-arla/)

13. Reptile and Amphibian Toxicology Literature. Canadian Wildlife Service, Environment Canada, Ontario, Canada. (http://www.cws-scf.ec.gc.ca/nwrc-cnrf/ratl/index_e.cfm)

14. Specific Chemical Fact Sheet – New Active Ingredients, Biopesticide Fact Sheet and Registration Fact Sheet. U.S Environmental Protection Agency, Washington, DC. (http://www.epa.gov/pestidides/factsheets/chemical_fs.htm)

15. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas. The Invasive Species Initiative. The Nature Conservancy. (http://tnsweeds.ucdavis.edu/handbook.html)

16. Wildlife Contaminants Online. U.S. Geological Survey, Department of Interior, Washington, D.C. (http://www.pwrc.usgs.gov/contaminants-online/)

17. One-liner database. 2000. U.S. Environmental Protection Agency, Office of Pesticide Programs, Washington, D.C.

Chemical Profile

Date:			
Trade Name(s):		**Common Chemical Name(s):**	
Pesticide Type:		**EPA Registration Number:**	
Pesticide Class:		**CAS Number:**	
Other Ingredients:			

Toxicological Endpoints

Mammalian LD_{50}:	
Mammalian LC_{50}:	
Mammalian Reproduction:	
Avian LD_{50}:	
Avian LC_{50}:	
Avian Reproduction:	
Fish LC_{50}:	
Fish ELS/Life Cycle:	
Other:	

Ecological Incident Reports

Environmental Fate

Water solubility (S_w):	
Soil Mobility (K_{oc}):	
Soil Persistence ($t_{½}$):	
Soil Dissipation (DT_{50}):	
Aquatic Persistence ($t_{½}$):	
Aquatic Dissipation (DT_{50}):	
Potential to Move to Groundwater (GUS score):	
Volatilization (mm Hg):	
Octanol-Water Partition Coefficient (K_{ow}):	
Bioaccumulation/Biocentration:	**BAF:`** **BCF:**

Worst Case Ecological Risk Assessment

Max Application Rate (ai lbs/acre – ae basis)	**Habitat Management:** **Croplands/Facilities Maintenance:**
EECs	**Terrestrial (Habitat Management):** **Terrestrial (Croplands/Facilities Maintenance):** **Aquatic (Habitat Management):** **Aquatic (Croplands/Facilities Maintenance):**

Habitat Management Treatments:

Presumption of Unacceptable Risk		Risk Quotient (RQ)	
		Listed (T&E) Species	Nonlisted Species
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish (100% overspray)	[1]	[1]

Cropland/Facilities Maintenance Treatments:

Presumption of Unacceptable Risk		Risk Quotient (RQ)	
		Listed (T&E) Species	Nonlisted Species
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish	[1]	[1]

Justification for Use:	
Specific Best Management Practices (BMPs):	
References:	

Table CP.1 Pesticide Name

Trade Name [a]	Treatment Type [b]	Max Product Rate – Single Application (lbs/acre or gal/acre)	Max Product Rate - Single Application (lbs/acre - AI on acid equiv basis)	Max Number of Applications Per Season	Max Product Rate Per Season (lbs/acre/season or gal/acre/ season)	Minimum Time Between Applications (Days)

[a]From each label for a pesticide identified in pesticide use proposals (PUPs), Service personnel would record application information associated with possible/known uses on Service lands.
[b]Treatment type: H – habitat management or CF – cropland/facilities maintenance. If a pesticide is labeled for both types of treatments (uses), then record separate data for H and CF applications.

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Appendix E. Wilderness Inventory for the Lewis and Clark National Wildlife Refuge

E.1 Introduction

The Lewis and Clark Refuge's acquisition boundary encompasses 33,000 acres of the Columbia River estuary, including 18 named islands and several unnamed islands sand bars, mud flats, intertidal marshes, and areas of open water in northern Clatsop County, Oregon. The refuge also includes three small parcels on the Oregon mainland at Tongue Point, Emerald Heights, and Brownsmead.

The Service and the state of Oregon share ownership within the refuge's land acquisition boundary; however because the river is constantly in flux, acreage figures are not entirely accurate. According to the original realty records, the Service owns approximately 12,167 acres in the lower Columbia River estuary with the remainder of the slightly over 21,000 acres consisting of mostly tidelands and a few uplands owned by the state of Oregon. However, recent GIS mapping of the area based on the approximate high tide line delineated using color-infrared photos taken on May 20, 2001, around the 1:00 p.m. tide (taken from Astoria Tongue Point site) reveals that the total acreage for Service-owned uplands (i.e., areas above the approximate high tide line) is 6,934 acres with the remainder consisting of either tidelands or permanent channels and waterways.

At one time the refuge had agreements with both the State and County to manage their public lands which were within the refuge's acquisition boundary. Both agreements have expired, with Clatsop County donating all county lands to the refuge (see Section 1.6.1 in the CCP/EIS). The refuge is managed by the Service and is one of more than 550 national wildlife refuges in the United States.

E.1.1 Policy and Direction for Wilderness Reviews

Service policy (Sec 602, also Sec 610 of Refuge Manual) requires wilderness reviews to be completed as part of the CCP planning process. A wilderness review is the process we use to determine whether or not we should recommend to the U.S. Congress that Refuge System lands and waters should be designated wilderness. The wilderness review process consists of three phases: inventory, study, and recommendation. The inventory is a broad look at the refuge to identify lands and waters that meet the minimum criteria for wilderness. All areas meeting the criteria are classified as Wilderness Study Areas (WSAs). If WSAs are identified, the review moves on to the study phase.

During the study phase, WSAs are further analyzed for all values (ecological, recreational, cultural), resources (wildlife, water, vegetation, minerals, soils), and uses (management and public) within the WSA. The findings of the study determine whether or not the WSAs merit recommendation for inclusion in the Wilderness System or should be managed under an alternate set of goals and objectives that do not involve wilderness designation.

The final phase, the recommendation phase consists of forwarding or reporting any wilderness recommendations from the Service's Director through the Interior Secretary and the President to Congress in a wilderness study report. Congress has reserved the authority to make final decisions on wilderness designations. The wilderness study report would be prepared after the Record of Decision for the Final CCP/EIS has been signed.

If it were determined during the inventory that no areas qualify as WSAs or if it were concluded from the study that we should not recommend any areas as wilderness, we would prepare a brief report that documents the unsuitability of the lands and waters for wilderness study or recommendation. That report would be submitted to the Director.

E.1.2 Previous Wilderness Reviews

There have been no previous Wilderness Reviews conducted on this refuge.

E.1.3 Lands Considered Under This Wilderness Review

All Service-managed lands (areas under fee title or agreement) within the Lewis and Clark Refuge's current approved boundaries were considered during the inventory of wilderness areas. This is consistent with current policy. These lands include 18 named islands and several unnamed islands and sandbars in the lower Columbia River between Skamokawa, Washington, and Astoria, Oregon. In addition, three mainland parcels of land—one near Knappa and two near Astoria, Oregon—were also considered because they are part of the refuge.

E.2 Wilderness Inventory

E.2.1 Criteria for Lands to Be Identified as for Potential Inclusion in the National Wilderness Preservation System

Criteria for identifying areas as wilderness are described further on in Section 2(c) of the Act, and are elaborated upon in the Service Wilderness Management Policy (610 FW 1-5). We inventory Refuge System lands and waters to identify areas that meet the definition of wilderness in Section 2(c) of the Wilderness Act.

(1) Size, an area meets the size criterion if it:
- has no permanent roads and is 5,000 contiguous acres or more;
- has no permanent roads and is of sufficient size as to make practicable its preservation and use in an unimpaired condition; or
- is a roadless island.

(2) Naturalness, an area meets the naturalness criterion if it would look fairly natural to the average visitor who would not realize that historic conditions of the ecosystem had been modified by humans. This means that an area:
- that was once logged, used for agriculture, or otherwise significantly altered by humans may be eligible for wilderness designation if it now appears substantially natural.

- that contains trails, trail signs, bridges, fire towers, fire breaks, stream barriers, snow gauges, research monitoring markers air quality monitoring devices, fencing, spring developments, and similar human impacts may be eligible.
- exposed to the "sights and sounds" of civilization located outside the areas (e.g., overhead airplanes, a view of a city or town in the distance, boat traffic on an adjacent river) may be eligible.
- with established or proposed refuge management activities or refuge uses that require the prohibited uses of Sec. 4 (c) may be eligible.

(3) Opportunities for solitude or primitive and unconfined recreation, an area meets these criterion if it offers:

- outstanding opportunities for solitude—visitors can experience nature essentially free of the reminders of society; or
- outstanding opportunities for primitive and unconfined recreation—dispersed, undeveloped recreation not requiring prohibited uses.

Outstanding opportunities do not have to be present on every acre and the area does not have to be open to public entry and use. At the end of the inventory, we may have identified no, one, or several Wilderness Study Areas based on the above criteria.

E.2.2 Process of Analysis

In February of 2006, the CCP team began the inventory phase of the wilderness review by visiting most of the refuge islands and completing a preliminary assessment and documenting the team findings. The following process was used to evaluate refuge lands and waters for their suitability for wilderness designation.

- Refuge unit sizes were determined.
- For any area that met the size criterion, an assessment was made of its capacity to provide opportunities for solitude or primitive and unconfined recreation.
- For any area that met the size criterion, an assessment was made of its naturalness.
- For any area that met the size criterion, an assessment was made of its features of scientific, educational, scenic, or historic value.

More detail on the actual factors considered used for each assessment step follows.

E.2.2.1 Identification of Roadless Areas and Roadless Islands

Identification of roadless areas and roadless islands required gathering land status maps, land use and road inventory data, and aerial photographs of existing refuge mainland tracts and islands. "Roadless" refers to the absence of improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use. Only lands currently owned by the Service in fee title were evaluated. The Tongue Point Unit did not meet the roadless criterion. The Emerald Heights Unit and Brownsmead Unit as well as the river islands did meet the roadless criterion.

E.2.2.2 Unit Size

Roadless areas met the size criterion if any one of the following standards applied.

- An area with over 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- 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.
- 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.
- An area of less than 5,000 contiguous Federal 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.

Both management roads and public access roads were considered as roads. Rail beds were also considered to comprise roads, since they are permanent structures. None of the refuge mainland units (Tongue Point Unit, Emerald Heights Unit, Brownsmead Unit), met the 5,000-acre size criterion but all of the refuge islands did meet the roadless island of any size criterion. This group of nearly 20 islands, collectively called the Lewis and Clark Islands, vary in acreage from approximately 1.5 acres on one unnamed island to approximately 1,095 acres for Karlson Island.

E.2.2.3 Solitude or Primitive and Unconfined Recreation:

A WSA must provide outstanding opportunities for solitude or primitive 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 criterion; 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 opportunities “elements” are not well defined by the Wilderness Act but, in most cases, can be expected to occur together. 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.

In the wilderness inventory for the roadless islands on the Lewis and National Wildlife Refuge, the following factors were the primary considerations in evaluating the availability of outstanding opportunities for solitude or primitive and unconfined recreation:

- Island size;
- Availability of vegetative screening;
- Presence of motorized boats or vehicles within the area or typically used to access the area; and
- Noise levels from motorized boats or vehicles.

Most of the Lewis and Clark Islands appear to have some degree of solitude and while a few of the islands are rather small, taken as a whole the islands within the refuge do provide a degree of solitude that would appear to meet with the objectives of the Wilderness Act. All of the islands have opportunities for unconfined recreation; however, access to the interior of several of the islands can be difficult due to tall dense vegetation and/or daily tidal inundation.

Two of the mainland units (Brownsmead and Emerald Heights) do not meet the solitude designation due to their locations immediately adjacent to highways and structures that combined with their limited size make it unlikely that visitors could find outstanding opportunities for solitude or primitive recreation. One unit, Tongue Point, has the potential for both because its location adjacent to the lower Columbia River and its topography help to shield it from the adjacent Jobs Corps and Coast Guard facilities.

E.2.2.4 Naturalness

In addition to being roadless, a WSA must meet the naturalness criterion. 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 man’s 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 human-caused hazards, such as the presence of unexploded ordnance from military activity, and the physical impacts of refuge management facilities and activities are also considered in evaluation of the naturalness criterion. 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.

In this wilderness inventory, the following factors were primary considerations in evaluating naturalness:

- Presence of buildings or facilities;
- Presence of irrigation structures and/or crops;
- Presence of water control structures or dikes; and
- Presence of motorized boats or vehicles.

The three mainland units; Tongue Point, Emerald Heights and Brownsmead units all have human-made structures and/or roads either on or directly adjacent to those properties which would disqualify them via the naturalness criterion. In addition, the Brownsmead Unit has active ongoing management of habitat that includes grazing of cattle and mowing of pasturelands. The

Emerald Heights Unit encompasses a second-growth fir forest and a large apartment complex; a road system is located directly adjacent to the unit. At the Tongue Point Unit an old fueling tank and machinery gun range from World War II are located on the property.

The river islands appear to qualify under the definition of natural. There are no structures on any of the Service-owned portions of the islands, and there are essentially in the same natural condition as they were during the Lewis and Clark Expedition, which came through this area from 1805 to 1806.

The only nonnatural conditions are at the old diked portion of Karlson Island, in one area at Marsh Island, and adjacent to Miller Sands and Welch Island. A portion of Karlson Island was managed as a farm until the early 1970s when it was sold to the Service. At that time sections of the dike breached allowing the daily tidal cycles of the Columbia River to once again flood the area. While portions of the dike and old wooden fences are still visible, the essential character of this 1,095-acre island remains wild and natural and will be included in the wilderness study.

Areas adjacent to two islands, Miller Sands and Welch Island, have large sand spits made up of dredge spoil materials. Both these dredge spoil islands are owned by the state of Oregon and will be excluded from potential wilderness study. In addition, about 30 percent of Marsh Island (approximately 280 acres) is owned and managed by the Oregon Department of State Lands (ODSL). One floating recreational cabin is currently located on the ODSL parcel at Marsh Island. This structure is slated to be removed from the upland portion of the island at some point in the future, according to ODSL personnel.

Depending on the refuge visitor’s location and the various island locations, presence and visibility of boat traffic, the noise from boat traffic can vary and depend upon several factors from weather conditions and the time of year. During the summer months recreational motorized boat traffic increases as compared to the winter months. The U.S. Coast Guard does not maintain boater use statistics within this area of the Columbia River. The larger shipping channel traffic has a daily presence on the river. These ships can be seen from a long distance and from many of the island shorelines. Dense vegetation on many of the islands makes viewing boats very unlikely along all areas but the immediate shorelines.

E.2.2.5 Features of value

Wilderness areas may contain other values or features, including ecological, geological, scientific, educational, scenic or historical values. These values or features are not required for designation. Where appropriate these items are listed on the maps for each of the islands. Features of value that are located on the refuge include a variety of unique wildlife and habitats which occur in the lower Columbia River estuary

E.2.2.6 Preliminary Inventory Results

Based on this preliminary inventory, all of the refuge owned islands inside the refuge boundary appear to possess wilderness qualities. After public review and comment on the Draft CCP/EIS, the Service has identified in the Final CCP which refuge islands if any, will be the subject of a subsequent wilderness study. The wilderness study, which will be available for public review, will then identify, if warranted, Wilderness Study Areas. If warranted, the Service's Director will make suitable wilderness recommendations to the Secretary of the Interior, the President, and Congress.

Table E.1 Results of Wilderness Inventory for Lewis and Clark Refuge

Area	Unit Acres	Meets Island and/or Size Criterion	Meets Solitude/ Primitive Recreation Criterion	Meets Naturalness Criterion	Meets Supple-mental Values Criterion (optional)	Preliminary Conclusion: Suitable for further consideration in Wilderness study.
Brownsmead Unit	45	No	No	No	No	No
Tongue Point Unit	121	No	Yes	Yes	Yes	No
Emerald Heights Unit	89	No	No	No	Yes	No
Russian Island	866	Yes	Yes	Yes	Yes	Yes
Minaker Island	186	Yes	Yes	Yes	Yes	Yes
Welch Island	796	Yes	Yes	Yes	Yes	Yes
Lois Island	487	Yes	Yes	Yes	Yes	Yes
Karlson Island	1,095	Yes	Yes	Yes	Yes	Yes
Grassy Island (West)	36	Yes	Yes	Yes	Yes	Yes
Seal Island	181	Yes	Yes	Yes	Yes	Yes
McGregor Island	8	Yes	Yes	Yes	Yes	Yes
Green Island	112	Yes	Yes	Yes	Yes	Yes
Marsh Island	842	Yes	Yes	Yes	Yes	Yes
Horseshoe Island	565	Yes	Yes	Yes	Yes	Yes
Brush Island	112	Yes	Yes	Yes	Yes	Yes
Snag Islands	60	Yes	Yes	Yes	Yes	Yes
Tronson Island	128	Yes	Yes	Yes	Yes	Yes
Quinns Island	373	Yes	Yes	Yes	Yes	Yes
Goose Island	25	Yes	Yes	Yes	Yes	Yes
Woody Island	208	Yes	Yes	Yes	Yes	Yes
Miller Sands	178	Yes	Yes	Yes	Yes	Yes
Grassy Island (East)	62	Yes	Yes	Yes	Yes	Yes
Fitzpatrick Island	20	Yes	Yes	Yes	Yes	Yes
Unnamed Islands and Sandbars	405	Yes	Yes	Yes	Yes	Yes

All island acreages were calculated in GIS based on the approximate high tide line delineated using color-infrared photos taken on May 20, 2001, around the 1:00 p.m. tide (taken from Astoria Tongue Point site). Acreages for the mainland units are based on information available in the Service's Division of Realty and Refuge Information.

E.2.3 Wilderness Study Area Designation

Based on the above inventory for the Lewis and Clark Refuge, one WSA, the Lewis and Clark River Islands, consisting of 6,745 acres has been identified. This resulting WSA will be further studied to determine if it merits recommendation from the Service to the Secretary of the Interior for inclusion in the National Wilderness Preservation System (NWPS). The WSA designation means that we will be studying the area for consideration as wilderness and that in the meantime, we will maintain and protect wilderness characters of the WSA. This wilderness study phase will be completed by 2015.

Appendix F. Wilderness Inventory for the Julia Butler Hansen Refuge for the Columbian White-tailed Deer

F.1 Introduction

The Julia Butler Hansen Refuge for the Columbian White-tailed Deer (Julia Butler Hansen Refuge, Refuge) was established in 1971 to protect and manage habitat for the Columbian white-tailed deer (CWT deer). The refuge contains over 6,000 acres of fields, forested tidal swamps, brushy woodlots, marshes, and sloughs along the lower Columbia River in both Washington and Oregon. Virtually all refuge lands were originally intertidal wetlands; some areas were diked, drained, and converted to uplands early in the twentieth century. The principal units of the refuge are the Mainland Unit, Hunting Islands, Price Island, Tenasillahe Island, Wallace Island and Crims Island. There are also some small scattered tracts of land located in Oregon including the 47-acre Kinnunen Cut, 3.55 acres on Anunde Island, and 145 acres on the Oregon mainland in the vicinity of Westport, Oregon. The refuge is managed by the Service and is one of more than 500 national wildlife refuges in the United States.

F.1.1 Policy and Direction for Wilderness Reviews

Wilderness review is the process used to determine whether or not to recommend lands or waters in the Refuge System to the U.S. Congress for designation as wilderness. Planning policy for the Refuge System (602 FW 3) mandates conducting wilderness reviews every 15 years through the CCP planning process.

The wilderness review process has three phases: wilderness inventory, wilderness study, and wilderness recommendation. After first identifying lands and waters that meet the minimum criteria for wilderness (inventory phase), the resulting Wilderness Study Areas (WSAs) are further studied to determine if they merit recommendation from the Service to the Secretary of the Interior for inclusion in the National Wilderness Preservation System (NWPS). Areas recommended for designation are managed to maintain wilderness character in accordance with management goals, objectives, and strategies outlined in the final CCP/EIS until Congress makes a decision or the CCP is amended to modify or remove the wilderness proposal. A brief discussion of wilderness study and recommendation follows.

During the study phase, WSAs are analyzed for all values (ecological, recreational, cultural), resources (wildlife, water, vegetation, minerals, soils), and uses (management and public) within the WSA. The purpose of the study is to determine each WSA’s suitability for management as wilderness in light of its primary purpose(s) as a refuge. The findings of the study determine whether or not the WSAs merit recommendation for inclusion in the Wilderness System or should be managed under an alternate set of goals, objectives, and strategies/actions that do not involve wilderness designation.

If the wilderness study determines that a WSA meets the requirements for inclusion in the NWPS, a wilderness study report that presents the results of the wilderness review, accompanied by a Legislative Environmental Impact Statement (LEIS), is prepared. The wilderness study report and LEIS that support wilderness designation are then transmitted through the Secretary of the Interior to the President, and ultimately to Congress for action.

If it were determined during the inventory that no areas qualify as WSAs or if it were concluded from the study that we should not recommend any areas as wilderness, we would prepare a brief report that documents the unsuitability of the lands and waters for wilderness study or recommendation. That report would be submitted to the Service's Director. This appendix includes the inventory of the wilderness review for the Julia Butler Hansen Refuge for the Columbian White-tailed Deer.

F.1.2 Previous Wilderness Reviews

There have been no previous wilderness reviews conducted on this refuge.

F.1.3 Lands Considered Under This Wilderness Review

All Service-owned lands and waters within the approved boundary of the Julia Butler Hansen Refuge for the Columbian White-tailed Deer were considered during the inventory of wilderness areas. This is consistent with current Service policy. These lands included the Mainland Unit near Cathlamet, Washington, and several parcels near Westport, Oregon and several Columbia River islands. Each refuge tract/unit is listed in Table F.1 and described in the CCP/EIS in Chapter 3.

F.2 Wilderness Inventory

F.2.1 Criteria for Lands to Be Identified for Potential Inclusion in the National Wilderness Preservation System

The Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136) provides the following description of wilderness: "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions.

The following criteria for identifying areas as wilderness are described further in Section 2(c) of the Act, and are elaborated upon in the Service Wilderness Management Policy (610 FW 1-5). We inventory Refuge System lands and waters to identify areas that meet the definition of wilderness in Section 2(c) of the Wilderness Act.

(1) Size, an area meets the size criterion if it:

- has no permanent roads and is 5,000 contiguous acres or more;
- has no permanent roads and is of sufficient size as to make practicable its preservation and use in an unimpaired condition; or

- is a roadless island.

(2) Naturalness, an area meets the naturalness criterion if it would look fairly natural to the average visitor who would not realize that historic conditions of the ecosystem had been modified by humans. This means that an area:

- that was once logged, used for agriculture, or otherwise significantly altered by humans may be eligible for wilderness designation if it now appears substantially natural;
- that contains trails, trail signs, bridges, fire towers, fire breaks, stream barriers, snow gauges, research monitoring markers air quality monitoring devices, fencing, spring developments, and similar human impacts may be eligible;
- exposed to the "sights and sounds" of civilization located outside the areas (e.g., overhead airplanes, a view of a city or town in the distance, boat traffic on an adjacent river) may be eligible; and
- with established or proposed refuge management activities or refuge uses that require the prohibited uses of Section 4 (c) may be eligible.

(3) Opportunities for solitude or primitive and unconfined recreation, an area meets these criterion if it offers:

- outstanding opportunities for solitude—visitors can experience nature essentially free of the reminders of society, or
- outstanding opportunities for primitive and unconfined recreation—dispersed, undeveloped recreation not requiring prohibited uses.

Outstanding opportunities do not have to be present on every acre and the area does not have to be open to public entry and use. At the end of the inventory, we may have identified no, one, or several Wilderness Study Areas based on the above criteria.

F.2.2 Process of Analysis

In February of 2006 the CCP team began the inventory phase of the wilderness review by visiting most of the refuge islands and completing a preliminary assessment and documenting the team findings. The following evaluation process was used in identifying their suitability for wilderness designation.

- Refuge unit sizes were determined.
- For any area that met the size/island criterion, an assessment was made of its naturalness.
- For any area that met the size/island criterion, an assessment was made of its capacity to provide opportunities for solitude or primitive and unconfined recreation.
- For any area that met the size/island criterion, an assessment was made of its features of scientific, educational, scenic, or historic value.

More detail on the actual factors considered and used for each assessment step follows.

F.2.2.1 Identification of Roadless Areas and Roadless Islands

Identification of roadless areas and roadless islands required gathering land status maps, land use and road inventory data, and aerial photographs of existing refuge mainland tracts and islands.

"Roadless" refers to the absence of improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use. Only lands currently owned by the Service in fee title were evaluated.

Both the Mainland Unit and Tenasillahe Island Unit have dike-top roads that surround each area along with management roads which bisect each unit. The roads on Tenasillahe Island are utilized by staff for necessary management purposes. This includes use of heavy equipment, tractors, ATVs, and trucks to maintain marshes, conduct farming activities, monitor wildlife, control invasive plants, maintain roads, and other infrastructure. The Mainland Unit roads are also used to access management areas with heavy equipment. The county roads that bisect the refuge Mainland Unit are open to and utilized by the traveling public and refuge visitors alike.

Hunting Islands, Price Island, Wallace Island, Crims Island, Kinnunen Cut, Anunde Island, and the Westport Unit were evaluated and determined to be roadless, for wilderness inventory purposes.

F.2.2.2 Unit Size

Roadless areas that met the size criterion, if any one of the following standards is applied:

- An area with at least 5,000 contiguous acres. Lands owned by States, local governments, and private parties are not included in making this acreage determination.

- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or an area that is markedly distinguished from the surrounding lands by topographical or ecological features.

- 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.

- An area of less than 5,000 contiguous Federal 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.

Both management roads and public access roads were considered as roads. Rail-beds were also considered to comprise roads, since they are permanent structures. None of the units meet the 5,000-acre size criterion but several island/units did meet the roadless-island-of-any-size criterion. These areas include:

- Price Island (57 Service-owned acres, 126 acres total)
- Crims Island (473 Service-owned acres, 695 acres total)
- Hunting Islands (765 Service-owned acres, 64.5 clouded title acres, 900 acres total)
- Wallace Island (579 acres, Service-owned island)
- Anunde Island (3.55 Service-owned acres, 102 acres total)

- Kinnunen Cut (is not being considered because it is a human-made cut, which was previously part of the Oregon mainland)

Service-owned and clouded title acreages were derived from realty records. Total island acreages were calculated in GIS based on interpretation from 2003, 2005, and 2006 aerial photography.

F.2.2.3 Solitude or Primitive and Unconfined Recreation

A WSA must provide outstanding opportunities for solitude or primitive 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 these criteria; Congress has designated a number of wilderness areas in the Refuge System that are closed to public access to protect natural 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. In some cases, they occur together. 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 recreational use that experiencing solitude is not an option.

In the wilderness inventory for the roadless islands on the Julia Butler Hansen Refuge, the following factors were the primary considerations in evaluating the availability of outstanding opportunities for solitude or primitive and unconfined recreation:

- Island size;
- Availability of vegetative screening;
- Presence of motorized boats or vehicles within the area or typically used to access the area; and
- Noise levels from motorized boats or vehicles.

Opportunities for solitude and primitive recreation were judged to be less than outstanding on Anunde Island; Kinnunen Cut; Crims Island; and Price Island. Anunde Island and the Kinnunen Cut are located at the confluence of the Clatskanie and Columbia rivers. This area is a major access point for boaters on their way to and from the Columbia River. Although it appears to be naturally occurring island, the “cut” in the Kinnunen Cut name refers to a human-made ditch, which created the island. The refuge owns a very small portion of Anunde Island (only 3.55 acres of over 20 acres). These refuge lands are all surrounded by farms which are actively managed.

Crims Island has recently benefited from a substantial wetland restoration project, and vegetative screening is minimal on the 120-acre restoration site. Evidence of the restoration is considerable; plants have yet to be fully established and the restoration project may need further work to achieve success. Private ownership of a portion of the island includes approximately 44 acres in the north central portion of the island, and 100 acres in the northwest portion. Once wetland and riparian vegetation becomes well established, there will be potential for opportunities for solitude on the refuge's 473 acres.

On Price Island the Service currently owns 57 acres, or roughly half of the 126-acre island; the other approximately 69 acres belongs to Wahkiakum County. If in the future, the land status of Price Island changes and is under control of the Service, the roughly 69-acre parcel should be reviewed and studied for potential consideration as wilderness. Due to Price Island's relatively small size and narrow width, it is more difficult to get a sense of solitude due to nearby boat traffic which is used by both commercial and private boaters on the mainstem of the Columbia River. Also, the Service-owned parcel is adjacent to Vista Park and the town of Skamokawa which support a moderate amount of boating traffic that can be seen and heard from most parts of the island.

Two of the islands, Wallace and Hunting, meet the solitude/primitive recreation criterion. Both islands offer waterfowl hunting opportunities in the fall/winter from the shorelines accessed by boat only. They offer an opportunity for exploration during which a visitor would likely find complete solitude. The size and vegetative cover on both of these islands supports the areas being considered as wilderness areas.

F.2.2.4 Naturalness and Wildness

In addition to being roadless, a wilderness area must meet the naturalness and wildness criterion. 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 man's work substantially unnoticeable." If not pristine, an area must at least appear natural to the average visitor. 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 human-caused hazards, such as the presence of unexploded ordnance from military activity, and the physical impacts of refuge management facilities and activities are also considered in evaluation of the naturalness criterion. 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. In this wilderness inventory, the following factors were primary considerations in evaluating naturalness:

- Presence of buildings or facilities;
- Presence of irrigation structures and/or crops;
- Presence of water control structures or dikes; and
- Presence of motorized boats or vehicles.

Wallace Island: This 597-acre island includes remnants of a small fenced area and a dilapidated shed. At one time pigs were released to roam the island. Roads, if there were any, have disappeared with natural forest succession and there is little if any evidence remaining. The islands forest was selectively logged over 25 years ago and natural forest succession continues to leave little evidence of this activity. Visitors to this island would have difficulty penetrating the dense vegetation to access the interior. It is likely that, to the average visitor, the island appears to be in a natural state. Waterfowl hunting in the fall and winter months is a traditional activity along the shores of this island.

The islands we refer to today as Hunting Islands were named by explorers Lewis and Clark. These islands have not changed much in the last 200 years and they provide excellent wildlife habitat, as they have since the native people of the Columbia River Basin first utilized the area's natural resources. A rare habitat type in the lower Columbia River referred to as Tidal Sitka Spruce Swamp covers a potion of these islands. The Service signed a 50-year agreement with the U.S. Coast Guard to maintain the "line-of-site" of a large channel marker which is used for navigation purposes. The marker is located in the slough adjacent to north Hunting Island. The Coast Guard maintains visibility of the channel marker by cutting a swath of vegetation as needed. This action intrudes a distance of about 300 feet inland from the water for a total of no more than 2 acres of the island. On the south end of Hunting Island 121 acres is held in trust by the Bureau of Indian Affairs (BIA). One of these tracts is 64.5 acres and has what is termed a clouded title ownership, which could be either Service or BIA lands. The wilderness proposal includes all of north Hunting Island, and only the Service-owned part of south Hunting Island. The presence of motorized boats can be found throughout the year around these islands.

Opportunities for naturalness were judged to be less than outstanding on the following units.

- Tenasillahe Island Unit: This roughly 1,950-acre island is actively managed for wildlife purposes. Refuge staff members routinely utilize farm and heavy equipment, trucks, and ATVs for transportation purposes. This island has the appearance of a farm, with gravel roads, barns, docking facility and water control structures. Due to the routine activities on the island it does not contain the appearance of a pristine natural island. As a result of all of this activity, this island has a farm-like appearance, which is reinforced by the constant resource management activity.

- Crims Island Unit: The refuge owns 473 acres of Crims Island and the remaining portion of the island's 695 acres is privately owned. In partnership with the U.S. Army Corps of Engineers, 120 acres were restored to improve tidal inundation in 2006. Very little vegetative screening has yet to be established at this site and future work (tree and shrub plantings) may be needed to ensure the success of this restoration project area. The 120-acre restoration area bisects the island and does not have a natural appearance due to the recent plantings. Also, additional plantings may be initiated using mechanized equipment should the need arise to provide a robust early successional riparian community. The newly enhanced tidal wetlands are also in the process of becoming vegetated. A good portion of the remaining area is still an open area infested with reed canary grass that in no way represents a natural lower Columbia River riparian community.

Based on the preceding discussion, the Crims Island and Tenasillahe Island units do not meet the minimum standards for a wilderness study. If the privately owned portion is acquired for the refuge in the future, the Service may want to reconsider identifying a WSA.

F.2.2.5 Supplemental Values or Features

Supplemental values have been determined to occur on all of the evaluated island units. These values include unique habitats occurring on the Hunting Island and Wallace Island units and the wide variety of wildlife species that occur on all of the evaluated units. Both the wildlife and habitat values occur as a result of protection and management of these sites as part of the Julia Butler Hansen Refuge.

F.2.2.6 Preliminary Inventory Results

Based on this preliminary inventory, two islands, Wallace and Hunting, appear to possess wilderness qualities. After public review and comment on the Draft CCP/EIS, the Service has identified in the Final CCP which refuge islands, if any, will be the subject of a subsequent wilderness study. The wilderness study, which will be available for public review, will then identify if warranted, Wilderness Study Areas. If warranted, the Service's Director will make suitable wilderness recommendations to the Secretary of the Interior, the President, and Congress.

Table F.1 Results of Julia Butler Hansen Refuge's Wilderness Inventory

Area	Unit Acres	Meets Island and/or Size Criterion	Meets Natural-ness Criterion	Meets Solitude/ Primitive Recreation Criterion	Meets Supplemen-tal Values Criterion (optional)	Preliminary Conclusion: Suitable for further con-sideration in Wilderness study.
Mainland Unit	2,001	No	No	No	Yes	No
Westport Unit	146	No	No	No	Yes	No
Hunting Island	765	Yes	Yes	Yes	Yes	Yes
Price Island	57	Yes	Yes	No	Yes	No
Tenasillahe Island	1,919	Yes	No	No	Yes	No
Wallace Island	579	Yes	Yes	Yes	Yes	Yes
Crims Island	473	Yes	No	Yes	Yes	No

Acreages each unit are based on documents and information available in the U.S. Fish and Wildlife Service, Division of Realty.

F.2.3 Wilderness Study Area Designation

Based on the above inventory for the Julia Butler Hansen Refuge, two WSAs, Hunting Island (765 acres) and Wallace Island (579 acres), have been identified. The WSA designation means that we will be studying each area for consideration as wilderness and that in the meantime, we will maintain and protect wilderness characters of the WSA. This wilderness study phase will be completed by 2015.

Appendix G. CCP Team Members

The following personnel served as core team members on the Lewis and Clark and Julia Butler Hansen National Wildlife Refuges Comprehensive Conservation Plan Planning Team.

Name	Position	Degree(s)	Years of Exp.
U.S. Fish and Wildlife Service			
Charlie Stenvall	Project Leader	BS, Wildlife Biology	21
Joel David	Refuge Manager	BS, Wildlife Biology	21
Dr. Alan Clark	Wildlife Biologist	PhD, Wildlife Biology	31
Rebecca Young	Conservation Planner	BS, Natural Resource Mgt.	21
Khem So	Geographer	MS, Resource Ecology Mgt. BA, Environmental Science	7
Ben Harrison	Division Chief of Natural and Cultural Resources	BS, Wildlife Biology	28
Virginia Parks	Archaeologist Cultural Res.	MAT, Museum Education BA, Archaeology	19
Kevin Kilbride	Region 1 Wildlife Biologist	MS, Wildlife Biology	20
U.S. Department of Agriculture:			
Dr. Gregory Phillips (Population Ecology, Experimental Design, and Quantitative Methods)	USDAWildlife Biologist	PhD, Wildlife Biology	25

Appendix H. Acronyms and Glossary

Acronyms

ADA	Americans with Disabilities Act
AHM	Adaptive Harvest Management
ai	Active Ingredient
AM	Adaptive Management
APHIS-PPQ	Animal Plant Health Inspection Service, Plant Protection and Quarantine
ARPA	Archaeological Resources Protection Act
ARS	Agricultural Research Service
BAF	Bioaccumulation Factor
BCF	Bioconcentration Factor
BIA	Bureau of Indian Affairs
BIDEH	Biological Integrity, Diversity, and Environmental Health
BLM	Bureau of Land Management
BMP	Best Management Practice
BPA	Bonneville Power Administration
BVD	Bovine Viral Diarrhea
bw	Body Weight
Ca	Calcium
CCP	Comprehensive Conservation Plan
CD	Compatibility Determination
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CLMA	Cooperative Land Management Agreement
Corps	U.S. Army Corps of Engineers
CP	Crude Protein
CWCS	Comprehensive Wildlife Conservation Strategies
CWT deer	Columbian White-tailed Deer
DAPA	Diaminopimelic Acid
DBH	Diameter at Breast Height
DOI	Department of Interior
DOL	Department of Labor
DPS	Distinct Population Segment
DT_{50}	Dissipation Time
EA	Environmental Assessment
EC_{50}	Environmental Concentration
EEC	Estimated Environmental Concentration
EEI	Environmental Education
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
F:D ratio	Fawn:doe Ratio

FERC	Federal Energy Regulatory Commission
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLIR	Forward Looking InfraRed
FMP	Fire Management Plan
FN	Fecal Nitrogen
FR	Federal Register
FRC	Floating Recreational Cabin
FWS	U.S. Fish and Wildlife Service (also, Service, USFWS)
GAP	Gap Analysis Program
GIS	Geographic Information System
GUS	Groundwater Ubiquity Score
HACCP	Hazard Analysis and Critical Control Points
HIP	Harvest Information Program
HMP	Habitat Management Plan
I	Vapor Pressure Index
IAC	Interagency Committee for Outdoor Recreation (Washington State)
IBR	Infectious Bovine Rhinotrachetis
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IVDMD	In Vitro Dry Matter Digestibility
JBH	Julia Butler Hansen Refuge for the Columbian White-tailed Deer
K_{oc}	Soil Adsorption Coefficient
K_{ow}	Octanol-Water Partition Coefficient
LAC	Lewis and Clark National Wildlife Refuge
LC_{50}	Median Lethal Concentration
LD_{50}	Oral Lethal Dose
LCREP	Lower Columbia River Estuary Partnership
LEIS	Legislative Environmental Impact Statement
LiDAR	Light-imaging Detection and Ranging
LNG	Liquefied Natural Gas
LOC	Level of Concern
LOEC	Lowest Observed Effect Concentration
LOEL	Lowest Observed Effect Level
MBCC	Migratory Bird Conservation Commission
mcy	Million Cubic Yards
MHHW	Mean High High Water
MLLW	Mean Low Low Water
MMS	Maintenance Management System
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	Miles per Hour
MSDS	Material Safety Data Sheet
NAWMP	North American Waterfowl Management Plan
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act

NOAA	National Oceanic and Atmospheric Administration
NOAEC	No Observed Adverse Effect Concentration
NOAEL	No Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
NPCC	Northwest Power and Conservation Council
NPR	Northern Pacific Region
NSRE	National Survey on Recreation and the Environment
NWPS	National Wilderness Preservation System
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Department of State Lands
OSHA	Occupational Safety and Health Administration
P	Phosphorus
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFMC	Pacific Fishery Management Council
PIF	Partners in Flight
P.L.	Public Law
PMP	Predator Management Plan
PPE	Personal Protective Equipment
ppm	Parts Per Million
PUP	Pesticide Use Proposal
PUPS	Pesticide Use Proposal System
RDD	Relative Deer Density
REI	Restricted Entry Interval
RNA	Research Natural Area
RONS	Refuge Operating Needs System
RQ	Risk Quotient
RV	Recreational Vehicle
SAMMS	Service Asset Management System
SCORP	Statewide Comprehensive Outdoor Recreation Plan
Se	Selenium
Service	U.S. Fish and Wildlife Service (also FWS, USFWS)
SLAMM 5.0	Sea Level Affecting Marshes Model, Version 5.0
SST	Sea Surface Temperature
Sw	Water Solubility
SWE	Snow Water Equivalent
$t_{1/2}$	Half Life
T&E	Threatened and Endangered
TEA	Transportation Equity Act
TWA	Time-Weighted Average
TNC	The Nature Conservancy
T-REX	Terrestrial Residue Exposure
U.S.C.	U.S. Code

USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTAB	Uptake, Translocation, Accumulation, and Biotransformation
WDFW	Washington State Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WSA	Wilderness Study Area
WSPRC	Washington State Parks and Recreation Commission
WV–LCR	Willamette Valley–Lower Columbia River
YCC	Youth Conservation Corps

Glossary

Adaptive Management. Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in management planning. Analysis of results help managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Alternative. Alternatives are different means of accomplishing refuge purposes and goals and contributing to the System mission (Service Manual 602 FW 1.5). The no action alternative is current refuge management while the action alternatives are all other alternatives.

Anadromous. Migratory fishes that spend most of their lives in the sea and migrate to fresh water to breed.

Approved Acquisition Boundary. A refuge boundary within which the Service can acquire land or interest in land from willing sellers.

Archeology. The scientific study of material evidence remaining from past human life and culture.

Basalt. A dark dense volcanic rock (Webster's II).

Biological Diversity (also Biodiversity). The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they interact. The System's focus is on indigenous species, biotic communities, and ecological processes.

Biological Integrity. Biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities (Service Manual 601 FW 3).

Birds of Conservation Concern. Species, subspecies, and populations of migratory nongame birds identified by the Service as likely to become candidates for listing under the Endangered Species Act unless additional conservation actions are taken.

Blockage. When used in reference to anadromous fish habitat, a complete blockage occurs when conditions fully block all life stages of all salmonid fish species to upstream migration. A partial blockage occurs when conditions prevent a species of salmon from completing its upstream migration, or prevent the life stages of a salmon from occurring (http//wdfw.wa.gov/mapping/salmonscape).

Candidate Species (Federal). Fish, wildlife, and plant species that the Service will review for possible listing as federally endangered or threatened. A species will be considered for designation as a Federal Candidate if sufficient evidence suggests that its status may meet the listing criteria defined for federally endangered or threatened.

Candidate Species (State). Fish, wildlife, and plant species that a state will review for possible listing as State Endangered, Threatened, or Sensitive. A species will be considered for designation as a State Candidate if sufficient evidence suggests that its status may meet the listing criteria defined for State Endangered, Threatened, or Sensitive.

Categorical Exclusion. 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).

Colonial nesting birds. Birds that nest in groups. At these refuges, most of the colonial nesting birds are waterbirds, such as gulls, terns, cormorants, and herons.

Columbia River Estuary. The area where the fresh water of a river meets the salt water of an ocean. The boundary of the Columbia River estuary is considered the lower 46 miles of the river (LCREP).

Compatibility Determination. A written determination signed and dated by the refuge manager and Regional Chief signifying that a proposed or existing use of a national wildlife refuge is a compatible use or is not a compatible use. The Director makes this delegation through the Regional Director. (Service Manual 603 FW 2)

Compatible Use. A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the Mission of the System or the purposes of the refuge (Service Manual 603 FW 3). A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Comprehensive Conservation Plan. A document that describes the desired future conditions of the refuge, and provides long-range guidance and management direction for the refuge manager to accomplish the purposes of the refuge, contribute to the mission of the System, and to meet other relevant mandates (Service Manual 602 FW 1.5).

Connectivity. The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation. The opposite of fragmentation. (Habitat Management Plan)

Conservation Target. A set of features or elements of biological diversity, that are the focus of conservation within a system of conservation areas.

Consumptive Use. Recreational activities, such as hunting and fishing that involve harvest or removal of wildlife or fish, generally to be used as food by humans.

Contaminants or Environmental contaminants. Chemicals present at levels greater than those naturally occurring in the environment resulting form anthropogenic or natural processes that potentially result in changes to biota at any ecological level. Pollutants that degrade other resources upon contact or mixing. (USGS, assessing EC threats to lands managed by USFWS) Pollutants that degrade other resources upon contact or mixing. (Adapted from Webster's II)

Cooperative Agreement. This is a simple habitat protection action, and no property rights are acquired. An agreement is usually long term but can be modified by either party. They are most effective in establishing multiple use management of land. An example would be a wildlife agreement on a Corps reservoir.

Cover Type. The present vegetation of an area.

Cultural Resources. The physical remains, objects, historic records, and traditional lifeways that connect us to our nation's past. (USFWS, Considering Cultural Resources)

Cultural Resource Inventory. A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Deciduous. Describes trees and shrubs which shed all of their leaves each year.

Disturbance. Significant alteration of habitat structure or composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).

Draw-down. The controlled reduction of water in managed wetlands.

Ecological Attribute. A characteristic or condition required to support the life history, habitat, physical processes, or community interaction of conservation targets.

Ecosystem. A dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

Ecosystem Management. Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.

Ecotone. A transitional zone between two communities containing the characteristic species of each.

Emergent Vegetation. is defined as herbaceous plants that require a water environment to grow for at least part of their life cycle, stem structure is rigid and self-supporting and vegetative growth continues above the waterline.

Endangered Species (Federal). A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species (State). A plant or animal species in danger of becoming extinct or extirpated in Washington within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

Enhancement. Improvement, especially for the benefit of habitats and/or species.

Environmental Assessment. A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Education Facility. A building with one or more classrooms and environmental education materials to accommodate groups of students.

Environmental Education Field Sites. Outdoor locations where groups of students receive hands-on environmental education.

Environmental Health. Composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment (Service Manual 601 FW 3).

Estuarine. Deepwater tidal habitats and adjacent tidal wetlands that are usually partly enclosed by land but have some access to the open ocean and are diluted by freshwater.

Estuary. The area where the fresh water of a river meets the salt water of an ocean. In the National Estuary Program, this definition is extended to include the tidally influenced waters of a river.

Exotic Species. A species from another part of the world. A non-native species.

Extirpated. Species no longer inhabiting an area that they historically occupied.

Finding of No Significant Impact (FONSI). A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Focal Conservation Target. A suite of conservation targets that for purposes of planning are sorted and condensed to represent threats to biological integrity, diversity, and environmental health at the Refuge level.

GAP Analysis. Analysis done to identify and map elements of biodiversity that are not adequately represented in the nation's network of reserves. It provides an overview of the distribution and conservation status of several components of biodiversity, with an emphasis on vegetation and terrestrial vertebrates (Cassidy et al.1997).

Goal. Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Service Manual 602 FW 1.5).

Habitat. Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat Connectivity (Also Landscape Connectivity). The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation. The opposite of fragmentation.

Habitat Management Plan. A plan that guides refuge activities related to the maintenance, restoration, and enhancement of habitats for the benefit of wildlife, fish, and plant populations.

Habitat Restoration. Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Headquarters. An administrative center.

Historic Conditions. Composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human related changes to the landscape (Service Manual 601 FW 3).

Hydrology. A science dealing with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere.

Hydrograph. A graph of water flows in a river or stream. A hydrograph provides a way of seeing seasonal and yearly changes in the flow or discharge of a waterway.

Hydroperiod. A segment of a hydrograph for a specific timeframe.

Indicator. Something that serves as a sign or symptom.

Inholding. Refers to lands within a refuge's Approved Acquisition Boundary that are not owned by the Fish and Wildlife Service. These can be private lands or lands owned by city, county, state, or other federal agencies.

Interpretation. A teaching technique that combines factual information with stimulating explanation. Frequently used to help people understand natural and cultural resources.

Interpretive Trail. A trail with informative signs, numbered posts that refer to information in a brochure, or where guided talks are conducted for the purpose of providing factual information and stimulating explanations of what visitors see, hear, feel, or otherwise experience while on the trail.

Invasive Species. Species of plants and animals that have the potential to rapidly colonize and dominate an area.

Issue. Any unsettled matter that requires a management decision (e.g., a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition) (Service Manual 602 FW 1.5).

Land Protection. The acquisition of fee-title, easement, or lease of a given land parcel to protect important natural resource values on the land from incompatible land uses.

Landform. A natural feature of a land surface.

Maintenance. The upkeep of constructed facilities, structure and capitalized equipment necessary to realize the originally anticipated useful life of a fixed asset. Maintenance includes preventative maintenance; cyclic maintenance; repairs; replacement of parts, components, or items of equipment, periodic condition assessment; periodic inspections, adjustment, lubrication and cleaning (non-janitorial) of equipment; painting, resurfacing, rehabilitation; special safety inspections; and other actions to assure continuing service and to prevent breakdown.

Maintenance Management System (MMS). A national database of refuge maintenance needs and deficiencies. It serves as a management tool for prioritizing, planning, and budgeting purposes.

Managed field. Refuge grasslands maintained for winter goose forage by mowing, haying, grazing, or burning.

Mean High Water (MHW). The average level of the surface of the river, used as a standard in determining land elevation or sea depths.

Migration. The seasonal movement from one area to another and back.

Migratory Birds. Those species of birds listed under 10.13 of 50 CFR chapter 1-USFWS, DOI.

Monitoring. The process of collecting information to track changes of selected parameters over time.

Monoculture. Vegetation composed primarily of a single species, such as in areas dominated by invasive weeds.

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 (40 CFR 1500).

National Wildlife Refuge. A designated area of land, water, or an interest in land or water within the System.

National Wildlife Refuge System. Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; games ranges; wildlife management areas; or waterfowl production areas.

Native Species. With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. (Service Manual 601 FW 3).

Neotropical Migrant. A bird that winters in southern Mexico, Central and South America, or the West Indies and migrates northward to breed in North America.

Nonnative species. An introduced species that did not naturally occur in an area. See also exotic species.

Nonpoint source. Coming from more than one location. Frequently refers to pollution or erosion that comes from a widespread area and accumulates in streams and rivers.

Noxious Weed. A plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or non-native, new, or not common to the United States, according to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the Untied States and to the public health.

Objective. An objective is a concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work. Objectives are derived from goals and provide the basis for determining management strategies. Objectives should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively (Service Manual 602 FW 1.5).

Old field. Refuge grasslands left relatively unmanaged to provide food and cover for a variety of native wildlife. Control of noxious weeds does occur on old fields.

Operations. Activities related to the normal performance of the functions for which a facility or item of equipment is intended to be used. Costs such as utilities (electricity, water, sewage) fuel, janitorial services, window cleaning, rodent & pest control, upkeep of grounds, vehicle rentals, waste management, and personnel costs for operating staff are generally included within the scope of operations.

Outreach. The process of providing information to the public on a specific issue through the use of the media, printed materials, and presentations.

Pacific Flyway. One of several major north-south travel corridors for migratory birds. The Pacific Flyway is west of the Rocky Mountains.

Palustrine. Freshwater wetlands that are less than 2 meters deep at low water. They do not include areas regularly impacted by waves or part of a bedrock shoreline. They are familiarly known as marshes, swamps, bogs, wet meadows, prairies, and small shallow ponds.

Plant Association. A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.

Plant Community. An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soils, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community (e.g., ponderosa pine).

Preferred Alternative. This is the alternative determined [by the decision maker] to best achieve the Refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.

Preplanning. The first phase of the comprehensive conservation planning process. It includes identifying the planning area and data needs; establishing the planning team and planning schedule; reviewing available information; preparing a public involvement plan and conducting internal scoping.

Priority Public Uses. Hunting, fishing, wildlife observation and photography, environmental education and interpretation were identified by the National Wildlife Refuge system Improvement Act of 1997 as the six priority public uses of the National Wildlife Refuge System.

Priority Species. Fish and wildlife species that the Washington Department of Fish and Wildlife believe require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) State-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.

Public. Refuge neighbors, 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 refuge issues and those who do or do not realize Service decisions may affect them.

Public Use Area. A designated area within a refuge open to the public year-round.

Raptor. A category of carnivorous birds, most of which have heavy, sharp beaks, strong talons, and take live prey (e.g., peregrine falcon, bald eagle).

Refuge Operating Needs System (RONS). A national database of unfunded refuge operating needs required to meet and/or implement station goals, objectives, management plans, and legal mandates. It is used as a planning, budgeting, and communication tool describing funding and staffing needs of the Refuge System.

Refuge Purpose(s). The purpose(s) 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 (Service Manual 602 FW 1.5).

Research Natural Area. A Federal land designation that establishes areas with predominantly natural conditions and processes for research and educational purposes.

Restoration. The act of bringing back to a former or original condition.

Revenue Sharing. Service payments (government lands are exempt from taxation) made to counties in which national wildlife refuges reside. These payments may be used by the counties for any governmental purpose such as, but not limited to, roads and schools.

Riparian. Refers to an area or habitat that is transitional from terrestrial to aquatic ecosystems; including streams, lakes wet areas, and adjacent plant communities and their associated soils which have free water at or near the surface; an area whose components are directly or indirectly attributed to the influence of water; of or relating to a river; specifically applied to ecology, riparian describes the land immediately adjoining and directly influenced by streams. For example, riparian vegetation includes any and all plant life growing on the land adjoining a stream and directly influenced by the stream.

Riverine. Flowing perennial to intermittent waters bounded by a channel. This habitat encompasses a river or stream, its channel, and the associated aquatic vegetation.

Salmonid. A category of fish that includes salmon, steelhead, and trout.

Scoping. Using news releases, and other appropriate media to notify the public of the opportunity to participate in the planning process and to help identify issues, concerns, and opportunities related to the project.

Seral. Of or relating to an ecological sere; a seral stage.

Songbirds (Also Passerines). A category of birds that are medium to small, perching landbirds. Most are territorial singers and migratory.

Special Status Species. Fish, wildlife and plant species that have special conservation status because they have been listed under one or more authorities such as Endangered Species Act, State-listed species, Birds of Conservation Concern and others.

Step-down Plan. A step-down plan provide the details necessary to implement management strategies identified in the Comprehensive Conservation Plan (Service Manual 602 FW 1.5).

Strategy. A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.5).

Threatened Species (Federal). Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Threatened Species (State). A plant or animal species likely to become endangered in Washington within the near future if factors contributing to population decline or habitat degradation or loss continue.

Threshhold. The lowest level or intensity at which a stimulus is perceptible or can produce an effect. This term is sometimes used in connection with monitoring the effects of public uses on natural resources.

Turbidity. A measurement of clarity of water based on particles suspended in the water. It is measured with a nephelometer, which indicates the amount of light that passes through (or is scattered by) a column of water.

Vegetation Type (Also Habitat Type, Forest Cover Type). A land classification system based upon the concept of distinct plant associations.

Vision Statement. A concise statement of the desired future condition of the planning unit, based primarily upon the System mission, specific refuge purposes, and other relevant mandates (Draft Service Manual 602 FW 1.5).

Watershed. The region or area drained by a river system or other body of water. (Webster’s II) See also subwatershed.

Wetlands. 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 at some time during the growing season of each year (Service Manual 660 FW 2).

Permanent wetland. A wetland basin or portion of a basin that is covered with water throughout the year in all years except extreme drought. Typically the basin bottom is vegetated with submerged aquatic plant species including milfoil, coontail, and pondweeds. **Semi-permanent wetland** - a wetland basin or portion of a basin where surface water persists throughout the growing season of most years. Typical vegetation is composed of cattails and bulrushes. **Seasonal wetland** - a wetland basin or portion of a basin where surface water is present in the early part of the growing season but is absent by the end of the season in most years. Typically vegetated with sedges, rushes, spikerushes or burreed.

Wildlife-dependent Recreation. Hunting, fishing, wildlife observation and photography, environmental education and interpretation. These are also referred to as priority public uses of the National Wildlife Refuge System.

Appendix I. Comments and Responses

Table of Contents

Letter 1

Rick Bailey
<prb18@humboldt.edu>
04/12/2010 11:51 AM

To FW1PlanningComments@fws.gov
cc
bcc
Subject comments on the DCCP/EIS for Lewis and Clark and Julia Butler Hansen Refuges

History: This message has been replied to.

Dear Mr. Stenvall,

Attached are my comments on the Draft Comprehensive Conservation Plan / Environmental Impact Statement. I appreciate the opportunity to provide feedback and hope that my comments help you prepare the final CCP/EIS.

Sincerely,
Paul Bailey

DEIS_Critique.pdf

I.1 Paul Bailey, April 12, 2010

Charlie Stenvall, Project Leader
Willapa National Wildlife Refuge Complex
3888 SR 101
Ilwaco, WA 98624-9707

April 12, 2010

Dear Mr. Stenvall,

I am grateful for the opportunity to comment on the Draft Comprehensive Con-
servation Plan and Environmental Impact Statement (DCCP/EIS) results for the
Julia Butler Hansen and Lewis and Clark National Wildlife Refuges. My opinion
of the draft is positive, but certain components leave room for improvement. I 1-1
hope my comments will help the staff create a Final EIS that fulfills NEPA and
DOI requirements and accurately communicates the intentions of refuge staff and
the US Fish and Wildlife Service.

NEPA Goals and Objectives Not Met

The DCCP/EIS meets all the requirements set forth by the National Environ-
mental Policy Act (NEPA) as amended, but violates Department of the Interior 1-2
(DOI) length limits without justification. Furthermore, the DEIS does not serve
as a decision-making tool; it is apparent that the preferred alternatives were fore- 1-3
gone conclusions before the DEIS was written.

Lead Agency

The lead agency is identified as the Department of the Interior, Fish and Wildlife Service.

Interdisciplinary Team

Team members are listed in Appendix G. The team on the project consisted
mainly of biologists. The concerns of the refuge deal almost exclusively with
maintaining biological aspects, whether habitat, biological diversity, public uses
or endangered, threatened or rare species. I have some concern that issues of 1-4
cultural or historical importance may have been overlooked in an effort to focus
on biological aspects of management.

Purpose and Need

The purpose and need are directly, succinctly and adequately addressed. The stated need is to "provide reasonable, scientifically grounded guidance for improving the Refuge's ... habitats, for the long term conservation of migratory birds, and native plants and animals." The management plan was developed for a 15 year time horizon and addresses the refuge's natural resources, threatened

Response 1-1: The Service believes the Draft EIS fulfills NEPA and Department of the Interior (DOI) requirements and yet acknowledges that there are areas where the document could be improved. Specific examples are described below.

Response 1-2: We believe the assertion that the number of pages comprising the Draft EIS violates DOI length limits is inaccurate. The number of pages mentioned in DOI regulation represents recommendations rather than requirement. The length of the Draft EIS reflects the complexity associated with addressing all management facets associated with managing two national wildlife refuges.

Response 1-3: We believe the assertion that the Draft EIS does not serve as a decision making tool is also inaccurate. The preferred alternative was identified at the Draft EIS stage as recommend in Council of Environmental Quality and DOI implementing regulations. By examining a reasonable range of alternatives and disclosing the environmental consequences associated with implementing each alternative, the EIS serves as a tool for deciding which alternatives should be adopted by the responsible official for implementation.

Response 1-4: The Draft EIS was developed using an interdisciplinary approach as required by NEPA and its implementing regulations. The number of biologists on the interdisciplinary team is a reflection of the fact that the primary purpose of a national wildlife refuge is wildlife conservation. Cultural, historical, and other resource management issues were addressed as appropriate in this CCP by means of the interdisciplinary approach used to develop this plan.

and endangered species, and public use programs as mandated

An EIS was completed in response to the legislated mandate of the National Wildlife System Administration Act of 1966 as amended, which requires each refuge to develop a CCP for 15 year management periods. Management activities are required to be designed to significantly and positively affect the diversity of fish, habitats, and wildlife and plants and to conserve archaeological and cultural values of each refuge.

The excess length of the DCCP/EIS is not justified in the document. Not including appendices, the document is 320 pages long, but the US Fish and Wildlife Service (USFWS) NEPA Reference Handbook[1] states an EIS should not exceed 300 pages unless necessary to comply with NEPA or CEQ regulations. Using figures and maps instead of tables and descriptive narrative may help the DCCP/EIS remain within 300 pages. See page 4 for more detailed comments on appropriate use of figures and maps. 1-5

Planning updates have been published in a timely manner to reflect ongoing analysis, data acquisition and changes in alternatives. As such, their content and publication follows the USFWS NEPA Reference Handbook. The update publications are clear and concise. The use of tables to compare features of alternative management plans allows readers to easily distinguish differences and similarities between plans.

Consultation with other federal agencies

The DCCP/EIS makes no mention of formal or informal consultation with other federal agencies. Consultation with the Army Corps of Engineers and the Coast Guard may have been warranted: the main shipping channel passes through both refuges, and dredge spoils are deposited within refuge boundaries. Due to ongoing agreements with both agencies, consultation may not have been necessary. Whatever the case, documentation of FWS consultation, or justification for not consulting with other agencies should be provided. 1-6

Documentation of public involvement

Refuge staff published notices as required by NEPA and documented public meetings. Appendix G provides documentation of public meetings and responds appropriately to public comments made during the planning process. Most public comment was directed towards the proposed liquefied natural gas plant, which is not within the scope of the DCCP/EIS.

It is unclear whether staff made efforts to include "all" public in the scoping process. The low population density of the surrounding communities is a likely 1-7

[1] Fish and Wildlife Service NEPA Reference Handbook, available online at http://www.fws.gov/r9esnepa/TOCnotebook.PDF

Response 1-5: We believe the assertion that the number of pages comprising the Draft EIS violates DOI length limits is inaccurate. The number of pages mentioned in DOI regulation represents recommendations rather than requirement. The length of the Draft EIS reflects the complexity associated with addressing all management facets associated with managing two national wildlife refuges.

Response 1-6: Consultation with the Army Corps of Engineers and the Coast Guard was not warranted because the refuge is not proposing to conduct any actions which require consultation with the Army Corps of Engineers and the Coast Guard. However, the Army Corps of Engineers and the Coast Guard were afforded the opportunity to review and comment on the Draft EIS. Appendix C identified all applicable consultation and compliance requirements. Identifying all the agencies the Service is not required to consult with is an unnecessary task.

Response 1-7: Appendix I of the Draft CCP/EIS described the public involvement process whereby the CCP Planning team appropriately identified the interested public and afforded more than reasonable opportunities for becoming involved in the CCP development process.

cause of the low level of attendance at public meetings. However, this indicates that greater effort–or a widening of public notification efforts and venue selection would have been appropriate to adequately involve "all" public stakeholders. The Portland metropolitan area would have been a good area in which to involve the public.

Development of reasonable alternatives
Reasonable alternatives were not developed for both refuges. The preferred alternatives present time-bound, realistic goals that meet the stated objectives of the refuge system as articulated in the DCCP/EIS and furthermore were identified as the alternatives that best meet the goals and objectives of the refuge. As required by NEPA, no-action (here, no-change) alternatives are presented and analyzed.

However, only one other alternative was developed for the JHB refuge, and no second alternative was developed for the LAC refuge. Although the staff may have come to consensus regarding the best and most effective actions to take to achieve refuge goals, this decision-making process is not documented in NEPA. The third alternative for JHB refuge management is merely different in degree to the preferred alternative. As such, the third alternative cannot from its inception compete with the preferred alternative. This leaves both refuges with only one viable alternative. 1-8

Finally, I believe that although the development of alternatives could have been improved upon, the evaluation process was adequate. A hierarchy of goals for each refuge was developed, as well as strategies for ranking competing objectives.

Level of language and vocabulary
Except for notable sections listed on page 5, language use and vocabulary was consistent with an eighth grade reading level, as specified in CEQ/NEPA guidelines.

Document Summary
Chapter 6 conforms with DOI guidelines regarding the Summary section. The chapter presents a concise summary of each alternative's short-term, long-term and cumulative impacts on to wildlife and habitat; physical environment; the human social environment; and other impacts.

Cost-Benefit analysis
No cost-benefit analysis was conducted. The lack of an analysis is appropriate and consistent with funding uncertainties and the non-commensurate benefits and costs. Funding to the national wildlife refuge system fluctuates yearly, and the alternatives clearly identify this uncertainty in their plans. Furthermore, although techniques exist to compare non-commensurate measures with those able to be easily measured in dollars, I feel a cost-benefit analysis would not improve the

Response 1-8: The range of alternatives reflects the fact that the Service has been managing these refuges since the 1970s. For example, over the course of four decades at Julia Butler Hansen Refuge, we have learned a great deal about which management strategies achieve desired outcomes and which do not. Based on that extensive knowledge, we understand there are not a wide variety of reasonable options available to the refuge for successfully managing refuge resources to meet refuge purposes, hence the limited range of alternatives evaluated in the Draft EIS. In the case of Lewis and Clark refuge, this refuge is "managed" mainly by allowing natural process to occur. In light of the fact that natural processes are achieving refuge purposes, there is little need to examine a wide range of alternative management schemes.

DCCP/EIS or add to the decision-making process.

Use of Graphics, Maps, and Tables

The use of graphics, maps and tables was generally appropriate, but could be improved. Edits should focus on the reader and how she or he will perceive information in each map, table or figure.

Maps

The boundaries of the national wildlife refuges, habitat and wetland areas are well-described and documented using maps. In sections 1.1 (Introduction), 2.6 (Description of Alternatives) and 2.7 (Goals and Objectives) the use of maps furthers the reader's understanding of the document and serves to clarify refuge boundaries, uses, vegetation, topography, and habitats. It would help the reader to interpret narrative descriptions of activities discussed in section 5.2 (Public Use) if Maps 10 and 12 were referred to in the text.

Graphics and Photographs

It is unclear what purpose certain graphics play in furthering the reader's understanding of the document. The photograph on page 2-24 entitled *Pintail Ducks*, while aesthetically pleasing, is not necessary to the reader's understanding of what waterfowl use the refuge; nor is the photograph cited anywhere in the text. An aerial photograph of the refuge complex exists on page 2-40, but would better inform the reader were it placed in the introduction with the maps. The photograph does not seem to provide relevance to section 2, where it is placed. Moving the aerial photograph to the introduction would give the reader a better sense of the environment and topography in which the refuge exists.

Figure 4.4 presents historical data collected on Columbia White Tail (CWT) deer, but fails to clearly identify which data series represent years in which coyote control was performed. One might assume that CC indicates coyote control, while NCC indicates no coyote control. This distinction must be made clear in descriptive captioning as well as in the text. Without a clear distinction of the difference in management, the graph serves only to confuse the reader.

While Figure 4.5 succinctly presents the results of a stochastic model, it fails to explain why coyote control was implemented for the first ten model years, and subsequently allowed to lapse. Furthermore, the symbol λ is not explained.

Tables

Tables such as those used in section 2.6 clearly and succinctly justify the choice of Alternative 2, Description of Alternatives, show an appropriate and concise way of presenting information, and play a pivotal role in the reader's understanding of the alternatives' features, how they differ and what features remain the same

between them. In this way, tables are appropriately used: differences between alternatives are clearly delineated; similarities and differences are easy for the reader to understand.

Certain data are inappropriately collated in tables. Table 4-13 contains much data, but its meaning is obscured because of the sheer amount of data presented. A good figure would concisely display the data, the change in Fawn:doe ratios over time, and allow for graphical illustration of the effects predator control and natural events (e.g. storms) have played in the changing ratios.

Likewise, Tables 4-18 and 4-19 do not convey meaning to the reader. The stochastic model results presented would have meaning if presented graphically. However, it is unclear why the model results are presented at all; the conclusion given in the document is that Alternative 2 best meets the needs of the CWT deer populations by providing habitat and controlling predation when needed.

Areas of Concern

In Section 4.5.3.2.6 *Mortality Factors*, an inset box incorrectly identifies the symbol P. The inset box lists symbols used in the section and indicates P is used to describe "all predation." In the text and in statistical notation, P describes not predation, but probability. Statistically, P is the probability a value or observed result arose by chance, when compared to an expected statistical distribution. The text box should be changed to correct this error.

Section 4.7.2.6.4, a description of the stochastic model and its results, should be replaced with a succinct and accessible description of the model. As written, the technical jargon is not written at an 8^{th} grade level and overwhelms even technically literate readers. A concise description, brief summary of model parameters, and graphically presented results would convey volumes more to readers than the current text. Because the model is used to justify Alternative 2 for the Julia Butler Hansen refuge, the description of the model should be retained, but moved to an appendix, while CWT management goals should be restated. The connection between the development of Alternative 2 and model results should then be explored: if predator control in Alternative 2 is based in large part on modeling, the particular model should be well justified. Currently, the choice of model and its role in developing alternatives is unexplained.

Vague Language or Editorial Oversights

In section 1.5.5, the paragraph describing appropriate uses should refer the reader to an appropriate source or the appendix. It is unclear, given the distance between the first sentence and the reference to Appendix B, if the authors intend for Appendix B to be the source of the assertion given in the first sentence. 1-9

Response 1-9: A reference to Appropriate Uses policy found at 603 FW 1 has been added to the end of the first sentence in the paragraph describing appropriate uses.

In section 1.6.1, the paragraph beginning "In 1993, the State of Oregon terminated..." requires clarification as to how the described agreements fit in the Purpose and Acquisition History of the LAC Refuge. A simple description of how the agreements molded or fit into the purpose or acquisition history of the LAC refuge would suffice. 1-10

In a list describing habitat in section 1.6.2, two items (American Bald Eagle and Recreational and Commercial Fishing) are erroneously listed. Either the description of the list should reflect contents other than habitat, or the list should be modified to refer solely to habitats. 1-11

In section 2.4.7, the wording describing when the FWS uses pesticides as part of its IPM strategy is unclear. Revision for clarity is suggested, along with citation of the pertinent Environmental Protection Agency (EPA) list of approved pesticides. 1-12

I recommend changing the title of Section 4.7.1 to include the full expression "Integrated Pest Management" rather than the acronym IPM. The acronym is not defined in Appendix H: Glossary. Its use in the title of Section 4.7.1 is inappropriate, and serves to confuse readers rather than further the document's objectives.

In the final paragraph of section 4.7.2.3.1, an unfinished sentence and grammatical mistakes should be corrected before the final EIS is published.

In section 5.1.1, the last sentence of the first paragraph gives the impression that all activities are restricted seasonally except for fishing, boating and kayaking. The paragraph or construction should be modified for clarity. 1-13

In section 5.2.2.1, the point of the main paragraph is difficult to discern. While the section ostensibly focuses on public use, the paragraph touches without connection on many topics. These include:

- islands which are open to hunting
- boating safety 1-14
- access restrictions
- appropriate and regular activities

The paragraph should be changed to present a coherent viewpoint that directly addresses and introduces public use.

Response 1-10: Section 1.6.1 describes, in chronological order, the changes in the areas managed over the course of the refuge's existence. At one time the refuge managed certain waters and submerged lands under the jurisdiction of the State of Oregon as part of the refuge under agreement with the State or Oregon. In 1993 the agreement was terminated for the reasons explained in Section 1.6.1.

Response 1-11: Section 1.6.2 describes other habitats and species which have been identified in refuge land acquisition documents as part of refuge management priorities. The section is correct as written.

Response 1-12: Appendix D addresses pertinent Environmental Protection Agency approved pesticides.

Response 1-13: Certain activities such as boating are not seasonally restricted but other activities such as hunting and fishing are seasonally restricted under state regulations.

Response 1-14: Section 5.2.2.1 describes public uses allowed at Lewis and Clark refuge; all the items listed are connected because they are associated with authorizing public use on refuge lands and waters.

Recommendations

1. Develop other viable alternatives that meet refuge objectives. NEPA documents are designed to be decision-making tools, but the preferred alternatives were clearly predetermined when the DCCP/EIS was written. 1-15
2. Use tables and graphs appropriately. Tables have been used to good effect in comparing and contrasting alternatives. However, well-constructed figures and graphs lead the reader to conclusions and a better understanding of the data. This meaning is not as clear when tables of numbers are presented and the reader is left to interpret meaning by herself or himself. 1-16
3. Justify the choice of a team comprised primarily of biologists: are biological concerns overriding, or do other concerns simply not exist as pertaining to NEPA and the CCP for the LAC and JBH refuges?

Thank you for your time and consideration, and most of all for your unceasing efforts to conserve some small part of the unique environment of the Columbia River. I hope my comments are helpful and will be addressed in the final CCP/EIS for the Lewis and Clark and Julia Butler Hansen National Wildlife Refuges.

Sincerely,

Paul Bailey
Environmental Resources
Engineering Undergraduate
Humboldt State University
Arcata, California

Response 1-15: As stated earlier, we believe a reasonable range of alternatives has been evaluated and the environmental consequences analysis allows the EIS to serve as a decision making tool. Also as stated earlier, we believe the EIS was developed appropriately using an interdisciplinary approach

Response 1-16: Various comments relating to graphs and tables have been addressed as deemed appropriate.

Letter 2

"John Baker" <emptynesterz@msn.com>
03/29/2010 03:43 PM

To <FW1PlanningComments@fws.gov>
cc
bcc
Subject Please keep Julia Butler Hanson Refuge open to hunting. 2-1

History: This message has been replied to.

John Baker
Enumclaw, WA

I.2 John Baker, March 29, 2010

Response 2-1: Thank you for your review and comment on the CCP regarding keeping the refuge open to hunting.

Letter 3

"Bob and Barbara" <canessab@pacifier.com>
02/16/2010 08:19 AM

To <FW1PlanningComments@fws.gov>
cc
bcc
Subject Lewis and Clark Refuge Comments

History: This message has been replied to.

Mr. Stenvall,

As someone who spends over 60 days a year hunting, fishing and boating in the Lewis and Clark Refuge area I would like to recommend that you Continue Current Management (Alternative 1). 3-1

The charm and attraction of the area is that it is substantially like it was a 100 years ago and hope that it will continue to be for another 100 years. My grandfather first hunted waterfowl in these islands around 1910 and my father followed in his tradition, it has been my favorite place for recreation since being introduced to it in the 1940's.

Keep up your good work.

Bob Canessa (Age 70)
88787 Blue Heron Road
Seaside, OR 97138
canessab@pacifier.com

I.3 Bob Canessa, February 16, 2010

Response 3-1: Thank you for your review and comment on the CCP. Although Alternative 1 is not the preferred alternative there are limited differences between Alternatives 1 and 2.

Letter 4

George Wehrfritz
<georgewehrfritz@yahoo.com
>
03/31/2010 08:06 PM

To FW1PlanningComments@fws.gov
cc
bcc
Subject Planning Comments,JBH Refuge Draft CCP/EIS

History: This message has been replied to.

To Whom it May Concern:

Attached is a letter to Mr. Charlie Stenvall that contains my comments on the Draft CCP/EIS review
I will send a hardcopy by post tomorrow.

Sincerely,

George Wehrfritz
Mayor
Town of Cathlamet

Juliabutlerhansentrails.docx

I.4 George Wehrfritz, March 31, 2010

March 30, 2010

Charlie Stenvall
Project Leader
Willapa National Wildlife Refuge Complex

Dear Mr. Stenvall:

Thank you for sending me the Draft CCP/EIS for the Julia Butler Hansen Refuge for the Columbian White-tailed Deer. I am writing to convey several comments to the U.S. Fish & Wildlife Service for consideration when determining the final CCP/EIS.

First, however, I would like to commend your team for its management of the refuge. I have visited frequently for almost a decade, and I usually enter by kayak or car. Each time I do, I marvel at the wildlife on display, at the feeling of remoteness the place affords and at how lucky we are that the area is preserved for low-impact use.

My primary comment on the Draft CCP/EIS is that, regardless of the alternative selected, I suggest that every effort be made to encourage non-motorized access. The refuge is an ideal place for bicycling and walking, and visitation from Cathlamet would certainly increase if bike routes and trails were enhanced. Additional trails would have minimal impact on the deer or other wildlife, and hopefully they might actually decrease automobile traffic into the refuge as people opt to park at the periphery and enter under their own power. 4-1

I also want to indicate that the Town of Cathlamet has committed in its latest Comprehensive Plan (2002) to "develop a network to provide year-round pedestrian and bicycle access" throughout the community. As you know, the Town's latest annexation pushed the town limits north on SR4 to the boundary of the refuge. This, I believe, affords us an opportunity for the town and the refuge to cooperate in development of additional walking/biking trails.

Response 4-1: Thanks for your comments in support of CCP/EIS and promoting of non-motorized visitor access. We agree that the refuge is an ideal place for bicycling and walking in areas that do not pose undue disturbance to refuge wildlife and that visitation would likely increase if bike routes and trails were enhanced. Areas that already have existing infrastructure such as along the Elochoman River and Brooks Slough are excellent areas for bicycling and walking routes. Both sites have proposals included in this plan. We would welcome the opportunity to work with the town of Cathlamet as well as other adjacent landowners and local governmental agencies to begin development of such trail.

What makes sense is a pathway connecting Cathlamet to the refuge along the Elochoman Slough. This would move cyclists and pedestrians off SR4 (the only current route from town to the refuge) and enhance public access to the town's newest section of waterfront. Although the parcels in question are privately-owned, I believe that obtaining the required easements would be possible. I also suspect that the concept of a trail would receive widespread public support.

Clearly, such a trail would be a major undertaking; funding in this or any economic climate would surely prove challenging. But that should not deter initial efforts to envision such a project, or to begin laying the groundwork for its eventual creation before the route in question is redeveloped in a manner that could thwart public access.

I therefore encourage Fish & Wildlife to include additional bicycle/pedestrian trails in its Final CCP/EIS, and to consider the town as a possible partner in development of trails linking the refuge with downtown Cathlamet. Such a project would advance several key long-term goals our community has set, and provide additional visitation to the refuge with minimal negative impact.

Sincerely,

George Wehrfritz
Mayor
Town of Cathlamet

Letter 5

Alan Clark
<alan_c_clark@hotmail.com>
04/19/2010 01:50 PM

To <fw1planningcomments@fws.gov>
cc <joel_david@fws.gov>
bcc
Subject Comments on CCP for Julia Butler Hansen and Lewis and Clark Refuges

History: This message has been replied to.

The CCP does a fine job of establishing realistic goals, objectives and actions that will guide the refuges into the future. I see no real weaknesses in the the document. Let's hope the goals can all be achieved.

I do have doubts about the criteria for coyote control (Section 2.6.2.2, page 2-18). The first criteria seems unnecessary. Combined with the others, it seems to say that the refuge will control coyotes whenever it feels like it. If fawn:doe ratios are above 37:100, the deer population should be increasing, thus coyote control should be unneeded. It would make more sense if it read "fawn:doe rations <u>less than</u> 37:100 ...." 5-1

A minor quibble is that the acreage figures for early successional riparian forest in particular are very difficult to follow throughout the document. Different sections of the document give seemingly different figures. Anyhow, the preferred alternative goal of increasing the acreage of early successional riparian forest is desirable.

Overall, a sound document.

Alan Clark
1725 Valley Forge Drive
Titusville, FL 32796

I.5 Alan Clark, April 19, 2010

Response 5-1: Thank you for your review and comment on the CCP/EIS in support of establishing goals, objectives, and actions that will guide the refuge into the future. Your comments regarding coyote control criteria and riparian acreages are noted and will be clarified in the document.

Letter 6

wfaubion@aol.com
03/26/2010 10:56 AM

To FW1PlanningComments@fws.gov
cc
bcc
Subject Julia Butler Hansen Refuge ccp

History: This message has been replied to.

I strongly support alternative 2 with a few changes.

1. As a local hunter for 50+ tears I have never known Price Island to be closed to hunting. Of course there is no reason to hunt Price unless for varmints because waterfowl seldom use it, and there are only whitetails living on it. It also is within the existing big game closure administered by the Wash. DFW. To "open" this island does nothing for hunters. 6-1

2. The closure of Steamboat Slough to hunting would have a serious and negative impact on hunting opportunity around the refuge and I oppose it most strongly. This slough is one of the few weather protected area accessible by land and available to hunting on the entire refuge. Certainly it is close to the public road on the adjacent dike, but over the years I have heard of no problems which would involve the need for law enforcement, or which have posed a danger to the public, as a result of legal hunting.

At low water this is also an area where many varmints are killed legally which reduces their depredation on the refuge mainland. This includes coyotes and raccoons. 6-2

Perhaps I know too much of the history of this refuge. When it was originally created the mainland portion of the refuge was closed to hunting with the promise that once the whitetail deer were saved form extinction there would be the opportunity for hunting on the mainland. In recent years changes in the refuge have increased the available winter habitat for waterfowl, but there has been no increase in the hunting opportunity.

Instead, the refuge now holds migrating waterfowl which seldom stray into areas accessible to legal hunters. No additional hunting opportunity is made available, and you propose to further restrict access to productive waterfowl habitat by hunters.

A case can be made that your preferred alternative #2 is anti-hunting, if not in intention, then at least in its result.

3. Additional lands within the refuge should be opened for waterfowl hunting. I am confident such action would have no significant impact upon the whitetail deer, and would go a long way toward reestablishing the credibility of the refuge management. If the whitetail deer living on "unprotected" Puget Island are flourishing alongside free and open access for hunters, there can be no legitimate argument for restricting hunter access to the mainland refuge, or Tenasilee Island. 6-3

4. There are many legal hunters who would eradicate problem predators for free if it was allowed. There is no legitimate reason not to allow these legal hunters to harvest predators within the mainland portion of the refuge. This would be done at no additional cost the refuge and would have an extremely beneficial effect upon the whitetail population. It should be part of the preferred option. 6-4

Thank you for the opportunity to express my concerns for your cosideration

William J. Faubion
Cathlamet,Wa.

I.6 William Faubion, March 26, 2010

Response 6-1: Thank you for your comments in support of Alternative 2 with a few changes.

Response 6-2: While there have not been any instances of known safety problems the potential for visitor injury/conflict remains. Over the past year we have had two incidents of hunters shooting from the shoulder of the road, which in our view is not in the best interests of hunter or wildlife observer. The area outside the refuge dike in the vicinity of Steamboat Slough Road down to and including some of the tidelands is part of the refuge. Based on public comments and a review of the proposed closure the area to be affected will be clarified in the CCP/EIS to identify only the areas under Service jurisdiction. These areas include the outside of the mainland dike and the shoreline of Hunting Island in the vicinity of the lower Elochoman River. The refuge portion of Price Island has never been officially opened to hunting and while it does not provide the best hunting opportunities combined with the addition of waterfowl hunting at Crims Island, the overall refuge hunt area will increase in size and quality. The river itself and the adjacent beach are not under the jurisdiction of the Service and therefore their hunt status will remain unchanged.

Response 6-3: The CWT deer population on Puget Island is doing quite well on "unprotected" areas. Based on that assertion you suggest that hunting be allowed on the mainland unit. There are a couple of differences in potential hunter activities on Puget Island versus the refuge Mainland. Puget Island is over 5,000 acres while the Mainland Unit is around 2,000 acres. Thus population capacity of the mainland unit is less than half of Puget Island. Hunter activity on Puget Island tends to be more dispersed, in which some areas are open but many smaller farms and sheltered areas not available to the hunting public. Should waterfowl hunting be allowed on the refuge mainland, it would almost certainly be fairly high intensity causing CWT deer to move to other areas of the refuge. While this would not be a problem if the population numbers were high enough, they are relatively low and until they become more stable we feel that the increased disturbance would be a detriment to the CWT deer.

Response 6-4: Predator control is a sensitive issue on refuges. While it may be easy to reduce populations on private lands control of predators on a national wildlife refuge needs to have a high level of accountability and have a definite wildlife objective. There is a lot of emotion on both sides of the issue. While some may see raccoons or coyotes as a lethal predator others may see them as an opportunity to view wildlife in a natural setting. For this reason, we are focusing our efforts on protection of CWT deer fawns while providing opportunities for people who want to view different animals.

Letter 7

"Nate Jackson"
<nataj1@verizon.net>
03/28/2010 05:22 PM

To <FW1PlanningComments@fws.gov>
cc
bcc
Subject Julia Butler Hansen National Wildlife Refuge

History: This message has been replied to.

Mr. Charlie Stenvall, Project Leader,

Concerning the Draft CCP/EIS Alternatives for the Julia Butler Hansen National Wildlife Refuge, I am in favor of the increased hunting listed in alternative ***#2.*** 7-1

Regards,
Nate Jackson
Sandy, OR

I.7 Nate Jackson, March 28, 2010

Response 7-1: Thank you for your review and comment on the Draft CCP/EIS regarding increased hunting opportunities listed in Alternative 2.

Letter 8

"Ken Lindstrom" <ken.lindstrom@bendbroadband.com>
03/20/2010 08:36 PM

To <FW1PlanningComments@fws.gov>
cc
bcc
Subject Julia Butler Hansen Refuge Management Plan

History: This message has been replied to.

I support your proposal to allow hunting on the refuge. 8-1

Ken Lindstrom
4327 SW Tommy Armour CT
Redmond, OR 97756

541-279-0618

I.8 Ken Lindstrom, March 20, 2010

Response 8-1: Thank you for your review and comment on the CCP regarding allowing hunting on the refuge.

Letter 9

"Chris Hathaway"
<Hathaway@lcrep.org>
04/14/2010 12:53 PM

To <FW1PlanningComments@fws.gov>
cc <charlie_stenvall@fws.gov>, <joel_david@fws.gov>
bcc
Subject CCP Comments Re: Lower Columbia River Water Trail

History: This message has been replied to.

Hello Charlie and Joel,

I realize these comments are past the due date. I found out just yesterday about the draft CCP and was able to to just a quick scan. The comments all related to sections that reference water trails - and I'm specifically hoping you can acknowledge the Lower Columbia River Estuary Partnership as the Lower Columbia River Water Trail Coordinator. Our work on the trail has slowed in the last couple of years but we are trying to re-energize it and continue to maintain the Lower Columbia River Water Trail Web site. www.columbiawatertrail.org. I'd love to work with you guys on any water trail related projects you're interested in and feel like we would be the correct organization due to our geography.

I hope you both are well. Please let me know if I can answer any questions.

Chris

Chris Hathaway
Director of Stewardship and Technical Programs
Lower Columbia River Estuary Partnership
811 SW Naito Parkway, Suite 410
Portland, OR 97204
503 226 1565 x. 228
hathaway@lcrep.org
www.lcrep.org

USFWS Refuge CCP - Estuary Partnership comments 4.2010.pdf

I.9 Chris Hathaway, Lower Columbia River Estuary Partnership, April 14, 2010

Lower Columbia River Estuary Partnership

April 14, 2010

Charles Stenvall, Project Leader
Willapa National Wildlife Refuge Complex
3888 SR 101
Ilwaco, WA 98624

Re: Comments for the Lewis and Clark National Wildlife Refuge and Julia Butler Hansen Refuge for the Columbian White-tailed Deer (Refuges) Draft Comprehensive Conservation Plan and EIS

Greetings Charlie,

I understand I have missed the deadline for comments to the Draft Comprehensive Conservation Plan and Environmental Impact Statement. I apologize for not realizing the draft CCP was out.

I wanted to share a couple of comments with you on the CCP with regard to the Lower Columbia River Water Trail with the hope that they still might be evaluated and considered. Preferred Option 2 makes a number of references to the water trails. I hope you can make a few minor changes at various places based my comments below.

The Lower Columbia River Estuary Partnership coordinates the Lower Columbia River Water Trail which stretches from Bonneville Dam to the Pacific Ocean and includes sites in both Oregon and Washington. A bi-state, Lower Columbia River Water Trail Committee developed the trail, which was officially launched in 2004, under the auspices of the Lower Columbia River Estuary Partnership. Washington Water Trails Association was an important member of the Lower Columbia River Water Trail Committee but was, and is not, the lead organization for the Lower Columbia River Water Trail. 9-1

We would fully support the Water Trail elements of Preferred Option 2 – especially USFWS efforts to better connect to the Lower Columbia River Water Trail, and the efforts to establish non-refuge campsites in the area. As we have talked about before, camp sites in that reach of the river in Oregon and Washington are a critical need for paddlers using the Lower Columbia River Water Trail and the establishment of legal, non-refuge camp sites in that reach is one the water trail's highest priorities. 9-2

The Lower Columbia River Estuary Partnership and our Lower Columbia River Water Trail Committee would look forward to working with the Julia Butler Hansen and Lewis and Clark Wildlife Refuges on promoting the water trail, establishing a number of specific refuge trips as part of the Lower Columbia River Water Trail, establishing appropriate signage marking Lower Columbia River Water Trail access points, camp sites, and other sites of interest, and working with the states of Oregon and Washington or private landowners to develop appropriate non-refuge camp sites that can be utilized by paddlers on the Lower Columbia River Water Trail and experiencing these two lower Columbia River wildlife refuges.

I appreciate, what I hope is an opportunity for you to read this and consider these comments. Please don't hesitate to let me know if I can answer any questions.

Thanks,

Chris Hathaway
Director of Stewardship and Technical Program

[illegible] SW Naito Parkway, suite [illegible] Portland, Oregon • [illegible] • [illegible] • www.[illegible]

Response 9-1: Thank you for your review and comment on the Draft CCP/EIS. As requested we will make modify sections of the document that refer to the Washington Water Trails Association as the lead organization for the Lower Columbia River Water Trail.

Response 9-2: Your comments in support of the proposed Lower Columbia River Water Trail improvements have been noted.

Letter 10

Doug Heiken
<dh@oregonwild.org>
Sent by:
dh.oregonwild@gmail.com

04/09/2010 12:18 PM

To FW1PlanningComments@fws.gov
cc
bcc
Subject CCP for the Julia Butler Hansen Refuge and the Lewis and Clark National Wildlife Refuge

History This message has been replied to.

OREGON WILD
PO Box 11648 | Eugene OR 97440 | 541-344-0675 | fax 541-343-0996
dh@oregonwild.org | http://www.oregonwild.org/

9 April 2010

TO: Charles Stenvall, Project Leader
Willapa National Wildlife Refuge Complex
C/O: FW1PlanningComments@fws.gov

Subject: draft Comprehensive Conservation Plan (CCP) for the Julia Butler Hansen Refuge for the Columbian White-tailed Deer and the Lewis and Clark National Wildlife Refuge

Dear FWS:

Please accept the following comments from Oregon Wild concerning the draft Comprehensive Conservation Plan (CCP) for the Julia Butler Hansen Refuge for the Columbian White-tailed Deer and the Lewis and Clark National Wildlife Refuge http://www.fws.gov/jbh/CCP/CCP.html Oregon Wild represents about 7,000 members and supporters who share our mission to protect and restore Oregon's wildlands, wildlife, and water as an enduring legacy.

The draft CCP does not adequately reflect the significant threat of sea level rise. "The study maintains that global average sea level increases could increase by an average of 0.28 meters (11.2 inches) by 2050 and by 0.69 meters (27.3 inches) for the study locations in the Willapa Bay, Columbia River, and Tillamook Estuary (Glick et al. 2007)." This statement does not reflect the fact that sea level rise is likely to be highly non-linear and not linearly related to temperature. This is because small increases in temperature could trigger rapid destabilization of big ice deposits on Greenland and Antarctica. No one knows for sure, but sea level rise could be much greater than the 0.69 meters assumed in cited study. 10-1

> An important point is that the nonlinear response could easily run out of control, because of positive feedbacks and system inertias. Ocean warming and thus melting of ice shelves will continue after growth of the forcing stops, because the ocean response time is long and the temperature at depth is far from equilibrium for current forcing. Ice sheets also have inertia and are far from equilibrium: and as ice sheets disintegrate their surface moves lower, where it is warmer, subjecting the ice to additional melt. There is also inertia in energy systems: even if it is decided that changes must be made, it may require decades

I.10 Doug Heiken, Oregon Wild, April 9, 2010

Response 10-1: Thank you for your review and comment on the CCP/EIS. We agree with your assertion that sea level rise is likely to be highly non-linear and not linearly related to temperature. However, over the life of the CCP, it is unclear how this will affect management.

to replace infrastructure.

The nonlinearity of the ice sheet problem makes it impossible to accurately predict the sea level change on a specific date. However, as a physicist, I find it almost inconceivable that BAU climate change would not yield a sea level change of the order of meters on the century timescale.

Hansen, L.E. 2007. Scientific reticence and sea level rise. Environ. Res. Lett. 2 (April-June 2007). doi:10.1088/1748-9326/2/2/024002
http://iopscience.iop.org/1748-9326/2/2/024002/fulltext#erl246875s4

We are concerned that the relatively successful recovery efforts for the Columbian Whitetail Deer may be significantly set back by global climate change and rising sea levels in the lower Columbia River. To respond to the threat of sea level rise, FWS should consider adding some redundancy to the Columbia Whitetail Deer plan by establishing an additional and acquisition area for another deer population above the elevation likely to be affected by sea level rise (possibly in the Willamette River Watershed, e.g. Finley NWR, or Buford Park/Mt Pisgah near the confluence of the Coast Fork and Middle Fork). 10-2

We support closing areas to hunting to improve public safety and bird refuge. We oppose expanding hunting on Crims and Price islands. 10-3

We support expanded hiking trails in carefully selected areas that minimize wildlife conflicts 10-4

We support the wilderness suitability study. 10-5

We support weed removal and mitigation. 10-6

We support restrictions on OHVs. 10-7

Sincerely,
/s/

Doug Heiken, Oregon Wild
PO Box 11648, Eugene OR 97440
dh@oregonwild.org, 541.344.0675

Doug Heiken, Oregon Wild
PO Box 11648, Eugene OR 97440
dh@oregonwild.org, 541.344.0675

Response 10-2: We also agree that recovery efforts for the CWT deer will likely be affected by global climate change and sea level rise. Your suggestion to establish additional lands for the deer have already been considered for non-FWS lands. This CCP/EIS only covers management of refuge lands. The CCP/EIS covers management for the next 15 years and thus while sea level rise and climate change needs to be considered, future planning efforts will be focused on looking at the longer term needs of the CWTD using the most up to date climate modeling available.

Response 10-3: In regards to your comment opposing the expansion of waterfowl hunting we reiterate the following: Opening the Service owned portions of Crims and Price islands to waterfowl hunting will complement state-permitted activities that are already occurring. This will resolve potential problems over the exact position of the refuge boundary that would exist with a waterfowl hunt closure, and associated enforcement of relevant laws and regulations. Hunting is currently permitted on Oregon- and Washington State–owned waters and tidelands surrounding both islands. These adjacent waters are all tidally influenced submerged lands below mean high water. It would be essentially impossible to establish and enforceable boundary between the state-owned tidelands and the refuge shoreline.

Response 10-4: Comment noted.

Response 10-5: Comment noted.

Response 10-6: Comment noted.

Response 10-7: Comment noted.

Letter 11

jean public
<usacitizen1@live.com>
02/10/2010 01:04 PM

To <fw1planningcomments@fws.gov>, <americanvoices@mail.house.gov>, <comments@whitehouse.gov>, <info@peta.org>,
cc
bcc
Subject public comment on federal register

History: This message has been replied to.

the document should have printed that wildlife "protection" is what you do because that is what the refuges were created to do until the gun wacko wildlife murderers sneaked in changes. we want it changed back to its original intent. we dont want perverted, sick wildlife murderers to have run of the sites we all strive to protect. after all these sick wildlife murderers are only 3% of the national population and yet they endanger all 975% of us who wantnto use these areas. conservation is a code word used to indicate "wildlife murder" . dont fall for it. it is used deceptively just like the word "harvest" for deer slaughter.thes. re is no place fo rhunting in this site as that use is non compliant with any other use and there are 97% of us who do not hunt in this united states. trapping also needs to be banned completely. holding meetings by the site shows bias in getting comments from local profiteers being there and the natiional owners of this site being discriminated against in commenting. you have skewed public comment with these meetings. i object to opening crimsisland to wildlife slaughter by perverted gun wackos. these gun wackos need to be kept off the entire site. 11-1
jean public 15 elm st florham park nj07932

[Federal Register: February 10, 2010 (Volume 75, Number 27)]
[Notices]
[Page 6694-6696]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr10fe10-98]

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

[FWS-R1-R-2009-N0112; 1265-0000-10137-S3]

Lewis and Clark National Wildlife Refuge and Julia Butler Hansen Refuge for the Columbian White-Tailed Deer

I.11 Jean Public, February 10, 2010

Response 11-1: Thank you for your review and comment on the CCP.

Letter 12

"" <arees@oz.net>
03/22/2010 09:51 AM

To <FW1PlanningComments@fws.gov>
cc
bcc
Subject JB Hansen Refuge CCP

History: This message has been replied to.

I would like to state my support for Alternative #2, the preferred alternative described in the CCP. I am a waterfowl hunter and appreciate your efforts to maintain quality and safe opportunities for me and my son. 12-1

Andrew Rees
22121 NE 60th St
Redmond, WA 98053
206 755-6831

I.12 Andrew Rees, March 22, 2010

Response 12-1: Thank you for your review and comment on the CCP regarding you support for Alternative 2 and the associated hunting proposal.

Letter 13

"Pamplin, Nathan (DFW)" <Nathan.Pamplin@dfw.wa.gov>

04/12/2010 01:30 PM

To <FW1PlanningComments@fws.gov>

cc "Kraege, Don (DFW)" <Don.Kraege@dfw.wa.gov>, "Jonker, Sandra A (DFW)" <Sandra.Jonker@dfw.wa.gov>, "Lasiter, Susan E (DFW)" <Susan.Lasiter@dfw.wa.gov>

bcc

Subject Comments on DCCP for Lewis & Clark and Julia Butler Hansen NWRs

History: This message has been replied to.

Dear Mr. Stenvall:

Thank you for the opportunity to review the DCCP/EIS for Lewis and Clark and Julia Butler Hansen National Wildlife Refuges. We have been a part of the "extended team" for this planning effort and we appreciate the opportunity to be involved throughout the making of this document. Attached are our comments on the draft CCP/EIS.

Thank you again for the opportunity to review this document. Please feel free to contact me at (360) 902-2693 or Don Kraege at (360) 902-2522 if you have any questions.

Sincerely,

Nate Pamplin
Deputy Assistant Director
Wildlife Program

WDFW_Comments_DCCP_April12_2010.pdf

I.13 Nate Pamplin, Washington Department of Fish and Wildlife, April 12, 2010

STATE OF WASHINGTON
Department of Fish and Wildlife
Mailing Adress: 600 Capitol Way N • Olympia WA 98501-1091 • (360) 902-2200; TTY (800) 833-6388
Main Office Location: Natural Resources Building • 1111 Washington Street SE • Olympia WA

April 12, 2010

Charlie Stenvall, Project Leader
Willapa National Wildlife Refuge
388 SR 101
Ilwaco, Washington 98624-9707

Dear Mr. Stenvall,

Thank you for the opportunity to review the Draft Comprehensive Conservation Plan/Environmental Impact Statement (DCCP/EIS) for Lewis and Clark and Julia Butler Hansen National Wildlife Refuges (NWR). We appreciate being involved as part of the "extended team" from this project's inception to present.

In general, we support Alternative 2. The emphasis on controlling non-native or noxious weeds is an important step toward improving wildlife habitat on the islands. There are, however, a few concerns we have outlined below:

On page 2-9 and 2-11, Maps 4 and 5 show the *closed to waterfowl hunting area* of Miller Sands Island to be in the bay area only, or the bay and spit area only. The signs at the Refuge are posted along the perimeter of the island – this appears to close all lands on the island, not just the bay and /or spit. Is there a change in how this island will be managed for hunting? Are the maps correct and the signs incorrectly posted, or vice versa? 13-1

On page 2-27, Map 9a shows much of Miller Sands Island to be in a grassland condition. We suggest that restoration options be identified – as scotch broom is nearly taking over what used to be the meadow/grassland complex. 13-2

On page 2-43, Map 10 is different from the other maps with regard to depicting public use and waterfowl hunting. Consistency in maps would help facilitate public understanding. 13-3

Section 2.9.5.2 outlines some strategies for enhancing Columbian White Tail Deer (CWTD). The Washington Department of Fish and Wildlife (WDFW) is concerned about the identification of Ridgefield NWR as a suitable site (p. 2-62). There are many issues that need to be resolved before such a determination might be made. WDFW supports studying the concept of re-location of CWTD to Ridgefield NWR; however, we suggest that the designation of Ridgefield NWR as a suitable site may be premature at this time. Ridgefield is one of the fastest growing urban areas in Clark County; we are concerned about the movement of deer from the refuge onto adjacent areas, and potential damage issues. The 13-4

Response 13-1: Thank you for your comments in general support of Alternative 2 for both refuges. Your comments regarding waterfowl hunt closures depicted on Maps 4 and 5 are correct, and this will be changed in the document.

Response 13-2: Your comments regarding the vegetative condition of Miller Sands are correct. The legend depicting a scotch broom infestation will be changed on the map. General restoration options are covered under Goal 6 (Section 2.8.6.4) for the Lewis and Clark NWR.

Response 13-3: Your comments regarding Map 10 on page 2-43 are correct. The map will be modified to show the entire waterfowl closure on Miller Sands.

Response 13-4: Your comments regarding potential relocation of CWT deer to Ridgefield National Wildlife Refuge are noted and the wording will be changed to show that Ridgefield is a “potentially suitable site.” This is consistent with the wording stated on page 4-69.

L&C and JBH CCP Review
April 12, 2010
Page 2

sentence on p. 2-62 should be reworded to identify Ridgefield as a "potentially suitable site" pending further study. This would be consistent with the wording on p. 4-69 referencing Ridgefield as a potential site.

Section 4.7.2.2 outlines a change in waterfowl hunting near the Elochoman River mouth. We are not aware of any safety problems in this area and are interested in more information on the problem. The idea of opening up the ship channel side of Price Island to hunting as a replacement is not without its problems. Hunting along the ship channel shoreline exposes hunters to ship wakes and creates a possible safety issue. The sheltered area of the Elochoman River is also available to hunters without boats, who would walk out from the county road. 13-5

Section 4.7.2.3 outlines potential impacts to raptors through the disturbance of hunting. It might be valuable to point out that WDFW hunting seasons take place outside of the critical nesting period for raptors.

The last two paragraphs on page 4-64, under Section 4.7.2.3.1, that begin with "Because the coyote population…" are unclear and confusing as to the intent. A review of these two paragraphs may help clarify the objectives for coyote control under the different alternatives.

On page 6-11, the statement is made that Tenasillahe Island is closed to hunting. Does that closure include the shorelines? There are many who think that any area outside of the dike is open, especially the tidal zone; so this may need to be clarified. 13-6

On page B-11, the third bullet in the listing of hunt areas and closures indicates that the new Steamboat Slough closure is directly adjacent to the wildlife viewing area on Steamboat Slough Dike Road. Will a new viewing area be built or is this the existing site at the Refuge Office? We are not sure that hunting in this area is interfering with wildlife viewing. Most of the birds observed from that area are in the closed area of the refuge – across the slough from the office.

Page B-19, the name for the "Advanced Hunter Education program" has been changed to the "Master Hunter Program."

Thank you again for the opportunity to review this document. Please feel free to contact me at (360) 902-2693 or Don Kraege at (360) 902-2522 if you have any questions.

Sincerely,

Nate Pamplin
Deputy Assistant Director
Wildlife Program

Response 13-5: Your comments regarding a change in waterfowl hunting along the lower section of the Elochoman River in Section 4.7.2.2 are noted. While there have not been any instances of known safety problems the potential for some type of incident remains. Over the past year we have had two incidents of hunters shooting from the shoulder of the road, which in our view is not in the best interests of hunter or wildlife observer. We do agree that the hunting opportunities adjacent to Price Island are not the perfect solution but with addition of waterfowl hunting Crims Island the overall refuge hunt area will increase. Also under this proposal, the private beach and its tidelands adjacent to the refuge would remain open to hunting with landowner approval. We would also like to point out that outside the refuge dike in the vicinity of Steamboat Slough Road down to and including some of the tidelands is part of the refuge. This area has never officially been opened to hunting and if we were to officially open it to hunting it would have to go through a NEPA process. Based on public comments and a review of the proposed closure the area to be affected will be clarified in the CCP/EIS to identify only the areas under Service jurisdiction. These areas include the outside of the mainland dike and the shoreline of Hunting Island in the vicinity of the lower Elochoman River. The river itself is not under the jurisdiction of the Service and therefore will remain open waterfowl hunting. Also remaining open are the private beach and its tidelands adjacent to the refuge with landowner approval.

Response 13-6: Your comments/suggestions regarding WDFW hunting seasons and raptors, clarification of coyote control measures, and clarification of the proposed Steamboat Slough hunting closure, and Master Hunt Program have been noted and included in the text. The Tenasillahe Island hunt closure does not extend to the tidal zone.

Letter 14

steve puddicombe <pudfella@willapabay.org>
02/02/2010 11:36 PM

To FW1PlanningComments@fws.gov
cc Charlotte Persons <cpersons@yahoo.com>
bcc
Subject CCP for Lewis & Clark Refuge

History: This message has been replied to.

February 2, 2010

Planning Managers:

I am writing regarding the CCP currently underway for the Lewis and Clark NWR. We have heard that the process may now skip the usual study of the land holdings as appropriate for designation as wilderness. If this is truly the case, we urge you to reconsider.

We would advocate that wilderness eligibility be evaluated for the refuge as part of the Comprehensive Management Plan. The NWRS is generally obligated under the National Environmental Policy Act to examine wilderness eligibility in the land management planning process and we see no reason to change that policy now.

We feel that many of the islands within the Lewis & Clark NWR ought to be considered for wilderness. Paddling a kayak through the islands can surely be a wilderness experience when away from the main channels where the power boats operate. With the resurgence of interest in the Lewis & Clark Expedition, and the recent formation of the National Park honoring their exploration, the designation of some wilderness areas within the refuge would seem to be a natural fit. We also feel wilderness status may better protect the islands for birds and wildlife in the future. 14-1

In any case a wilderness elgibility study will examine all aspects of the designation before any determination is made.

We would like to hear back from you on this, and will consider your response before taking any further action.

Thank you,

Steve Puddicombe
Willapa Hills Audubon
Conservation Committee

I.14 Steve Puddicombe, Willapa Hills Audubon, February 2, 2010

Response 14-1: Thank you for your comment regarding the Wilderness Review process for the Julia Butler Hansen and Lewis and Clark refuges. During the development of the Draft CCP for these refuges, the Service elected to conduct only the first phase of the Wilderness Review. The Wilderness Inventory phase for these stations was conducted, and our analysis shows the findings of the inventory for potential wilderness study (Appendices E and F). As a result of this analysis, and public comments on this information in the Draft CCP/EIS, the Service has determined that we have adequate information and assessment of management actions to designate Wilderness Study Area(s) of over 6,745 acres for the Lewis and Clark NWR and 1,344 acres of the JBH NWR. See Appendices E and F for more information. Within five years, the Service will further evaluate the lands within the Lewis and Clark and Julia Butler Hansen NWRs WSAs and decide whether to recommend them for wilderness designation. The continuation of the wilderness study may change the acreage of the WSA(s) and will address management requirements for these areas. Public input will be included during the additional study and proposal development. In the meantime, the lands under Service jurisdiction within the Lewis and Clark Islands WSAs on the Lewis and Clark Refuge and on the Wallace Island and Hunting Islands WSA on the Julia Butler Hansen Refuge will be managed by the Service to retain their wilderness values and character in accordance with our policy (610 FW 4,. Section 4.21) [See http://www.fws.gov/policy/610fw4.html].] The public will be kept apprised of our analysis and future recommendations. Before the agency makes any formal proposal for Wilderness designation, a formal public process will be announced and will include additional planning and NEPA compliance.

Letter 15

"Herman Biederbeck"
<herman.h.biederbeck@state.or.us>

04/12/2010 11:04 AM

To Joel_David@fws.gov

cc "David Nuzum" <david.j.nuzum@state.or.us>, "DonVandeBergh" <don.j.vandebergh@state.or.us>, "RickKlumph" <rick.l.klumph@state.or.us>, "Troy Laws"troy.s.laws@state.or.us

Subject RE: NOTICE! Lewis and Clark and Julia Butler Hansen NWRs Draft CCP/EIS public comment period

Joel
After reviewing the draft CCP/EIS on the Lewis and Clark and Julia Butler Hansen NWRs I support the USFWS in selecting the preferred alternatives (PAs) for both refuges.

Both PAs maintain or expand waterfowl hunting opportunties over current levels; wildlife observation and photography opportunities are enhanced over current levels in both PAs. It appears that other public uses, such as fishing, will not be negatively impacted by implementation of the PAs.

In the PAs, I support expanding research, inventory and monitoring work through assistance from colleges, and enhancing environmental education and interpretation (EEI) opportuntities. 15-1

Selection and implementation of the PA for the JBH NWR is especially important for the listed Columbian white-tailed deer (CWTD). It allows for maximum flexibility in predator management activities, and supports enhanced habitat management for CWTD. I feel that both strategies are needed to insure recovery of the species, along with establishment of other CWTD populations along the Columbia River, another strategy in the PA.

The draft CCP/EIS document was very well written, with all the needed details to effectively evaluate the alternatives. I appreciate the opportunty to review and comment on it.

Sincerely,
Herman Biederbeck
District Wildlife Biologist
North Coast Watershed District
Oregon Dept. of Fish and Wildlife
4907 Third Street
Tillamook, OR 97141
Ph: 503-842-2741 ext. 227
Fax: 503-842-8385
email: herman.h.biederbeck@state.or.us

I.15 Herman Biederbeck, District Wildlife Biologist, Oregon Department of Fish and Wildlife, April 12, 2010

Response 15-1: Thanks for your review and comment on the CCP/EIS and the preferred alternatives.

Letter 16

"Don VandeBergh"
<don.j.vandebergh@state.or.us>

04/12/2010 03:15 PM

To <Joel_David@fws.gov>
cc
Subject Lewis and Clark and Julia Butler Hansen NWR's DRAFT CCP/EIS public comment period.

Joel,
I have reviewed the DRAFT CCP/EIS for the Lewis and Clark and Julia Butler Hansen NWRs and support the preferred alternative as the most suitable for the future management of the refuge.

In particular, the preferred alternative really stands out from the other options in many ways:

Provides the most comprehensive habitat restoration and protection options (Goal 1, 2, 3, 4) that not only create a more diverse and species rich environment but also enhances recovery of Oregon Conservation Strategy species such as Columbian White-tailed deer (CWTD), Olive-sided flycatcher, Coho and Chinook salmon and winter steelhead. The restoration and protection of aquatic, riparian and wetland habitats are clearly identified as Oregon Conservation Strategy habitats requiring conservation actions in the Coast Range Ecosystem.

Supports healthy populations of CWTD by allowing flexibility in predator management (Goal 5). 16-1

Identifies and supports expansions in inventories, monitoring, research and studies that support Adaptive Management decisions (Goal 7).

Enhances the quality of outdoor recreation (hunting, fishing, photography, viewing), environmental education, and interpretation opportunities (Goal 8) without negatively impacting existing opportunities.

Supports the Oregon Conservation Strategy for the improvement of fish passage, maintaining water quality, reduce sedimentation and continue to provide functional riparian habitats (Goal 6).

Thank you for the opportunity to review and comment on the Lewis and Clark and Julia Butler Hansen NWR's DRAFT CCP/EIS.

Best of luck,

Donald J. VandeBergh
District Wildlife Biologist
Oregon Department of Fish and Wildlife
North Willamette Watershed District
18330 NW Sauvie Island Road
Portland, OR 97231
503-621-3488 ext. 229
Fax 503-621-3025

I.16 Don Vandebergh, District Wildlife Biologist, Oregon Department of Fish and Wildlife, April 12, 2010

Response 16-1: Thanks for your review and comment on the CCP/EIS in support of the preferred alternatives and management goals 1 through 8.

Appendix J. Implementation

J.1 Overview

Implementation of the CCP will require increased funding, which will be sought from a variety of sources. This plan will depend on additional Congressional allocations, partnerships and grants. There are no guarantees that additional Federal funds will be made available to implement any of these projects. Other sources of funds will need to be obtained (both public and private). Activities and projects identified will be implemented as funds become available.

Operational management of Refuge lands is accomplished by permanent and temporary staffing, volunteers and partnerships. Operational management includes managing public use, law enforcement, biology, fire, maintenance, administration, and habitat management programs on the Refuge.

Many of the infrastructure and facility projects will be eligible for funding through construction or Transportation Equity Act (TEA 21) funds (i.e., Refuge Roads).

The CCP proposes several projects to be implemented over the next 15 years. All of these projects are included in either the Refuge Operational Needs System (RONS) or the Service Asset Management System (SAMMS). Both are used to request funding from Congress. Currently, a large backlog of maintenance needs exists on the Refuges. In 2007, the deferred maintenance backlog for Julia Butler Hansen and Lewis and Clark refuges was $2.5 million. Reduction of the backlog is an ongoing goal and is included here in the analysis of funding needs. The Refuge Operational Needs System (RONS) documents proposed new projects to implement the CCP to meet Refuge goals and objectives and legal mandates.

Annual revenue sharing payments to Clatsop and Columbia counties, Oregon and Wahkiakum County, Washington will continue. Total revenue sharing payments made in 2007 were $18,000 to Clatsop County, $6,000 to Columbia County and $12,000 to Wahkiakum County.

Monitoring activities will be conducted on a percentage of all new and existing projects and activities to document wildlife populations and changes across time, habitat conditions, and responses to management practices. Actual monitoring and evaluation procedures will be detailed in step-down management plans.

J.2 Costs to Implement CCP, by Alternative

The following sections detail both one time and recurring costs for various projects, by alternative. One time costs reflect the initial costs associated with a project whether it is purchase of equipment, contracting services, or construction. Recurring costs reflect the future operational and maintenance costs associated with the project.

One Time Costs

One time costs are project costs that have a start up cost associated with them, such as purchasing a new vehicle for wildlife and habitat monitoring or designing and installing an interpretive sign. These projects are usually projects that can be completed in three years or less. These projects do not include permanent operational costs (staff salary and support). They can, however, include the cost of temporary or term salary associated with a short term project. Salary for new positions and operational costs are reflected in operational or recurring costs.

Funds for one time costs will be sought through increases in Refuge base funding, special project funds, grants, Refuge Roads or Transportation Equity Act (TEA3) funding, and fire funds. Projects listed in Tables J-1 through J-5 show one time costs, such as those associated with refuge facilities such as offices, public use facilities, road improvements, and new signs. One time costs are also associated with habitat restoration and protection projects such as specific riparian and wetland projects or research. New research projects, because of their short term nature are considered one time projects, and include costs of contracting services or hiring a temporary employee for the short term project. Tables J-1 and J-2 compare the one time costs between the various alternatives for the Lewis and Clark Refuge while Tables J-3, J-4, and J-5 do the same for the Julia Butler Hansen Refuge.

Lewis and Clark Refuge

Table J-1 One Time Costs (in thousands) for Research, Monitoring, and Planning

Research and Monitoring Projects	Priority	Unit	Unit Cost (in dollars)	Alt 1	Alt 2	Potential Fund Source
Monitor species composition, distribution, and timing of migratory bird use of the refuge, including mid-winter waterfowl survey, bald eagle survey, and dusky Canada goose survey Obj 2.8.7.1A	H	Project	20	20	20	*
Work with graduate programs to conduct research/monitoring studies	M	Project	10	0	10	*
Monitor species composition, distribution, and life history attributes of fishery resources	H	Project	30	30	30	*
Identify high-priority, wilderness-related research and monitoring needs for the Refuge Islands WSA	M	Project	10	0	10	*
Monitor the status of wilderness character within the Refuge Islands WSA and its conduct avoids generally prohibited uses	M	Project	10	0	10	*
All Research, Monitoring and Planning Projects Subtotal (thousands)				**$50**	**$80**	
High Priority Research, Planning, and Monitoring Only (thousands)				**$50**	**$50**	

* Projects will be funded as opportunities arise.

Table J-2 One Time Costs (in thousands) for Habitat Management

Habitat Projects	Priority	Unit	Unit cost (in dollars)	Alt 1	Alt 2	Fund Source
Protect Scrub-Shrub Swamp Habitat on Refuge over 15 Years - Obj 2.8.1.1						
number of acres				*2,360*	*2,360*	*
total cost	H	ac	$5	$12	$12	
Protect Sitka Spruce Swamp Habitat on Refuge over 15 Y - Obj 2.8.1.2						
number of acres				*285*	*285*	*
total cost	H	ac	$25	$9	$9	
Protect Cottonwood/Willow Swamp Habitat on Refuge over 15 Y - Obj 2.8.1.3						
number of acres				*127*	*127*	*
total cost	H	ac	$25	$3	$3	
Protect Emergent Tidal Marsh Habitat on Refuge over 15 Y - Obj 2.8.2.1						
number of acres				*4,000*	*4,000*	*
total cost	H	ac	$5	$20	$20	
Protect Mudflats and Sandbars on Refuge over 15 Y - Obj 2.8.3.1						
number of acres				*7,610*	*7,610*	*
total cost	H	ac	$5	$38	$38	
Protect Upland Forest on Refuge over 15 Y - Obj 2.8.4.1						
number of acres				*80*	*80*	*
total cost	M	ac	$50	$4	$4	
Protect Riparian Forest on Refuge over 15 Y - Obj 2.8.4.2						
number of acres				*470*	*470*	*
total cost	H	ac	$50	$24	$24	
Protect Riverine and Estuarine Open Water and Slough Habitats - Obj 2.8.5.1						
number of acres				*7,775*	*7,775*	*
total cost	H	ac	$5	$39	$39	
All Habitat Projects Subtotal (in thousands)				**$149**	**$149**	
High Priority Habitat only Subtotal (in thousands)				**$144**	**$144**	

* Projects will be funded as opportunities arise.

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Table J-3 One Time Costs (in thousands) for Research and Monitoring Projects

Research and Monitoring Projects	Priority	Unit	Unit Cost (in dollars)	Alt 1	Alt 2	Alt 3	Fund Source
Monitor migratory bird species composition, distribution, and timing of refuge use including surveys of mid-winter waterfowl, bald eagles, and dusky Canada geese.	H	Project	$20	$20	$20	20	*
Work with graduate school programs to conduct research and monitoring studies.	M	Project	$10	$10	$10	10	*
Monitor fish species composition, distribution, and life history attributes.	H	Project	$30	$30	$30	30	*
Identify high-priority, wilderness-related research and monitoring needs for the Refuge Islands WSA.	M	Project	$10	$0	$10	0	*
Monitor the status of wilderness character within the Refuge Islands WSA and its conduct avoids generally prohibited uses	M	Project	$10	$0	$10	0	*
All Research, Monitoring, and Planning Projects Subtotal (thousands)				**$60**	**$80**	**$60**	*****
High Priority Research, Planning, and Monitoring Only (thousands)				**$50**	**$50**	**$50**	*****

* Projects will be funded as opportunities arise.

Table J-4 One Time Costs (in thousands) for Facilities

Facilities Projects	**Priority**	**Unit**	**Unit Cost** (in dollars)	**Alt 1**	**Alt 2**	**Alt 3**	**Fund Source**
Enhance Hwy 4 wildlife viewing site - Obj 2.8.8.1A	M	Mainland	$70	$0	$70	$70	*
Auto pull-outs for wildlife observation on Steamboat Slough Road - Obj 2.8.8.1 B	M	Mainland	$120	$0	$120	$120	*
Install spotting scopes at two additional viewing areas - Obj 2.8.8.1 C	M	Mainland	$20	$0	$0	$20	*
Add mile markers on auto tour route and trails - Obj 2.8.8.1 D	M	Mainland	$10	$0	$0	$10	*
Develop an all-season hiking and cycling route - Obj 2.8.8.1 E	H	Mainland	$150	$0	$150	$150	*
Install interpretive panel/map at Steamboat Slough Road Tenasillahe Island viewpoint - Obj 2.8.8.1 F	M	Mainland	$40	$0	$40	$40	*
Improve signage to better delineate refuge hunt boundaries - Obj 2.8.8.2 A	H	Refuge	$60	$60	$60	$60	*
Improve signage to more clearly delineate fishing opportunities - Obj 2.8.8.3 A	M	Mainland	$10	$0	$10	$10	*
All Facilities Subtotal (thousands)				**$60**	**$450**	**$480**	*
High Priority Facilities Subtotal (thousands)				**$60**	**$210**	**$210**	*

* Projects will be funded as opportunities arise.

Table J-5 One Time Costs (in thousands) for Habitat Management

Habitat Projects	**Priority**	**Unit**	**Unit Cost** (in dollars)	**Alt 1**	**Alt 2**	**Alt 3**	**Fund Source**
Manage Short Grass Fields on Refuge over 15 Years - Obj 2.8.1.1							
number of acres				*790*	*950*	*790*	*
total cost	H	ac	$90	$32	$38	$32	
Restore and Maintain Early Successional Riparian Forest on Refuge over 15 Years - Obj 2.8.2.1							
number of acres				*210*	*400*	*210*	*
total cost	H	ac	$900	$9	$9	$9	
Maintain Mid-successional Riparian Forest on Refuge over 15 Years - Obj 2.8.2.2							
number of acres				*90*	*90*	*90*	*
total cost	H	ac	$40	$0	$0	$0	
Maintain Late-successional Riparian Forest on Refuge over 15 Years - Obj 2.8.2.3							
number of acres				*875*	*875*	*875*	*
total cost	H	ac	$10	$10	$10	$10	
Restore and Maintain Non-tidal Wetland Habitat on Refuge over 15 Years - Obj 2.8.3.1							
number of acres				*132*	*172*	*132*	*
total cost	H	ac	$5	$12	$15	$12	
Maintain and Protect Existing Sloughs on Refuge over 15 Years - Obj 2.8.3.2							
number of acres				*156*	*156*	*156*	*
total cost	M	ac	$5	$140	$140	$140	
Maintain and Protect Scrub-Shrub Swamp on Refuge over 15 Years - Obj 2.8.4.1							
number of acres				*865*	*865*	*865*	*
total cost	H	ac	$5	$35	$35	$35	
Maintain and Protect Sitka-Spruce Swamp on Refuge over 15 Years - Obj 2.8.4.2							
number of acres				*356*	*356*	*356*	*
total cost	H	ac	$5	$4	$4	$4	

Habitat Projects	Priority	Unit	Unit Cost (in dollars)	Alt 1	Alt 2	Alt 3	Fund Source
Maintain and Protect Cottonwood/Willow Swamp on Refuge over 15 Years - Obj 2.8.4.3							
number of acres				*625*	*625*	*625*	*
total cost	H	ac	$5	$56	$56	$56	
Maintain and Protect Emergent Tidal Marsh on Refuge over 15 Years - Obj 2.8.4.4							
number of acres				*330*	*330*	*330*	*
total cost	H	ac	$5	$30	$30	$30	
Maintain and Protect Open Water and Tidal Slough Habitat on Refuge over 15 Years - Obj 2.8.4.5							
number of acres				*300*	*300*	*300*	*
total cost	H	ac	$5	$27	$27	$27	
All Habitat Projects Subtotal (in thousands)				**$355**	**$364**	**$355**	
High Priority Habitat Only Subtotal (in thousands)				**$214**	**$308**	**$214**	

* Projects will be funded as opportunities arise.

Operational and Maintenance (Recurring) Costs

Operational and maintenance costs reflect Refuge spending of base funds allocated each year. These are also known as recurring costs and are usually associated with day to day operations and projects that last longer than three years. Operational costs use base funding in Service fund codes 1261, 1262, 1263, 1264, 1265, 9131, 9263, and 9264.

Maintenance includes preventative maintenance; cyclic maintenance; repairs; replacement of parts, components, or items of equipment; adjustments, lubrication, and cleaning (non janitorial) of equipment, painting; resurfacing; rehabilitation; special safety inspections; and other actions to assure continuing service and to prevent breakdown. Alternatives 1, 2, and 3 reflect the backlog and chart the increased maintenance need associated with new facilities and additional acquisitions.

Tables J-6 and J-7 displays operating and maintenance costs by alternative by refuge. Alternatives 1, 2, and 3 reflect increased funding needs for proposed increases in public uses and facilities, increased habitat restoration and conservation activities, and new monitoring needs. This table includes such things as salary, operational expenditures such as travel, training, supplies, utilities and annual maintenance costs.

Lewis and Clark Refuge

Table J-6 Operational (Recurring) costs (in thousands).

Project	Action	Resources Needed	Alt 1	Alt 2
1.a Survey and Censuses	All methods of enumerating fish and wildlife populations, vegetative habitats, analysis, interpretation and reporting.	1260- biologist, bio techs, & volunteers	$20	$20
1.b Studies and Investigations	Research projects for managing fish and wildlife populations and habitats.	1260 - biologist & cooperators	$10	$10
2.a Wetland Restoration	The conversion of altered or degraded on-refuge wetland habitats, including riparian zones back to their original conditions.	1260, special project funds	$0	$0
2.b Upland/ island/cliff Mgmt	The conversion of altered or degraded refuge upland habitats back to their original condition by such actions as replanting native species.	1260, special project funds	$0	$0
3.a Wetland Management	Manipulating water bodies to affect vegetation and/or create desired wildlife conditions.	1260 funds	$0	$0

Project	Action	Resources Needed	Alt 1	Alt 2
3.b Riparian Habitat Management	Planting of native trees and brush to mimic historic conditions.	1260 funds	$0	$0
3.c Graze/Mow/ Hay Crop Management	The management of grasslands and other habitats for the benefit of wildlife by cropland, grazing, mowing, or haying.	1260 funds	$0	$0
3.f Fire Management	Prescribed burning and wildfire preparedness activities. Follow-up monitoring and reporting.	1260 funds	$0	$0
3.g Native Pest Plant Control		1260, special project funds	$10	$10
3.h Invasive Plant Management	The eradication, reduction, or control of invasive or exotic plants. Includes monitoring.	1260, special project funds	$25	$25
4.a Bird Banding	Marking and banding of birds.		$0	$0
5.a Interagency Coordination	Interacting with other Federal, State and local governments to share information, resolve problems, develop cooperative efforts, and manage species and habitats.	1260 funds	$50	$50
5.b Tribal Coordination	Activities associated with the development of cooperative agreements, MOUs, annual funding agreements and similar cooperation/coordination/ communications efforts with tribes.	*	0	0
5.c Private Lands Activities	Assist private landowners with habitat improvement and wildlife issues (Initiate stewardship).	1260, special project funds	$50	$50
5.d Wildlife Population Management		1260, special project funds, biologist	$10	$10
6.a Law Enforcement	Public Safety, Resource Protection, Hunt Program	1260, law enforcement officer	$100	$100
7.a Visitor Services and Outreach	Providing access, facilities, and programs for refuge visitors. Planning, construction, operation and maintenance of visitor facilities such as roads, trails, signs. Interpretation, environmental education, hunting and other recreation. Off-site presentations, exhibits, news releases, and radio/TV spots.		$10	$10
TOTALS	**Subtotals Annual Operational Costs (in thousands)**		**$285**	**$285**
	Operational Costs over 15 years (in thousands)		**$4,275**	**$4,275**

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Table J-7 Operational (Recurring) costs (in thousands).

Project	Action	Resources Needed	Alt 1	Alt 2	Alt 3
1.a Survey and Censuses	All methods of enumerating fish and wildlife populations, vegetative habitats, analysis, interpretation and reporting.	1260 - biologist, bio techs, & volunteers	$20	$30	$20
1.b Studies & Investigations	Research projects for managing fish and wildlife populations and habitats.	1260 - biologist & cooperators	$10	$20	$10
2.a Wetland Restoration	The conversion of altered or degraded on-refuge wetland habitats, including riparian zones back to their original conditions.	1260, special project funds	$0	$30	$0

Project	Action	Resources Needed	Alt 1	Alt 2	Alt 3
2.b Upland/ island/cliff Mgmt	The conversion of altered or degraded on-refuge upland habitats back to their original condition by such actions as replanting native species.	1260, special project funds	$10	$15	$10
3.a Wetland Management	The manipulation of water bodies to affect vegetation and/or create desired wildlife conditions.	1260, special project funds	$20	$25	$20
3.b Riparian Habitat Management	Planting native trees and brush to mimic historic conditions.	1260, special project funds	$50	$80	$50
3.c Graze/Mow /Hay Crop Management	The management of grasslands and other habitats to benefit wildlife by cropland grazing, mowing, or haying.	1260, special project funds	$10	$10	$10
3.f Fire Management	Prescribed burning and wildfire preparedness activities. Follow-up monitoring and reporting.	*	$0	$0	$0
3.g Native Pest Plant Control		1260, special project funds	$10	$10	$10
3.h Invasive Plant Management	The eradication, reduction, or control of invasive or exotic plants. Includes monitoring.	1260, special project funds	$25	$25	$25
4.a Bird Banding	Marking and banding birds.	*			
5.a Interagency Coordination	Coordinate with Federal/State/local governments to share information, resolve issues, develop cooperative efforts, and manage species/habitats.	1260 funds	$10	$10	$10
5.b Tribal Coordination	Activities associated with the development of cooperative agreements, MOUs, annual funding agreements and similar cooperation/coordination/ communications efforts with tribes.	*			
5.c Private Lands Activities	Efforts to assist private landowners with habitat improvement and wildlife issues. (Initiate Stewardship Mgt.)	1260, special project funds	$10	$10	$10
Wildlife Population Management		1260, special project funds, biologist	$25	$50	$25
6.a Law Enforcement	Public Safety, Resource Protection, Hunt Program.	1260, law enforcement officer	$100	$100	$100
6.e Water Rights Managements	Compliance with state and Federal laws to protect and achieve adequate supplies of water. Reading, maintaining and installing measurement devices and gauging stations, preparing water mgt. plans, also monitoring off-refuge water uses.	1260, special project funds	$5	$5	$5
6.f Cultural Resource Management	Supporting the study and protection of significant prehistoric and historic sites. Evaluation and management of cultural resources and property.	Special project funds	$5	$5	$5
6.g Land Acquisition Support	Staff participation in land acquisition activities, including development of acquisition proposals, appraisals, meetings, inventories and surveys.	*			

Project	Action	Resources Needed	Alt 1	Alt 2	Alt 3
7.a Visitor Services	Providing access, facilities, and programs for refuge visitors. Planning, construction, operation and maintenance of visitor facilities such as roads, trails, signs. Interpretation, environmental education, hunting and other recreation.	1260 funds	$20	$20	$40
7.b Outreach	Off-site education of public about Service activities through presentations, exhibits, news releases, and radio/TV spots.	1260 funds	$5	$5	$10
TOTALS	**Subtotals Annual Operational Costs (in thousands)**		**$335**	**$450**	**$360**
	Operational Costs over 15 years (in thousands)		**$5,025**	**$6,750**	**$5,400**

Staffing

Table J-8 includes costs for permanent and seasonal staff for both refuges needed each year. It does not include staff costs associated with special projects; these are summarized in Tables J-1 through J-5.

Table J-8 Annual costs of staff salaries and benefits by alternative

Staff – Refuge Operations	Status	Positions	Salary
Project Leader (Supported From Willapa Complex HQ)	PFT	GS-0485-13	$81,823
Deputy Project Leader (Supported From Willapa Complex HQ)	PFT	GS-0485-12	$71,000
Visitor Services Specialist (Supported From Willapa Complex HQ)	PFT	GS-0023-11	$57,408
Administrative Officer (Supported From Willapa Complex HQ)	PFT	GS-0341-09	$47,448
Refuge Manager	PFT	GS-0485-11	$57,408
Wildlife Biologist	PFT	GS-0486-12	$57,408
Law Enforcement Officer	PFT	GS-0025-09	$47,448
Engineering Equipment Operator	PFT	WG-5716-10	$42,655
Total Positions/Salaries	**8**	**8**	**$462,598.00**

PFT: Permanent Full Time, PS: Permanent Seasonal, Temp: Temporary Position, Term: Term Position, GS: General Schedule Federal Employee, WG: Wage Grade Scale

Budget Summary

Tables J-9 and 10 summarize the data from the above tables and display the overall annual funding need, by alternative, for each refuge.

Lewis and Clark Refuge

Table J-9 Summary of Refuge Annual Funding Need, by CCP Alternative (in thousands)

	Alt 1	Alt 2
All projects - One time expenditures (total costs over 15 years), in thousands		
Research and Monitoring	$50	$80
Facilities	0	0
Habitat Management	$148	$148
A. Subtotal One Time Expenditures – All	**$198**	**$228**
High Priority Projects - One time expenditures (total costs over 15 years), in thousands		
Research and Monitoring	$50	$50
Facilities	0	0
Habitat Management	$144	$144
B. Subtotal One Time Expenditures high priority projects only	**$194**	**$194**
Recurring Costs – all (total costs over 15 years), in thousands		
C. Recurring Costs – all projects/salaries/maintenance	$4,275	$4,275
Total Annual Need – All projects. (In thousands) (A + C)/15		
	$298	**$300**
Total Annual Need – High Priority Projects Only (In thousands) (B + C)/15		
	$298	**$298**

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Table J-10 Summary of Refuge Annual Funding Need, by CCP Alternative

	Alt 1	Alt 2	Alt 3
All projects - One time expenditures (total costs over 15 years), in thousands			
Research and Monitoring	$60	$80	$60
Facilities	$60	$450	$480
Habitat Management	$354	$364	$354
A. Subtotal One Time Expenditures–All	**$474**	**$894**	**$894**
High Priority Projects - One time expenditures (total costs over 15 years), in thousands			
Research and Monitoring	$50	$50	$60
Facilities	$60	$210	$210
Habitat Management	$214	$308	$214
B. Subtotal One Time Expenditures high priority projects only	**$324**	**$568**	**$484**
Recurring Costs – all (total costs over 15 years), in thousands			
C. Recurring Costs – all projects/salaries/Maintenance	$5,025	$6,750	$5,400
Total Annual Need – All projects. (In thousands) (A + C)/15			
	$366	**$509**	**$420**
Total Annual Need – High Priority Projects Only (In thousands) (B + C)/15			
	$356	**$488**	**$392**

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National Wildlife Refuge System Information
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