U.S. Fish & Wildlife Service

Bandon Marsh National Wildlife Refuge

Comprehensive Conservation Plan

A Vision of Conservation

Where the sinuous Coquille River meets the Pacific Ocean, their cool nutrient rich waters slowly ebb and flow over the mudflats, salt marshes, and forested wetlands at Bandon Marsh National Wildlife Refuge. The invertebrate laden mudflats fuel the migration of tens of thousands of shorebirds every spring and fall making it an essential stop-over site. Before their journey at sea begins, young salmon and cutthroat trout find sanctuary in steep-banked tidal channels and driftwood anchored in the estuary.

For centuries both people and wildlife have flourished in the marsh amid geologic and human induced changes. Through restoration of tidal flows and natural cycles, the estuary will continue to sustain fish, wildlife, and people. The Refuge works with partners, friends, and volunteers to protect, restore, and monitor the estuarine ecosystem and provide opportunities for people to understand and appreciate the Refuge.

Short-billed dowitchers
David Ledig/USFWS

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

Bandon Marsh
National Wildlife Refuge

Comprehensive Conservation Plan

Prepared by:
Bandon Marsh National Wildlife Refuge
83673 North Bank Lane
Bandon, Oregon 974119

U.S. Fish and Wildlife Service
Pacific Northwest Planning Team
911 NE 11th Avenue
Portland, Oregon 97232

April 2013

Approved:______________________ Dec. 21, 2012
Acting Regional Director, Region 1 — Date
Portland, Oregon

U.S. Fish and Wildlife Service
Bandon Marsh National Wildlife Refuge
Comprehensive Conservation Plan
Approval Submission

In accordance with the National Wildlife Refuge System Administration Act, as amended, the U.S. Fish and Wildlife Service completed a Comprehensive Conservation Plan (CCP) for Bandon Marsh National Wildlife Refuge. The purpose of this CCP is to specify a management direction for the Refuge for the next 15 years. The goals, objectives, and strategies for improving Refuge conditions – including the types of habitat we will provide, partnership opportunities, and management actions needed to achieve desired future conditions – are described in the CCP. The Service's preferred alternative for managing the Refuge is described in this CCP and the environmental consequences of implementing the CCP were described in the Draft CCP and Environmental Assessment.

This CCP is submitted for the Regional Director's approval by:

Rebecca G. Chuck Acting ______________________ 12/18/12 __________
Roy Lowe, Project Leader — Date
Oregon Coast National Wildlife Refuge Complex

Concur:______________________ 12/18/12 __________
Bob Flores — Date
Refuge Supervisor

Concur: Rob J. West ______________________ 12-19-12 __________
Robin West — Date
Regional Chief, National Wildlife Refuge System

Finding of No Significant Impact for the Bandon Marsh National Wildlife Refuge Comprehensive Conservation Plan

Coos County, Oregon

The U.S. Fish and Wildlife Service (Service) has completed a Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) for Bandon Marsh National Wildlife Refuge (Refuge). The CCP will guide management of the Refuge for 15 years. The CCP/EA describes our proposals for managing the Refuge and their effects on the human environment under three alternatives, including the no action alternative.

Decision

Based on our comprehensive review and analysis in the CCP/EA, we selected Alternative C for implementation, because it will guide management of the Refuge in a manner that:

- Achieves the mission of the National Wildlife Refuge System, and the purposes, vision, and goals of the Refuge.
- Maintains and restores the ecological integrity of the Refuge's habitats and populations.
- Addresses the important issues identified during the CCP scoping process.
- Addresses the legal mandates of the Service and the Refuge.
- Is consistent with the scientific principles of sound wildlife management and endangered species recovery.
- Facilitates priority public uses appropriate and compatible with the Refuge's purposes and the Refuge System mission.

Summary of the Actions to be Implemented

Implementing the selected alternative will have no significant impacts on the environmental resources identified in the CCP/EA. Refuge management under the selected alternative will protect, maintain, and enhance habitat for priority species and resources of concern, and improve the public's opportunities to enjoy wildlife-dependent recreation.

Under Alternative C, an emphasis on protecting and maintaining estuarine, stream-riparian, and forested habitats would remain; however, an increased level of active habitat management, monitoring, and restoration would also be implemented. Approximately 29 acres of grasslands (former pastures) and 11 acres of forested wetlands would be restored. Inventory, monitoring, and research programs would be expanded.

Wildlife observation and photography would remain open on the Bandon Marsh Unit 7 days per week. The viewing deck and marsh trail at the Ni-les'tun Unit would be open daily. In addition, a portion of the Ni-les'tun Unit would be open to wildlife observation and photography daily during the non-waterfowl hunting season.

Waterfowl hunting would continue to be allowed 7 days per week on 256 acres of the Bandon Marsh Unit outside of the Bandon city limits. Additionally, hunting would be allowed on 299 acres of the Ni-les'tun Unit 3 days per week. Artificial fly and lure fishing for cutthroat trout only, in accordance with State and refuge regulations, would be permitted on the tidal portions of Fahys, No Name, and

Redd creeks south of North Bank Lane. The start of the fishing season would coincide with the Oregon Department of Fish and Wildlife's season for trout fishing; however, the fishing season on the refuge would end on September 30 to avoid conflicts with the waterfowl hunting season. Clamming would continue to be allowed on the Bandon Marsh Unit and opportunities to provide clamming would be explored on the Ni-les'tun Unit.

Environmental education and interpretation efforts would be expanded. Partners would take the lead on developing an environmental education center and work with the Service to develop curriculum. Interpretive signs and materials would be developed and added.

Additional parking lots and trails would be constructed to facilitate these public uses. Some administrative and visitor facilities would be replaced. Off-refuge, the Service would participate in partner- and community eco-tourism or natural resource-based visitor centers.

Other proposed actions under Alternative C include the consideration of climate change effects in all management; the reduction of the Refuge's carbon footprint; monitoring and control of invasive species; fire management; maintenance of existing structures; coordination with State, Tribal, and other partners to accomplish goals; cultural resources protection; volunteer opportunities; and the continuation of land protection within the approved Refuge boundary. All proposed actions are subject to funding availability.

Public Involvement and Changes Made to the Selected Alternative Based on Comments

We incorporated a variety of public involvement techniques in developing and reviewing the CCP/EA. This included two open houses, several planning updates, numerous meetings with partners and elected officials, and public review and comment on the Draft CCP/EA. The details of our public involvement program are described in the CCP in Appendix J.

Based on the public comments we received and considered, Alternative C as described in the CCP/EA has been slightly modified.

- The waterfowl hunting area acreage at the Ni-les'tun Unit has been changed from 300 to 299 acres.
- Clarification on the closure of the Ni-les'tun Unit to unrestricted walking and all other non-hunting uses during the hunting season (October 1 through January 31) has been added.
- Clarification about clamming being subject to Oregon Department of Fish and Wildlife and Oregon Department of Agriculture shellfish safety closures has been added.
- Clarification about fishing on the Bandon Marsh Unit has been added.
- Clarification regarding artificial fly and lure fishing for cutthroat trout on the Ni-les'tun Unit has been added.
- Under facilities management, an additional strategy to utilize habitat-appropriate native plants for landscaping has been added.
- Compatibility Determinations for wildlife observation, photography, interpretation, and environmental education; waterfowl hunting; and fishing were modified to improve clarity and consistency.
- Some maps were updated to reflect the revised waterfowl hunting area and above-referenced clarifications.
- Some text changes were made to improve readability and accuracy.

Conclusions

Based on review and evaluation of the information contained in the supporting references, I have determined that implementing Alternative C as the CCP for Bandon Marsh National Wildlife Refuge is not a major Federal action that would significantly affect the quality of the human environment within the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969. Accordingly, we are not required to prepare an environmental impact statement.

Acting Regional Director

Dec. 21, 2012
Date

Supporting References

U.S. Fish and Wildlife Service. 2012. Bandon Marsh National Wildlife Refuge draft Comprehensive Conservation Plan and Environmental Assessment. U.S. Department of the Interior, Fish and Wildlife Service, Region 1, Portland, OR. 431 pp.

Note: This Finding of No Significant Impact and supporting references are available for public review at the Oregon Coast National Wildlife Refuge Complex, 2127 SE Marine Science Drive, Newport, Oregon 97365 and U.S. Fish and Wildlife Service, Division of Planning, Visitor Services, and Transportation, 911 NE 11th Avenue, Portland, Oregon, 97232. These documents can also be found on the Internet at http://www.fws.gov/oregoncoast/. Interested and affected parties are being notified of our decision.

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Chapter 1
Introduction and Background

Chapter 1. Introduction and Background

1.1 Introduction

Bandon Marsh National Wildlife Refuge (NWR or Refuge) is managed by the U.S. Fish and Wildlife Service (USFWS or Service) as part of the National Wildlife Refuge System (NWRS). The Oregon Coast National Wildlife Refuge Complex (Complex) comprises six individual National Wildlife Refuges that span the coast of Oregon and support a rich diversity of wildlife habitats including coastal rocks, reefs, and islands; forested and grass-covered headlands; estuaries; and freshwater marshes. The six National Wildlife Refuges include Cape Meares, Oregon Islands, Three Arch Rocks, Bandon Marsh, Nestucca Bay, and Siletz Bay (Figure 1-1). This Comprehensive Conservation Plan (CCP) applies only to Bandon Marsh NWR. The CCPs for Nestucca Bay and Siletz Bay NWRs are being developed concurrently, and the CCPs for the Complex's other three NWRs have been completed under a previous planning effort.

Bandon Marsh NWR consists of the 307-acre Bandon Marsh Unit and the 582-acre Ni-les'tun Unit (Figure 1-2). The total approved refuge boundary includes 1,000 acres. The Bandon Marsh Unit was established in 1983 and is located near the mouth of the Coquille River with approximately 25% of the Unit within the city limits of Bandon. The Ni-les'tun Unit was established in 2000 and is located on the east side of Highway 101 on the north bank of the Coquille River. The primary purpose for establishing the Bandon Marsh Unit was to protect the physical and biological integrity of the tidal salt marsh, and to conserve the last substantial tract of salt marsh in the Coquille River estuary (USFWS 1981). The Ni-les'tun Unit was established to protect and restore intertidal marsh, freshwater marsh, and riparian areas to provide a diversity of habitats for migratory birds including waterfowl, shorebirds, wading birds and songbirds, and to restore intertidal marsh habitat for anadromous fish such as Chinook and chum salmon, steelhead, cutthroat trout, and the threatened coho salmon (USFWS 1999a).

Over the past 100-150 years logging, road building dredging and agricultural activities throughout the Coquille River watershed have resulted in periods of intense flooding and siltation and by the mid-1980s it was estimated that the total estuary received an average of 100,000 tons of sediment each year, resulting in a steady development of Bandon Marsh's current tidally influenced tidal mudflat and salt marsh system (Brophy 2005, Byram and Witter 2000). During this period of accretion the Bandon Marsh Unit has not been significantly altered by humans; however, substantial filling of the tidelands south of the Refuge took place from the mid-1930s to the 1980s (USFWS 1985a). In Oregon, the Coquille River estuary has suffered the greatest loss of tidal wetlands with a reduction of 94% of the historical total acreage (Good 2000). The loss of tidal wetlands, through agricultural dike construction and subsequent draining, has been identified as a major factor contributing to the decline of fishery resources and overall estuarine productivity throughout coastal Oregon. Establishment of the Refuge afforded permanent protection to one of the few remaining unspoiled salt marshes in Oregon.

The Ni-les'tun Unit is an historic tidal wetland in the lower Coquille River watershed. It was diked and drained for agricultural purposes in the late 19th or early 20th century. Prior to the agricultural conversion, this tidal wetland was shaped by the periodic earthquakes and tsunamis within the Cascadia subduction zone and the daily tidal processes associated with the Coquille River. Twelve subduction earthquakes during the period between 6,500-6,700 years ago and the present (BP) have dropped the Coquille River estuary to tidal flat elevations (Witter et al. 2003). Each of these events reduced local elevations and resulted in more flooding of the site. Over time, accretion of fine sediments resulted in formation of a classic tidal mudflat and marsh system (Byram and Witter 2000).

The Ni-les'tun Unit's tidal marsh restoration project, completed in summer 2011, restored 418 acres of historic tidal wetlands within the lower Coquille River estuary and is the largest tidal wetlands restoration project ever accomplished in Oregon. Until completion of restoration activities in August of 2011, this site had not experienced natural tidal flooding events for approximately 100 years. Most of the artificial features in this historic wetland, including drainage ditches, dikes, and tidegates, were removed during the restoration project, allowing natural tidal exchange to take place once again. The influx of varying levels of tidally driven brackish riverine water will allow re-establishment of mudflats and salt marsh plants, and development of sinuous interconnecting tidal channels providing wildlife habitat within the refuge unit. As the land and ecological processes return to a functioning intertidal marsh, young fish and flocks of resident and migratory birds will use the restored habitat. The restoration represents a significant increase in habitat available to native salmonids, migratory birds and other wildlife in the lower Coquille River estuary.

1.2 Significance of the Refuge

A great diversity of wading birds and shorebirds use the Coquille River estuary, especially the Bandon Marsh Unit, as stop-over habitat. The Coquille River and estuary support large runs of anadromous fish including Chinook and threatened coho salmon, cutthroat trout and steelhead. The estuary also provides important rearing habitat for several species of marine fish including starry flounder and English sole. In 1980, Bandon Marsh was ranked seventh in "Important Fish and Wildlife Habitats of Oregon" by the Service (USFWS 1980). The location encompassed by the Ni-les'tun Unit has been used for thousands of years by the Coquille people and there are several very important cultural sites found within the refuge unit. During the mid-1990s, the Coquille Indian Tribe conducted several archeological excavations in this area when some of the constructed dikes were eroding and the sites and the information they contained were recorded for the archaeological record. On receiving approval to establish the new refuge unit, the Service requested that the Coquille Indian Tribe name the new unit because of the cultural significance of the site. The Ni-les'tun (nee-lay'-tun) Unit is named after the Miluk phrase for "people by the small fish dam" and is a reference to the fish weirs, gates and basket traps used by ancestors of the Coquille and other Tribes to catch lamprey, salmon, flounder and other fish species that lived in the estuary.

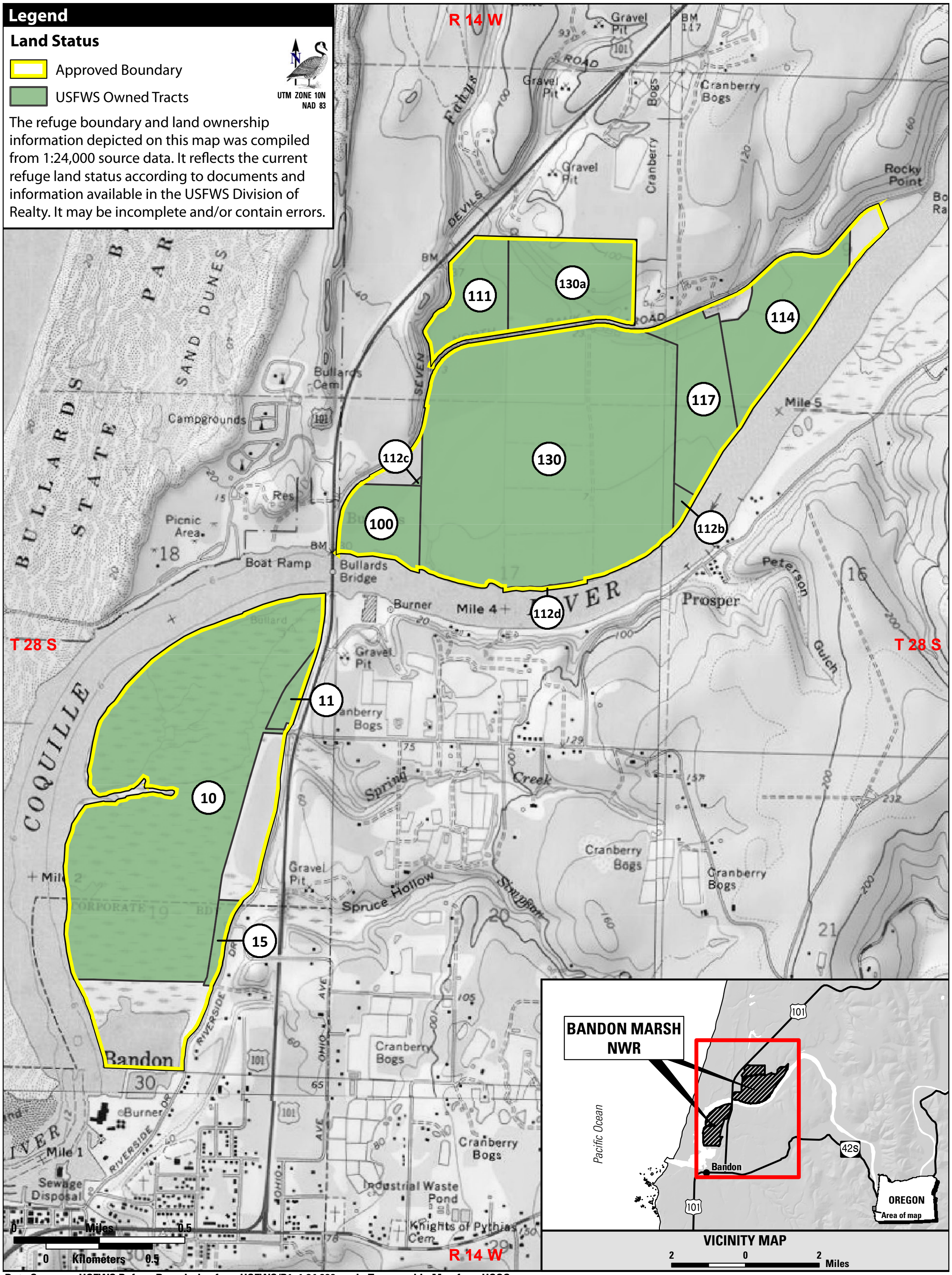
Within the approved boundary of Bandon Marsh NWR there are thirteen recorded archeological sites. Two of the sites have been document as long-term occupation locations. Three sites have major midden components and the rest are single fish weirs or a complex of weirs. This pattern and density of sites extends both up and down river from the Refuge and clearly demonstrates the significance of the area to the Coquille people (Tveskov and Cohen 2007).

Figure 1-1. 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 maps are blank to improve readability.

Figure 1-2. Land status.



Data Sources: USFWS Refuge Boundaries from USFWS/R1, 1:24,000 scale Topographic Map from USGS

The back sides of maps are blank to improve readability.

1.3 Proposed Action

We, the U.S. Fish and Wildlife Service (Service), manage wildlife refuges as part of the National Wildlife Refuge System. This document is the Refuge's Comprehensive Conservation Plan (CCP). A CCP sets forth management guidance for a refuge for a period of 15 years, as required by the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd -668ee, et seq.) (Refuge Administration Act), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). The Refuge Administration Act requires CCPs to identify and describe:

- The purposes of the refuge;
- The fish, wildlife, and plant populations, their habitats, and the archaeological and cultural values found on the refuge;
- Significant problems that may adversely affect wildlife populations and habitats and ways to correct or mitigate those problems;
- Areas suitable for administrative sites or visitor facilities and opportunities for fish and wildlife dependent recreation.

The Service developed and examined alternatives for future management of Bandon Marsh Refuge through the CCP process. These were presented in the Draft Comprehensive Conservation Plan and Environmental Assessment (USFWS 2012a). We developed and evaluated three alternatives for the CCP and selected Alternative C as the preferred alternative.

The goals, objectives, and strategies under the preferred alternative best achieve the purpose and need for the CCP while maintaining balance among the varied management needs and programs. Thus, the preferred alternative represents the most balanced approach for achieving the Refuge's purposes, vision, and goals; contributing to the Refuge System's mission; addressing relevant issues and mandates; and managing the Refuge consistently with sound principles of fish and wildlife management. The preferred alternative was slightly modified between the draft and final documents based upon comments received from the public or other agencies and organizations (see Appendix K). The Service's Regional Director for the Pacific Region made the final decision about the alternative to be implemented. For details on the specific components of management direction for the Refuge over the next 15 years, see Chapter 2.

1.4 Purpose and Need for Action

The purpose of developing the CCP is to provide the refuge manager with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible, wildlife-dependent recreational uses. The CCP, when fully implemented, should achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; help achieve the goals of the National Wilderness Preservation System; and meet other mandates. The CCP must be specific to the planning unit and identify the overarching wildlife, public use, or management needs for the Refuge (602 FW 3.4C1d).

The need for the CCP is to provide reasonable, scientifically-grounded guidance for ensuring that over a period of 15 years, Bandon Marsh NWR will achieve the following purposes:

- Enhance, maintain, and protect refuge habitats (including upland forests; forested wetlands; and estuarine and stream-riparian habitats) and other lands for the benefit of migratory birds and other wildlife.
- Gather sufficient scientific information to guide responsible adaptive management decisions.
- Provide visitors compatible wildlife-dependent public use opportunities that foster an appreciation and understanding of the Refuge's fish, wildlife, plants, and their habitats, and have limited impacts to wildlife.
- Initiate and nurture relationships and develop cooperative opportunities to promote the importance of the Refuge's wildlife habitat, and support refuge stewardship.
- Protect and manage the Refuge's cultural resources, and identify new ways to gain an understanding of the Refuge's history and cultural resources.

1.5 Legal and Policy Guidance

1.5.1 The U.S. Fish and Wildlife Service

All refuges are managed by the Service, an agency within the Department of the Interior. The Service is the principal Federal agency responsible for conserving, protecting, and enhancing the Nation's fish and wildlife populations and their habitats.

The mission of the Service is "working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people." Although we share this responsibility with other Federal, state, tribal, local, and private entities, the Service has specific trust responsibilities for migratory birds, endangered and threatened species, and certain anadromous fish and marine mammals. The Service has similar trust responsibilities for the lands and waters we administer to support the conservation and enhancement of fish, wildlife, plants, and their habitats. The Service also enforces Federal wildlife laws and international treaties for importing and exporting wildlife, assists with state fish and wildlife programs, and helps other countries develop wildlife conservation programs.

1.5.2 National Wildlife Refuge System

A refuge is managed as part of the National Wildlife Refuge System within a framework provided by legal and policy guidelines. The Refuge System is the world's largest network of public lands and waters set aside specifically for conserving wildlife and protecting ecosystems.

The needs of wildlife and their habitats come first on refuges, in contrast to other public lands that are managed for multiple uses. Refuges are guided by various Federal laws and executive orders, Service policies, and international treaties. Fundamental 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 derive from the National Wildlife Refuge System Administration Act of 1966 as amended (16 U.S.C. 688dd -688ee), the Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended, Title 50 of the Code of Federal Regulations, and the Fish and Wildlife Service Manual. The Refuge Administration Act is implemented through regulations covering the Refuge System, published in Title 50, subchapter C of the Code of Federal Regulations. These regulations govern general administration of units of the Refuge System.

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)(16 U.S.C. 668dd et seq.)

The goals of the Refuge System, as articulated in the Mission Goals and Purposes policy (601 FW 1) are:

- 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 inter-jurisdictional 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.

Law and Policy Pertaining to the Refuge System

Refuges are guided by various Federal laws and 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 derive from the National Wildlife Refuge System Administration Act of 1966 (Administration Act) as amended (16 U.S.C. 668dd-668ee); the Refuge Recreation Act of 1962 as amended (16 U.S.C. 460k-460k-4); Title 50 of the Code of Federal Regulations; and the Service Manual. The Administration Act is implemented through regulations covering the Refuge System, published in Title 50, subchapter C of the Code of Federal Regulations and policies contained in the Service Manual. These regulations and policies govern general administration of units of the Refuge System.

Many other laws apply to the U.S. Fish and Wildlife Service and management of Refuge System lands. Examples include the Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966, as amended. Brief descriptions of laws pertinent to Bandon Marsh Refuge are included in this chapter. A complete list of laws pertaining to the Fish and Wildlife Service and the Refuge System can be found at http://laws.fws.gov.

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4). The Refuge Recreation Act authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It provided for public use fees and permits, and penalties for violating regulations. It also authorized the acceptance of donated funds and real and personal property, to assist in carrying out its purposes. Enforcement provisions were amended in 1978 and 1984 to make violations misdemeanors in accordance with the uniform sentencing provisions of 18 U.S.C. 3551-3586.

National Wildlife Refuge System Administration Act (16 U.S.C. 668dd et seq.) as amended by the National Wildlife Refuge System Improvement Act (Public Law 105-57). Of all the laws governing activities on national wildlife refuges, the Refuge Administration Act exerts the greatest influence. The National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act) amended the Administration Act by defining a unifying mission for all refuges, including a new process for determining compatible uses on refuges, and requiring that each refuge be managed under a comprehensive conservation plan. Key provisions of the Refuge Administration Act follow.

- Comprehensive conservation planning. A CCP must be completed for each refuge by the year 2012, as is required by the Refuge Administration Act. Each CCP will be revised every 15 years or earlier if monitoring and evaluation determine that changes are needed to achieve the refuge's purposes, vision, goals, or objectives. The Refuge Administration Act also requires that CCPs be developed with the participation of the public. Public comments, issues, and concerns are considered during the development of a CCP, and together, with the formal guidance, can play a role in selecting the preferred alternative. Information on public involvement can be found in Appendix J. The CCP provides guidance in the form of goals, objectives, and strategies for refuge programs, but may lack some of the specifics needed for implementation. Therefore, step-down management plans will be developed for individual program areas as needed, following completion of the CCP. The step-down plans are founded on management goals, objectives and strategies outlined in a CCP, and require appropriate NEPA compliance.
- Wildlife conservation; biological diversity, integrity and environmental health. The Refuge Administration Act expressly states that the conservation of fish, wildlife and plants, and their habitats is the priority of Refuge System lands, and that the Secretary of the Interior shall ensure that the biological integrity, diversity, and environmental health of refuge lands 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."
- Refuge purposes. Each refuge must be managed to fulfill the Refuge System mission and the specific purpose(s) for which the refuge was established. 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. When a conflict exists between the Refuge System mission and the purpose of an individual refuge, the refuge purpose may supersede the mission.
- Priority public uses on refuges. The Administration Act superseded some key provisions of the Refuge Recreation Act regarding compatibility, and also provided significant additional guidance regarding recreational and other public uses on units of the Refuge System. 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. The Service is to grant these six wildlife-dependent public uses special consideration during planning for, management of, and establishment and expansion of units of the Refuge System. When determined compatible on a refuge-specific basis, these six 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.

Compatibility and Appropriate Refuge Uses Policies (603 FW 2 and 1). With few exceptions, lands and waters within the Refuge System are different from multiple-use public lands in that they are closed to all public access and use unless specifically and legally opened. 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. 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.

The six wildlife-dependent recreational uses described in the Refuge Administration Act (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are defined as appropriate. When determined to be compatible, they receive priority consideration over other public uses in planning and management. Other non-wildlife-dependent uses on a refuge are reviewed by the refuge manager to determine if the uses are appropriate. If a use is determined appropriate, then a compatibility determination is completed.

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) occurring or proposed on a refuge for appropriateness and compatibility. Updated appropriate use and compatibility determinations for existing and planned uses for Bandon Marsh NWR are in Appendices A (Appropriateness) and B (Compatibility) of this CCP.

Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3). The Refuge Administration Act directs the Service to “ensure that the biological integrity, diversity, and environmental health of the National Wildlife Refuge System are maintained for the benefit of present and future generations of Americans.” The policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and the Refuge System mission. It provides for the consideration and protection of a broad spectrum of native fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges (e.g., in compatibility determinations), refuge managers will use sound professional judgment to determine their refuge’s contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources, an understanding of the refuge’s role within an ecosystem, applicable laws, and best available science, including consultation with others both inside and outside the Service. The policy states that “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.”

Wildlife-dependent Recreation Policies (605 FW 1-7). The Refuge Administration Act states that “compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the System.” A series of recreation policies provide additional guidance and requirements to consider after a recreational use has been determined to be compatible. These policies also establish a quality standard for visitor services on national wildlife refuges. Through these policies, we are to simultaneously enhance wildlife-dependent recreational opportunities, provide access to quality visitor experiences, and manage refuge resources to conserve fish, wildlife, plants, and their habitats. New and ongoing recreational uses should help visitors focus on wildlife and other natural resources, and provide an opportunity to display resource issues, management plans, and how the refuge contributes to the Refuge System and the Service's mission. The policies also require development of a visitor services plan.

1.5.3 Other Laws and Mandates

Many other Federal laws, executive orders, Service policies, and international treaties govern the Service and Refuge System lands. Examples include the Migratory Bird Treaty Act of 1918, Refuge Recreation Act of 1962, National Historic Preservation Act of 1966, and the Endangered Species Act of 1973. For additional information on laws and other mandates, a list and brief description of Federal laws of interest to the Service can be found in the Laws Digest at http://www.fws.gov/laws/Lawsdigest.html.

In addition, over the last few years, the Service has developed or revised numerous policies and Director's Orders to reflect the mandates and intent of the Refuge Administration Act. Some of these key policies include the Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3); the Compatibility Policy (603 FW 2); the Comprehensive Conservation Planning Policy (602 FW 3); Mission, Goals, and Purposes (601 FW 1), Appropriate Refuge Uses (603 FW 1); Wildlife-Dependent Public Uses (605 FW 1); wilderness-related policies (610 FW 1-5) and the Director's Order for Coordination and Cooperative Work with State Fish and Wildlife Agency Representatives on Management of the National Wildlife Refuge System. These policies and others in draft or under development can be found at http://refuges.fws.gov/policymakers/nwrpolicies.html.

In developing a CCP, refuges must consider these broader laws and policies as well as Refuge System and ecosystem goals and visions. The CCP must be consistent with these and also with the refuge purpose.

1.6 Refuge Establishment and Purposes

1.6.1 Legal Significance of the Refuge Purpose

The purpose for which a refuge was established or acquired is of key importance in refuge planning. Purposes must form the foundation for management decisions. The refuge purposes are the driving force in the development of the refuge vision statements, goals, objectives, and strategies in a CCP and are critical to determining the compatibility of existing and planned refuge uses.

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, plants, and the habitats on which they depend, take precedence over other purposes in the management and administration of any 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 authority used to establish the original unit, 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. When a conflict exists between the Refuge System mission and the purpose of an individual refuge, the refuge purpose may supersede the mission of the System.

1.6.2 Purpose and History of Refuge Establishment

Bandon Marsh National Wildlife Refuge (NWR) was authorized by Public Law 97-137, of December 29, 1981 "for the preservation and enhancement of the highly significant wildlife habitat of the area known as Bandon Marsh, in the estuary of the Coquille River in the State of Oregon, for the protection of migratory waterfowl, numerous species of shorebirds and fish, including Chinook and silver salmon, and to provide opportunity for wildlife-oriented recreation and nature study on the marsh." This purpose applies to all portions of Bandon Marsh NWR. The original 289 acres acquired from the Port of Bandon were also authorized by the Transfer of Certain Real Property for Wildlife Conservation Purposes Act of May 19, 1948, Public Law 80-537, (16 U.S.C. 667b-667d; 62 Stat. 240), as amended, because of its "particular value in carrying out the national migratory bird management program."

Most of the tracts that make up the Refuge were authorized by the same Public Law and purchased with funds authorized by Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j), as amended. This Act authorized the acquisition of refuge lands "for development, advancement, management, conservation, and protection of fish and wildlife resources… 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." Section 7(a)(1) of the Land and Water Conservation Fund Act (16 U.S.C. 4601-9) provides authority to use Land and Water Conservation Fund (LWCF) monies for acquisition under this Act. Purposes of the Land and Water Conservation Fund Act of 1965, as amended, include acquisition of "(d) any areas authorized for the National Wildlife Refuge System by specific Acts" (16 U.S.C. 4601-9).

1.6.3 Land Status and Ownership

Bandon Marsh NWR was established in 1983 with the acquisition of 289 acres of salt marsh, mudflats, and tidal sloughs. Bandon Marsh NWR consists of the Bandon Marsh Unit and the Ni-les'tun Unit (Figure 1-2). The Bandon Marsh Unit is located near the mouth of the Coquille River with approximately 25% of the Unit within the city limits of Bandon. Additional acquisitions to the Bandon Marsh Unit were completed in 1992 when 17 acres of tidal salt marsh and Sitka spruce/red alder forest were acquired. In 2000, the Ni-les'tun Unit of Bandon Marsh NWR was established and a total of 582 acres has been acquired within this unit including historic salt marsh that had been converted to diked lowland pastures, former Sitka spruce forest that had been converted to pasture, and forested freshwater wetlands. The Ni-les'tun Unit is located on the east side of Highway 101 on the north bank of the Coquille River. The total land base of Bandon Marsh NWR is 889 acres. The total approved refuge boundary includes 1,000 acres.

Just south of the existing refuge boundary a former large tidal flat was filled to create the site of a lumber mill industrial site, including dock facilities (Moore Mill personal communication). The threat existed for additional tideflats and tidal marsh within the current boundary of Bandon Marsh NWR to be converted by dredging and/or filling for industrial and/or commercial purposes. In 1980 the marsh was owned by the Port of Bandon, which was interested in acquiring an abandoned U.S. Coast Guard station located at the edge of the Coquille River in the port area. The building rested half on federal land and half on private property. Originally, the private property was donated to the federal government with the stipulation that it would revert to its former owner(s) if the Coast Guard

Station was ever abandoned. The Port was willing to trade Bandon Marsh for the Coast Guard Station. To facilitate this process, the Trust for Public Lands offered to purchase the private property and exchange it with the Port of Bandon for the marsh. Meanwhile, in a desire to assure preservation of an historic site and structure (the Coast Guard Station), the General Services Administration of the Federal Government offered to give the federally owned half of the land, and the entire building, to the Port of Bandon. Thus, the Port Authority would acquire the entire Coast Guard station, and the Service would then purchase the marsh from the Trust for Public Land. In order to accomplish this process the heirs of the former owners who had originally donated the land to the Coast Guard had to be contacted and relinquish any claims to the land. This complicated set of transactions did in fact take place. Following the signing of the Finding of No Significant Impact in June 1981 and the concurrent introduction of legislation (H.R. 2241 and S. 1148), the 289-acre Bandon Marsh National Wildlife Refuge was established on December 29, 1981 with the passage of Public Laws 97-137 and 80-537.

The Service took ownership of the land on February 14, 1983 (Tract 10). At this time the Refuge contained the mudflats and tidal marsh habitats within the estuary, but no adjacent lands, so the only way the public could access the Refuge was by boat. In order to provide easy public access to the Refuge from Riverside Drive, and to protect the fringing forested wetlands and uplands, the refuge boundary was expanded by 100 acres in 1991 to include the lands between the marsh and Riverside Drive. In 1992, two parcels totaling 17 acres were acquired from willing sellers along Riverside Drive and added to the Refuge (Tracts 11 and 15).

In 1998 the Service began the planning process to expand Bandon Marsh NWR by approximately 600 acres, within the lower Coquille estuary just upstream from the Bandon Marsh Unit on the east side of U. S. Highway 101. This addition was proposed due to the availability of lands from willing sellers; the potential to construct a large tidal marsh restoration project; the opportunity to provide additional public use; and the potential ability to protect important archaeological resources. The core of the expansion area was the Bussmann property, formerly known as the Philpott Ranch. The Philpott Ranch was managed as a dairy farm, but was converted to a beef livestock grazing ranch by Bussmann. If the refuge boundary was expanded, the Service indicated a desire to purchase the property through the Archaeological Conservancy, a non-profit group dedicated to seeking permanent protection of archaeological sites in the United States. Archaeologists from the University of Oregon and the Coquille Indian Tribe had been studying the site for the previous five years and had been investigating the remains of 400 years of fishing camps and summer villages that had been uncovered by erosion in an exposed cross section of the property. The Archaeological Conservancy obtained an option to purchase the Philpott Ranch from Bussmann, and planned to exercise their option to purchase the ranch only if the Service decided to expand the Refuge. The Conservancy would then sell the tracts to the Refuge (Tracts 130 and 130a).

In early 2000, Section 102 of Public Law 97-137 increased the size of the Bandon Marsh NWR boundary from 300 acres to 1,000 acres. Expansion of the refuge boundary authorized the Service to begin negotiating with other willing sellers in accordance with Service policy to acquire private lands within the new boundary. In January 2000, the Service purchased the former Philpott Ranch from The Archaeological Conservancy establishing the Ni-les'tun Unit. A second lowland parcel of 53 acres was purchased by The Nature Conservancy in mid-2002 and sold to the Service in 2003 for addition to the new unit (Tract 117), and late in 2002 another 55 acres of former tidal marsh was parceled off from the house, barn, and uplands and added to the Ni-les'tun Unit (Tract 114). In mid-2003, a generous and unexpected donation of an anadromous fish creek that flows through the unit, forested wetlands, abandoned cranberry bogs and a residential site added another 34 acres to the unit

(Tract 111). Additional tracts of the former ranch and intact estuary were acquired in 2003 and 2004 that filled in the gaps to make a complete land unit ready for estuary restoration (Tracts 100, 112b, 112c, and 112d).

1.7 Relationship to Other Planning Efforts

When developing a CCP, the Service considers the goals and objectives of existing national, regional, state, and ecosystem plans and/or assessments. The CCP is expected to be consistent, as much as possible, with existing plans and assist in meeting their conservation goals and objectives (602 FW 3). This section summarizes some of the key plans reviewed by members of the core team while developing the CCP.

1.7.1 Refuge Plans

Key plans utilized for the Bandon Marsh Unit of the Refuge include the Environmental Assessment for the Proposed Acquisition of Bandon Marsh National Wildlife Refuge, produced in 1981 by the Service. This plan includes a history of the area and its various ownerships, the rationale for proposing its inclusion into the Refuge System, a description of historical and current uses and threats, detailed descriptions of wildlife and habitats included in the proposed refuge, and an evaluation of the biological, social and economic effects of establishing this refuge. The Bandon Marsh Refuge Management Plan (1985a) contains a detailed listing of establishing authorities as well as a description of habitat and wildlife resource changes through time, up to the date of publication. Goals, objectives and management strategies provided direction for the management of the new refuge and were utilized in developing updated goals and objectives for this CCP. Outdated compatibility determinations were also reviewed for an understanding of the initial rationale for allowing public uses that will be continued under this CCP. Some additional information useful for the Physical Environment (Chapter 3) and Biological Environment (Chapter 4) was found in the Habitat Management Plan (USFWS 1989) and included climate data, plant and wildlife species listings, and specific salt marsh, mudflat and upland topography and microclimate information for Bandon Marsh. The Preliminary Project Proposal for expanding the Bandon Marsh Unit (USFWS 1990a) provided biological information as well as historical uses for the tracts adjoining Riverside Drive.

In addition to describing the need for further expanding the Refuge to include lands east of the Highway 101, the Environmental Assessment and Land Protection Plan for the Ni-les'tun Unit addition (USFWS 1999a) contains detailed descriptions of the wildlife and habitat resources of the area and evaluates the environmental and socio-economic effects of expanding the refuge boundary and acquiring additional lands. Threats to existing sensitive resources are detailed in the Land Protection Plan along with a clear explanation of the purpose of the proposed expansion. The subsequent Conceptual Management Plan for the Ni-les'tun Unit (USFWS 1999b) describes proposed actions to be undertaken under that Environmental Assessment's preferred alternative of expanding the refuge boundary. These actions detail the key areas of management focus, such as habitat management, tidal marsh restoration, population monitoring, facilities development, and wildlife-dependent recreational opportunities.

The Environmental Assessment for the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge Wetland Restoration and North Bank Lane Improvement Project (USFWS and FHA 2009) was referenced for biological information pertaining to the restored tidal marsh. Specific information on the Ni-les'tun tidal marsh restoration, including the need for action, planning and concurrent project needs, critical partnerships, and a thorough evaluation of potential effects are also contained in this EA. Additional information on hunting and fishing trends and opportunities is contained in the Sport Hunting and Fishing Decision Document Package for Bandon Marsh NWR (USFWS 1985b). Information on wildfire risk and suppression options as well as sensitive habitats to be considered in planning for fire risk reduction and suppression actions, is contained in the Fire Management Plan for Bandon Marsh NWR (USFWS 2004).

1.7.2 Other Plans and Assessments

When developing a CCP, the Service considers the goals, objectives, strategies, and other information available in existing national, regional, and ecosystem plans, state fish and wildlife conservation plans, and other landscape-scale plans developed for the same watershed or ecosystem in which the refuge is located. To the extent possible, the CCP is expected to be consistent with the existing plans and assist in meeting their conservation goals and objectives. The following list identifies some of the key plans which were reviewed by members of the core team while developing the CCP.

- Birds of Conservation Concern (USFWS 2008a)
- Birds of Management Concern (BMC) – Region 1 (USFWS 2005)
- The U.S. Shorebird Conservation Plan (Brown et al. 2001)
- Coquille Sub-basin Plan (Coquille Indian Tribe 1997)
- Rising to the Challenge: Strategic Plan for Responding to Accelerating Climate Change (USFWS 2010a)
- Strategic Plan for Inventories and Monitoring on National Wildlife Refuges: Adapting to Environmental Change (USFWS 2010b)
- Estuarine Resources Goal 16 for the City of Bandon Master Plan (City of Bandon 2011)
- Conservation Plan for the Western Sandpiper, version 1.1 (Fernández et al. 2010)
- Important Fish and Wildlife Habitats in Oregon (USFWS 1980)
- North American Waterbird Conservation Plan (Kushlan et al. 2002)
- North American Waterfowl Management Plan (NAWMP Plan Committee 2004)
- Northern Pacific Coast Regional Shorebird Management Plan (Drut and Buchanan 2000)
- Oregon Biodiversity Information Center (ORBIC 2010)
- Partners In Flight Species Assessment Database (PIF 2010)
- State of Oregon Conservation Strategy (ODFW 2006)
- Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon (ODFW 2012a)
- Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook (USFWS 2008b)

1.8 Special Designation Lands

1.8.1 Important Bird Areas (IBA)

The Important Bird Areas (IBA) program is a global effort to identify the most important areas for maintaining bird populations and focusing conservation efforts on protecting these sites. Within the U.S., the program has been promoted and maintained by the American Bird Conservancy (ABC) and the National Audubon Society (NAS). The ABC is coordinating the identification of nationally significant IBAs while NAS is working to identify sites in individual states. NAS is working within each state to identify a network of sites across the U.S. that provide critical habitat for birds. This effort recognizes that habitat loss and fragmentation are the most serious threats to birds across North America and around the world. By working through partnerships, principally the North American Bird Conservation Initiative, to identify those places that are critical to birds during some part of their life cycle (breeding, wintering, feeding, migrating), the intent is to minimize the effects that habitat loss and degradation have on bird populations. The IBA program has become a key component of many bird conservation efforts. More information is available at http://www.audubon.org/bird/iba /index.html.

The goals of the IBA program are to identify the sites that are the most essential for long-term conservation of birds and to take action to ensure the conservation of these sites (Cullinan 2001). An IBA is a site that provides essential habitat for one or more species of birds. The IBA selection process examines sites based on the presence and abundance of birds and/or the condition and quality of habitat. IBAs are chosen using standard biological criteria and expert ornithologists' review. All sites nominated as potential IBAs are rigorously evaluated to determine whether they meet the necessary qualifications. IBAs represent discrete sites, both aquatic and terrestrial, that are critically important to birds during their annual life cycle (e.g., breeding, migration, and/or wintering periods).

The 900-acre Bandon Marsh NWR IBA at the mouth of the Coquille River consists of the Bandon Marsh Unit and the newly restored (2011) areas in the Ni-les'tun Unit east of Highway 101. This site contains the largest remaining tract of salt marsh in the Coquille River Estuary and is considered an important migratory stop-over site along the Pacific Coast for migrating shorebirds. Other habitats present include mudflats, sloughs, and riparian alder forest. The newly restored Ni-les'tun Unit contains intertidal marsh, freshwater marsh, mudflats and riparian areas. Bandon Marsh may be the premium shorebird site on the Oregon Coast, with numbers peaking in spring (late April-early May) and fall (August-October). Thousands of shorebirds of numerous species are routinely found here, with peak counts including 75,000 western sandpiper, 6,000 dunlin, 2,500 least sandpiper, and 2,000 short-billed dowitcher. Additional sightings include semipalmated plover, black-bellied plover, Pacific golden plover, red phalarope, whimbrel, and occasional Asiatic rarities like sharp-tailed sandpiper and ruff.

1.9 Planning Process and Issue Identification

1.9.1 Planning Process

Planning Team: The core planning team for Bandon Marsh NWR consists of the project leader, deputy project leader, refuge manager, visitor services manager, biologist, and natural resource planner. An extended team consisting of biologists; cultural resource, public use, and realty specialists; economists; and law enforcement officers from the Regional Office, other Federal agencies, State agencies, the Coquille Indian Tribe, and a private environmental consultant assisted in the development of this CCP, particularly in providing comments at key milestones. The full list of core and extended team members and their roles is provided in Appendix I.

Resources of Concern: The planning process began when the planning team reviewed refuge purposes and considered other plans and reports, and sought input from Oregon State conservation agencies and non-governmental organizations. The planning team then identified the top priority species, groups, and communities for the Refuge. A comprehensive list of potential resources of concern was compiled based upon review of the plans referenced above, many of which highlight priority species or habitats for conservation. From this list, those species and habitats that are most representative of refuge purposes and habitats, BIDEH, as well as other FWS and ecosystem priorities, were chosen as priority resources of concern (habitat types) and focal resources (plant and animal species). This list was then provided to participants in the Wildlife and Habitat Review which was held on March 16, 2010 and included the extended team as well as Oregon Department of Fish and Wildlife biologists. The participants raised important issues and provided feedback that was used to refine the Priority Resources of Concern table. This table includes focal species, also called conservation targets, which were selected as representatives or indicators for the overall condition of important refuge habitats. Most of the biological emphasis of the CCP is focused on protecting and restoring these species. See Appendix E for the Comprehensive Resources of Concern and Priority Resources of Concern.

Public Use Planning: Public use planning centered on developing goals, objectives and strategies around the six wildlife-dependent recreational uses that are defined in Service policy as priority, appropriate public uses for refuge lands. A Visitor Services Review for Bandon Marsh NWR was held on April 13, 2010 with representatives from the extended team, public use specialists from Oregon Parks and Recreation Department, and several state law enforcement officers. A background document including existing uses and visitor facilities was provided to participants prior to the Visitor Services Review. The participants' input was used by the planning team to assess past, current, and future management issues surrounding public use while developing objectives and strategies during the Comprehensive Conservation Plan process. In addition, the Service hired a contractor to conduct a Facilities Review which provided insight and conceptual plans for the future of administrative and visitor facilities at Bandon Marsh NWR. This information was also incorporated into the alternatives and some ideas were included as strategies to achieve broader goals for future management of this refuge.

Public Involvement: Public scoping began in November 2010 with a notice in the Federal Register [November 29, 2010, Volume 75, Number 228] and a public meeting December 2, 2010 in Bandon. Public input was also solicited through distribution of planning updates to our mailing list and meetings with key stakeholder groups (Appendix J). The comments and suggestions made through this process helped further develop and refine the management alternatives for the CCP, including the preferred alternative. A second planning update containing preliminary draft alternatives was distributed in November 2011 and another public open house meeting was held in Bandon on November 9, 2011 to explain the alternatives and take comments. The Bandon Marsh Refuge Draft Comprehensive Conservation Plan and Environmental Assessment (DCCP/EA) was issued for public review and comment on September 17, 2012. The availability of the plan was announced through a notice in the Federal Register [September 17, 2012, Volume 77, Number 180] and via direct contact with approximately 600 people on our mailing list. The plan was made available for downloading on the Oregon Coast National Wildlife Refuge Complex Planning website and was made available upon request in CD or printed format. Printed copies of the DCCP/EA were available at local public libraries, and upon request. All changes made as a result of public and agency comments were documented. A summary of public involvement is included in Appendix J; public comments on the DCCP/EA and the Service's responses to comments are included in Appendix K.

1.9.2 Key Issues Addressed in the CCP

The core planning team evaluated the issues and concerns raised during public scoping. The Service defines an issue as "Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition (602 FW 1 1.6 K).” 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. It is the Service’s responsibility to focus planning and the analysis on the major issues. Major issues typically suggest different actions or alternative solutions, are within the Refuge’s jurisdiction, and have a positive or negative effect on the resource. The following issues are within the scope of the CCP and were considered by the Service to be the major issues to address in this planning process:

Wildlife and Habitat Management: What actions should the Service take to sustain and restore priority species and habitats over a period of 15 years? Should the Service place highest priority on restoring hydrologic function, historic water flows, tidal flows and floodplain functions on the Refuge, and would this emphasis allow maintenance of a balance between diverse habitat types including some rare habitats that are least well-represented? Are there opportunities to restore upland forest, forested wetlands, and riparian areas? How will the Service prioritize inventory, control, and monitoring of invasive species?

Climate Change: What actions should the Service take to address anticipated impacts to refuge resources from climate change/sea level rise, including species range shifts, phenological changes, decoupling of species assemblages, hydrological changes, ocean acidification, and changes in disturbance regimes? Are there focal species that will be adversely affected (directly or indirectly) by climate change/sea level rise, and what might be done to mitigate for that? How can cumulative stresses be reduced (e.g., among climate stress and other anthropogenic stresses, which do we have most control over)? Many of these threats are much larger in scope than just Bandon Marsh NWR. They will be addressed at various scales depending on available information and what is most appropriate and relevant to the Refuge.

Public Uses: What public use opportunities will best support refuge purposes and increase visitor awareness of the Service’s and Refuge System mission and goals? Should the Service consider opening new areas of the Refuge to public access, and what activities should be allowed in these areas? Where would new trails and other wildlife observation facilities be compatible and desirable on Bandon Marsh NWR, and if constructed how can these be designed to enhance the public’s wildlife enjoyment, understanding, appreciation, and stewardship of refuge resources? Should the Service consider opening portions of the Refuge to waterfowl hunting and fishing, and if so, where? Should the existing waterfowl hunting program at Bandon Marsh Unit be changed, and would this improve the waterfowl hunting experience on that unit?

Facilities: Is there a need for a Service-owned visitor contact station, interpretive displays, or visitor and education center at this refuge or in the adjacent community? Should the Service place high priority on securing or constructing a visitor contact station and/or visitor and education center at Bandon Marsh NWR? Do facilities exist already in the community that could serve this purpose?

1.9.3 Issues outside the Scope of the CCP

While CCPs are comprehensive plans, no single plan can cover all issues. The planning team has compiled a list of issues which are currently considered to be outside the scope of this CCP.

Refuge Boundary Expansion Study. Although Bandon Marsh National Wildlife Refuge, currently consisting of 889 acres of fee title ownership within an approved boundary of 1,000 acres, represents a valuable contribution to the protection of biodiversity in the Coquille River estuary, several scientific assessments indicate that much of the region's fish and wildlife and habitats would benefit from further protection, enhancement, and/or restoration (e.g., OWJV 1994, OCSRI 1997, CWA 2003, ODFW 2006, Vander Schaaf et al. 2006, Coquille Indian Tribe 2007, ODFW 2007). To address this need, the Service is conducting a separate Land Protection Planning (LPP) process to study options for possibly expanding the approved refuge boundary adjacent to and upstream from the existing boundary. The identified study area totals approximately 4,636 acres and is located in the lower Coquille River estuary, between River Miles 0.5 and 10.4, which corresponds with the upstream extent of historic tidal marsh.

The concept of a boundary expansion study was formerly within the scope of the CCP and introduced as one of the preliminary draft alternatives within the CCP in November 2011. However, in early February 2012 due to the need for greater public involvement and additional time for detailed study, the Service made the decision to separate CCP development from the LPP process. Thus, the question of whether the approved refuge boundary should be expanded is outside of the scope of the CCP.

The LPP process is an evaluation, planning, and compliance process. It is used by the Service to study land conservation opportunities including adding lands to the National Wildlife Refuge System. Protection can be accomplished through a variety of approaches such as purchasing land or a conservation easement or establishing a long-term lease. The LPP process is initiated when wildlife habitat areas of interest are identified in long-term resource plans or are brought to our attention by another agency, conservation group, or interested individual. The Service then evaluates the area to determine if detailed planning—which includes developing a National Environmental Policy Act (NEPA) compliance document, Land Protection Plan, and Conceptual Management Plan–is appropriate. After reviewing the evaluation, the Director of the U.S. Fish and Wildlife Service (Director) makes the determination whether to continue with detailed planning. A proposal to conduct a land protection study for the lower Coquille River estuary area was forwarded to the Director of the U.S. Fish and Wildlife Service on July 28, 2011 and approved on September 6, 2011.

During the LPP process, the Service will solicit public involvement, conduct socioeconomic analyses, and apply spatially-explicit biological planning and conservation design to evaluate habitat conservation and refuge boundary expansion options within the LPP study area. The Service will describe, analyze, and publish for public review and comment the following documents: which constitute "compliance":

- A NEPA analysis–either an Environmental Assessment (EA) or Environmental Impact Statement (EIS)–evaluates the effects each alternative would have on the physical, biological, social, and economic environment.
- A Land Protection Plan describes resource protection needs, a proposed refuge boundary, and generally prioritizes ownerships that may be acquired from willing sellers. It also describes other conservation opportunities including easements and cooperative management agreements with willing landowners.
- A Conceptual Management Plan (CMP) describes potential refuge management needs, activities, and public uses, and determines which public uses would be compatible with the purpose of the proposed refuge.

Public comments will be reviewed and considered during development of the final decision documents which are forwarded to the Regional Director and Director for approval. The Director reviews the documents and decides what course of action, if any, the Service will take. The Director's approval is necessary to expand the refuge boundary and implement the LPP and CMP. If the Director makes the decision that expansion of the refuge boundary is not justified, then the boundary will not be expanded. If the Director approves the boundary expansion proposal, then the Service may move forward and begin the process of identifying funding needs and opportunities and initiate discussions with any interested landowner within the new approved boundary.

1.10 Refuge Vision and Goals

1.10.1 Vision Statement

Where the sinuous Coquille River meets the Pacific Ocean, their cool nutrient rich waters slowly ebb and flow over the mudflats, salt marshes, and forested wetlands at Bandon Marsh National Wildlife Refuge. The invertebrate laden mudflats fuel the migration of tens of thousands of shorebirds every spring and fall making it an essential stop-over site. Before their journey at sea begins, young salmon and cutthroat trout find sanctuary in steep-banked tidal channels and driftwood anchored in the estuary.

For centuries both people and wildlife have flourished in the marsh amid geologic and human induced changes. Through restoration of tidal flows and natural cycles, the estuary will continue to sustain fish, wildlife, and people. The Refuge works with partners, friends, and volunteers to protect, restore, and monitor the estuarine ecosystem and provide opportunities for people to understand and appreciate the Refuge.

1.10.2 Refuge Goals

Refuge management goals are descriptive, open-ended, and often broad statements of desired future conditions that convey a purpose, but do not define measurable units. Goals must support the refuge vision and describe the desired end result.

Wildlife and Habitat Goals:

1. Restore, protect, and maintain upland forests characteristic of the North Pacific Coastal Ecosystem.
2. Restore, protect, and maintain forested wetlands and stream-riparian habitat characteristic of the North Pacific Coastal Ecosystem.
3. Restore, protect, and maintain estuarine habitats characteristic of the North Pacific Coastal Ecosystem.
4. Enhance, protect, and maintain instream aquatic habitat for all dependent species including anadromous fish.
5. Research and monitoring. Gather scientific information (surveys, research, and assessments) to support adaptive management decisions.

Public Use Goals:

6. Provide and manage quality opportunities for visitors of all abilities to spend time outdoors observing and/or photographing freshwater wetland and estuarine dependent wildlife thus fostering an appreciation of and understanding for coastal wildlife and habitat.

7. In cooperation with our friends and partners, offer scientifically based environmental education and place-based interpretation for all ages that advances a connection with and an appreciation of fish and wildlife that use tidal and freshwater marshes.
8. Provide and manage safe, enjoyable, and high quality hunting and fishing opportunities for people of all ages that furthers the tradition of wildlife conservation and stewardship.
9. Provide facilities and materials that welcome and orient children and adults to the natural wonders of the fish and wildlife that use tidal and freshwater marshes, Sitka spruce forest, and riparian habitats.

Chapter 2 Management Direction

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Chapter 2. Management Direction

2.1 Overview

During development of this CCP, the Service reviewed and considered a variety of local and regional physical and biological resource conditions, as well as social, economic, and organizational aspects important for managing the Refuge. This background information is described more fully in Chapters 3, 4, and 5. As is appropriate for a national wildlife refuge, natural 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." Toward this end, the refuge planning team reviewed scientific reports and studies to better understand ecosystem trends and the latest scientific recommendations for species and habitats.

Public involvement was an important part of the planning process. Local, State, and Federal agencies, Tribes, and elected officials were contacted by the Refuge Complex planning team to ascertain priorities and problems as perceived by others. In addition to holding a public scoping meeting to explain the process and accept comments and suggestions, the team contacted refuge users, nonprofit groups, and community organizations to ensure their comments and ideas were considered during the development of alternatives. The planning team then developed preliminary management concepts and strategies, which they presented to the public in a planning update and at a public meeting in fall 2011. Based on all of the information gathered and feedback from others through the public involvement process, the Service developed three draft alternatives for the Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA) for Bandon Marsh National Wildlife Refuge (USFWS 2012a), which was released in September 2012. Alternative C was selected as the preferred alternative.

The CCP planning team reviewed and evaluated all of the comments received during the 30-day Draft CCP/EA comment period. Alternative C within the DCCP/EA was selected for implementation. In some cases, the management direction has been either clarified or modified based upon public feedback. The details of public participation can be found in Appendix J, Public Involvement, and Table K-2 within Appendix K, Comments Received during Public/Agency Review Period and Service Responses, shows the major changes between the draft and the final CCP.

2.2 Management Directions Considered but Not Developed

Early in the alternatives development process, the planning team considered including the following actions in one or more CCP alternatives. These actions were ultimately eliminated from further consideration in this CCP for the reasons provided.

Separation of Public Uses on Bandon Marsh Unit. The Bandon Marsh Unit has been open 7 days per week since establishment in 1983. All six priority uses are allowed on this unit, and the only restriction is that waterfowl hunting is not permitted on refuge lands that are within Bandon city limits. The proposal was made that the Service close the Bandon Marsh Unit to hunting several days per week and close the other days to wildlife observation, with the intent of separating the uses and eliminating potential for conflict. Because these uses are separated in time and location by the primary wildlife species being observed or pursued (spring and early fall for shorebird observation;

winter for waterfowl hunting), there have been no reported conflicts to date. The lack of conflicts between the uses and the low potential for development of these conflicts in the future led the Service to remove the option of separating public uses on the Bandon Marsh Unit from further consideration as an alternative. The Service will continue to evaluate and monitor for user conflicts on this unit and will adjust management accordingly.

Substantial Participation in a Community-based Visitor Center. During the public scoping process the Service received comments from the public, the City of Bandon, and the Port of Bandon regarding the development of a community-based visitor center. The City of Bandon proposed the construction and management of an "ecotourism center" on the city-owned property that was the former location of the Bandon Cheese Factory. The property is currently a graveled lot with no structures on it. Specifically it was requested that the Service partner with the City of Bandon to build a visitor center that would be staffed jointly by Service and City personnel and volunteers. The property is directly adjacent to U.S. Highway 101, is in a high traffic area adjacent to small businesses or residential homes, and is bordered by a highly modified (e.g., concrete walled) tributary to the Coquille River. This property does not provide a quality opportunity for visitors to experience nature and wildlife outside of a vehicle, and it does not meet the Service's criteria for a USFWS-funded wildlife-oriented visitor contact station; therefore this concept was not developed as an alternative. The Port of Bandon additionally discussed the potential of a natural resources-based visitor center at a building and location west of the boat basin and adjacent to the Coquille River. This location provides many opportunities for visitors to view riverine habitat, distant views of Bandon Marsh NWR and wildlife using the Coquille River. The existing warehouse building onsite is in need of substantial modification to provide public facilities.

In the future, if the City or Port of Bandon were to construct an "ecotourism" or natural resource-based visitor center, the USFWS could assist these local government agencies in creating high quality interpretive materials and displays. These interpretive materials would assist the Refuge in educating visitors to the Bandon area about the sensitivity of the wildlife and habitats of Bandon Marsh and Oregon Islands NWRs.

2.3 Description of Management Direction

A brief description of the management direction follows. Table 2-1 contains additional details regarding actions associated with the CCP. A map displaying management direction for the Refuge is located at the end of this chapter (Figure 2-1).

Wildlife and Habitat Management. Refuge management actions will continue to emphasize protecting and maintaining estuarine, stream-riparian, and forested habitats; however, an increased level of active habitat management, monitoring, and restoration will also be implemented. Approximately 29 acres of grasslands (former pastures) will be restored to upland forest, and 11 acres of forested wetlands will continue to be restored. While the Service will primarily allow natural processes to drive vegetative changes, additional techniques such as thinning, girdling, and falling will be used to promote the development of late-successional characteristics within 39 acres of existing forest. Inventory, monitoring, and research programs will be expanded.

Public Use Management. Wildlife observation and photography will remain open on the Bandon Marsh Unit 7 days per week. The viewing deck and marsh trail at the Ni-les'tun Unit will be open daily. In addition, a portion of the Ni-les'tun Unit will be open to wildlife observation and photography daily except during the waterfowl hunting season.

Waterfowl hunting will continue to be allowed 7 days per week on 256 acres of the Bandon Marsh Unit outside of the Bandon city limits. Additionally, hunting will be allowed on 299 acres of the Ni-les'tun Unit 3 days per week. Artificial fly and lure fishing for cutthroat trout only, in accordance with State and refuge regulations, will be permitted on the tidal portions of Fahys, No Name, and Redd Creeks south of North Bank Lane. The start of the fishing season will coincide with ODFW's season for trout fishing; however, the fishing season on the Refuge will end on September 30 to avoid conflicts with the waterfowl hunting season. Clamming will continue to be allowed on the Bandon Marsh Unit and opportunities to provide clamming will be explored on the Ni-les'tun Unit.

Environmental education and interpretation efforts will be expanded. Partners will take the lead on developing an environmental education center and work with the Service to develop curriculum. Interpretive signs and materials will be developed and added.

Additional parking lots and trails will be constructed to facilitate these public uses. Some administrative and visitor facilities will be replaced. The Service will partner with local government agencies and non-governmental organizations to create interpretive materials and displays for off-refuge ecotourism or natural resource-based visitor centers.

Adaptive Management. Adaptive management is a management philosophy and decision process that incorporates flexibility and continual learning. It involves monitoring and evaluation of refuge accomplishments, comparing accomplishments to objectives, and changing management strategies or objectives as necessary to achieve desired results. In the presence of accelerated climate change, adaptive management is an increasingly important management-decision process. The Refuge will employ adaptive management as a standard operating procedure.

Appropriateness and Compatibility. Consistent with relevant laws, regulations, and policies, prior to allowing any public use of the Refuge (including commercial use), each use will first need to be found appropriate and determined compatible (16 U.S.C. 668dd-668ee, 50 CFR 25, 26, and 29; and 603 FW 1 and 2). In the Draft CCP/EA, the Service made preliminary findings and determinations regarding the appropriateness and compatibility of each use included in each alternative. Appropriateness findings and compatibility determinations have been finalized for each use included in the management direction. Appropriateness and compatibility are further discussed in Appendix B.

Climate Change. As stated in the Department of the Interior's Secretarial Order 3226 and the Service's Climate Change Strategic Plan (USFWS 2010a), the Service considers and analyzes climate change in its decisions, long-range plans and other activities. Habitat conditions and wildlife populations are directly and indirectly sensitive to climatic conditions, namely precipitation and temperature and changes to hydrologic conditions, sea level rise and ocean acidification. As described in greater detail in Chapter 3, the Refuge is currently not affected by sea level rise due to upward vertical land movement and estimated sediment accretion rates. However, the Refuge may be affected by storm surges, increases in extreme precipitation events, higher water temperatures, and ocean acidification.

The combined changes can affect the Refuge's habitats and species directly, such as the timing of arrival of migratory birds and many other phenologic responses, changes in species' ranges and physiology, and indirectly such as added vulnerability to other stressors including increasing invasive species and pathogens. Predicting biological response at the population level, however, requires complex research and information and sophisticated models that can be validated with field studies over time. This highlights the importance of monitoring habitat and species to establish potential correlations and adaptation options.

Knowledge and monitoring of regional and local climate trends on refuge resources will be used to assess potential changes or enhancements to the Refuge's management actions and techniques and/or their timing, using the adaptive management approach described above.

The Refuge Complex staff will participate in and contribute to climate change and sea level rise assessment efforts, including those underway at a landscape scale. Participation in the North Pacific Coast Landscape Conservation Cooperative (LCC) will provide refuge staff with a means to tie in with a larger scale assessment of the impacts of climate change (USFWS 2010a). LCCs are formal science-management partnerships between the Service, Federal agencies, states, tribes, non-government organizations (NGOs), universities, and other entities to address climate change and other biological stressors in an integrated fashion. LCCs provide science support, biological planning, conservation design, research, and design of inventory and monitoring programs.

As needed, objectives and strategies will be adjusted to assist in enhancing the resiliency of refuge resources to climate change. Specific management goals, objectives and strategies, based on climate change impact projections, will be identified for refuge habitats most vulnerable to climate change and sea level rise.

The Service has developed a Strategic Plan for Responding to Accelerating Climate Change in the 21st Century (USFWS 2010a), and an Action Plan outlining specific actions needed to implement the Strategic Plan. The Action Plan calls for the Service to make its operations carbon-neutral by 2020. The Refuge will work toward this goal by continuing to pursue and engage in mechanisms to conserve energy in refuge operations, including the use of fuel-efficient vehicles and building appropriately sized, energy-efficient facilities, as funding becomes available. The Refuge will also reduce the carbon footprint of land management activities by using energy-efficient techniques, where feasible and in line with management goals. The Refuge will also explore ways of offsetting any remaining carbon balance, such as carbon sequestration through reforesting the upland grasslands and other means.

Cultural Resources Protection. The Service will continue to uphold Federal laws protecting cultural resources, including the National Historic Preservation Act (NHPA), Archaeological Resources Protection Act (ARPA), and Native American Graves Protection and Repatriation Act (NAGPRA). These laws also mandate consultation with Native American tribes, the State Historic Preservation Office (SHPO), and other preservation partners. The NHPA mandates that all projects that use federal funding, permitting, or licensing be reviewed by a cultural resource professional to determine if there is the potential to affect cultural resources. An inventory will be conducted as necessary, and appropriate actions to mitigate effects will be identified prior to implementation of the project. A project-specific determination will be conducted for all undertakings as defined by NHPA, including habitat maintenance and restoration projects as well as new or expanded trails, roads, facilities, and public use areas.

Fire Management. The overall objective for fire management on the Complex is to promote a program that provides for firefighter and public safety, reduces the occurrence of human-caused fires, and ensures appropriate suppression response capability to meet expected wildland fire complexity.

Fire Management Plans (FMPs) were completed for the entire Complex, including Bandon Marsh Refuge, in 2004. The FMP details response to the threat of wildfire and under what circumstances the refuges will use wildland fire as a tool on refuge lands.

Implementation Subject to Funding Availability. Actions described in this CCP will be implemented over the life of the plan as funding becomes available. Project priorities and projected staffing/funding needs are included in Appendix C.

Integrated Pest Management (IPM). In accordance with 517 Departmental Manual (DM) 1 and 569 Fish and Wildlife Service Manual (FW) 1, an integrated pest management (IPM) approach will be utilized, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on refuge lands. IPM will involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to non-target 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 is needed on refuge lands, the most specific (selective) chemical available for the target species will be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage will be further restricted because only pesticides registered with the U.S. Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction.

Appendix G contains the Refuge's IPM program documentation to manage pests for this CCP. 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 will be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects will be documented in "Chemical Profiles" (see Appendix G). Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as facilities maintenance will 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 (exceed threshold values) in order to protect human health and safety (e.g., mosquito-borne disease).

Because invasive plants and animals currently represent the greatest threat to the Refuge's wildlife and habitat, control of invasive species will be a high priority management activity. Invasive species such as gorse, Himalayan blackberry, reed canarygrass and Scotch broom will continue to be a primary management concern and will be controlled to the degree that funding permits. Invasive species control will be initiated prior to or concurrently with habitat restoration efforts.

The magnitude of pest problems on the Refuge is beyond the available capital resources to expect control or eradication during any single field season; therefore it is essential to prioritize treatment of infestations. Some non-native species which are pervasive on refuge lands are the subject of long-term control efforts and will continue to be a high priority. Also, the Service will find and verify the identity of new invasive species as early after entry as possible, when eradication and control are still feasible and less costly. Regardless of whether the invasive species is well established or newly introduced, the Refuge will prioritize 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.

Land Protection. The Service has the authority to acquire land or negotiate agreements on behalf of the National Wildlife Refuge System only within an approved refuge boundary. The Service can make offers to purchase land, purchase conservation easements or enter into management agreements with willing landowners within the approved boundary. Lands or interests therein, do not become part of the National Wildlife Refuge System unless they are purchased from or are placed under a management agreement with the individual landowner. Service authority over any use of lands within an approved refuge boundary is limited to lands the Service has acquired in fee title, conservation easement or entered into a management agreement. Private landowners within an approved refuge boundary retain all of the rights, privileges, and responsibilities of private land ownership and are under no obligation to sell their property to the Service. Service policy for land acquisition is to work on a one-on-one basis with a willing seller/interested landowner. Based on the availability of funds, the Service will continue to negotiate with willing sellers to acquire lands within the existing approved refuge boundary.

The Service is conducting a separate Land Protection Planning (LPP) process to study options for expanding the approved refuge boundary adjacent to and upstream from the existing boundary. Thus, the question of whether the approved refuge boundary should be expanded is outside of the scope of the CCP (See also Section 1.9.3, Issues outside the Scope of the CCP).

Maintenance of Existing Facilities. Periodic maintenance of refuge buildings and facilities will be necessary. Periodic maintenance and upgrading of facilities is necessary for safety and accessibility and to support management and visitor needs, and is incorporated in the Service Asset Management System.

Regulatory Compliance. Prior to implementation, all planned activities will undergo appropriate reviews and consultations, and permits and clearances will be secured, as necessary, to comply with legal and policy requirements. This includes water quality permits required under section 401, and dredge and fill permits required under section 404 of the Federal Water Pollution Control Act of 1982, as amended (33 U.S.C. 1251-1382); appropriate evaluations and documentation under the National Environmental Policy Act; and, as noted above, evaluation and consultation required by Section 7 of the Endangered Species Act, and review and consultation required by Section 106 of the National Historic Preservation Act.

Response to Mosquito-borne Diseases. Under draft refuge policy (72 FR 71939), mosquito populations on refuge lands are allowed to fluctuate and function unimpeded unless they pose a threat to wildlife and/or human health. While the Service recognizes that mosquitoes are a natural component of most wetland ecosystems which provide food for some fish and wildlife including migratory birds, we also recognize they can be a nuisance and may represent a threat to human and/or wildlife health. To protect human and wildlife health and safety, the state or a local vector control agency would be allowed to control mosquito populations on refuge lands using pesticide treatments (larvicides, pupacides, or adulticides) only if local, current population monitoring and/or disease surveillance data indicate refuge-based mosquitoes pose a health threat to humans and/or wildlife. As previously described, mosquito treatments would be allowed on refuge lands in accordance with IPM principles applicable to all pests (see Appendix G). Proposed pesticide uses for mosquito control will utilize appropriate and practical BMPs, where possible, given potential effects documented in Chemical Profiles. If mosquitoes are determined to be posing a threat to wildlife and/or human health, a refuge compatibility determination (CD) will be written, which will provide details regarding mosquito population monitoring, disease surveillance, and treatments.

After approval of the CCP, a disease contingency plan (DCP) will be prepared addressing response to mosquito-borne disease outbreaks on and/or adjacent to refuge lands. Much of the information will be evaluated and described in the previously mentioned CD (e.g., IPM treatment options) and will be incorporated with additional specificity, where necessary, into this plan. The DCP also will include other information such as the history of mosquito-borne diseases on and/or adjacent to the Refuge as well as measures to protect refuge visitors, Service authorized agents and Service employees when a health threat or emergency is identified by health officials.

Participation in Regional Planning and Conservation Efforts. The Refuge Complex staff will actively participate in and contribute to planning and conservation efforts for ongoing and future monitoring and research associated with tidal marsh restoration, invasive species detection and rapid response, and other activities that may affect refuge wildlife resources and habitats. Refuge Complex staff will cultivate working relationships with pertinent local, county, State, and Federal agencies to stay abreast of current and potential developments; and will utilize outreach, education, and information as needed to raise awareness of refuge resources and their dependence on a healthy local environment.

Partnerships. Partnerships on the Refuge are critical components in maintaining and continuing efforts to implement resource management improvements, such as restoring habitat for threatened and endangered species or enhance recreation opportunities. These partnerships typically involve joining forces with Federal, state, and local agencies and organizations. The Service will continue to devote time and effort towards maintaining existing and developing new partnerships to enhance collaboration on support of fish and wildlife resources, wildlife-dependent recreational opportunities, and educational programs, and to explore ways to share funding and seek grants on projects of mutual interest. Specifically, the Service will work with local and state agencies to promote mutual understanding, encourage environmentally friendly development, and promote ecotourism opportunities.

Refuge Revenue Sharing. Annual payments to Coos County under the Refuge Revenue Sharing Act (16 U.S.C. 715s) will continue according to the established formula and subject to congressional appropriations.

State Coordination. The Refuge Complex will continue to coordinate with Oregon State agencies regarding areas of mutual interest. This includes communications with ODFW regarding public recreation, fish passage, and habitat restoration and management priorities identified through the Oregon Conservation Strategy.

Tribal Coordination. The Service will coordinate and consult with Native American Tribes on a regular basis regarding issues of shared interest. Currently the Service seeks assistance from Tribes in Native American Graves Protection and Repatriation Act and National Historic Preservation Act and related issues. The Service is also interested in partnering with Tribes to provide cultural resources education and interpretation opportunities.

Volunteer Opportunities and Partnerships. Volunteer opportunities and partnerships are recognized as key components of the successful management of public lands and vital to implementation of refuge programs, plans, and projects.

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, the planning team completed a wilderness review, which can be found in Appendix D. This review concluded that the Refuge is not suitable for wilderness designation.

Table 2-1. Summary of Management Direction

Key Theme/issue	Future Management
Upland Forest Habitat	
Restoration of grasslands (former pastures) to forest	29 acres restored. Manage to accelerate restoration to old-growth forest, including control of invasive species, understory establishment, placement of nurse logs.
Management of existing forest	39 acres actively managed. Continue control of invasive species. Use appropriate forest management techniques (e.g., girdling, falling) to thin trees using multiple entry approach, where needed.
Forested Wetlands and Stream-Riparian Habitat	
Forested wetlands and stream-riparian habitat (wet-mesic Sitka spruce-western hemlock forest)	79 acres of forested wetlands protected and maintained. Continue invasive species control.
	11 acres restored. Import and place nurse logs. Control invasive species. Control grasses with mechanical/mowing and herbicides to protect establishing trees/shrubs. Mechanical removal to thin trees, as needed.
Coastal stream-riparian corridor	0.5 mile protected and maintained. Control invasive species. Install logs, woody debris, and root wads in channels to promote diverse hydrological and physical structure. Remove fish passage barriers.
Estuarine Habitat	
Salt marsh and intertidal mudflats	Protect and maintain integrity of 750 acres of estuarine habitats through monitoring for presence of invasive species, salmonid use (woody debris installations), vegetation response, invertebrates, water quality parameters, biofilm/algae abundance and composition, and water quality.
Monitoring and Research	
Status monitoring	Continue and expand existing data collection. Collect additional data on fish, amphibians, small mammals, plants, migratory songbirds, water quality, and forest diseases and pests.
Effectiveness monitoring	Monitor CCP and other step-down plan objectives.
Research and scientific assessments	Continue existing research. Identify priority and long-term research needs and cooperate with partners to accomplish. Complete water resource assessment for the Refuge.
Hunting	
Bandon Marsh Unit	Waterfowl hunting allowed on 256 acres at Bandon Marsh Unit outside of Bandon City Limits 7 days per week per ODFW regulations.
Ni-les'tun Unit	Allow waterfowl hunting on 299 acres of Ni-les'tun Unit 3 days per week.
Wildlife Observation and Photography	
Wildlife observation and photography – Bandon Marsh Unit	Bandon Marsh Unit remains open 7 days per week.
Wildlife observation and photography – Ni-les'tun Unit	Viewing deck and marsh trail open daily. Allow unrestricted walking on part of the Unit daily during non-hunting season (Feb.–Sept.). To avoid conflicts between visitors participating in waterfowl hunting and

Table 2-1. Summary of Management Direction

Key Theme/issue	Future Management
	those engaged in wildlife observation or photography, the Ni-les'tun Unit will be closed to unrestricted walking from Oct. 1 through Jan. 31 annually, which coincides with the waterfowl hunting season. Develop trail connecting restored forest above office with parking lot.
Fishing	
Fishing and clamming – Bandon Marsh Unit	Allowed per ODFW regulations and subject to Oregon Department of Agriculture (ODA) and ODFW shellfish safety closures.
Fishing and clamming – Ni-les'tun Unit	Allow artificial fly and lure fishing for cutthroat trout only, in accordance with refuge and ODFW regulations regarding allowable methods, on the tidal portions of Fahys, No Name, and Redd Creeks on the Ni-les'tun Unit. Fishing season closes on Sept. 30. Explore options for providing clamming opportunities.
Interpretation	
Interpretation	Maintain existing interpretive structures and panels on both units. Develop interpretive panels on new trail system. Offer staff- or partner-led activities (e.g., walks and paddle trips, community-based offsite programs).
Environmental Education	
Environmental education (EE) programs	Partners take lead on developing EE center and work with Service to develop curriculum. Continue existing EE programs.
Facilities	
Facilities	Build a small administrative office and a visitor contact station at current office site. Maintain existing and develop new trails and interpretive panels. Participate in a community-based visitor information center off the Refuge. Utilize habitat-appropriate native plants for landscaping around buildings, kiosks, and other public use facilities.
Climate Change Adaptation	
Reduce carbon footprint	Replace current vehicles with more fuel-efficient vehicles. Any new or replaced facilities will be appropriately sized and energy-efficient. Use energy-efficient land management techniques where feasible and in line with management goals. Explore ways of offsetting carbon balance, such as carbon sequestration.

2.4 Goals, Objectives, and Strategies

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

The goals for Bandon Marsh NWR over the next 15 years under the CCP are presented on the following pages. The goal order does not imply any priority. Each goal is followed by the objectives that pertain to that goal. Some objectives pertain to multiple goals and have simply been placed in the most appropriate location. Similarly, some strategies pertain to multiple objectives. The timeframe for accomplishing CCP objectives is the 15-year life of the CCP, unless otherwise specified in the objective.

Readers, please note the following:

Below each objective statement are the strategies that could be employed in order to accomplish the objectives. Symbols used in the following tables include:

% percent sign
> greater than
< less than

2.4.1 Goal 1: Restore, protect, and maintain upland forests characteristic of the North Pacific Coastal Ecosystem.

Objective 1.1 Restore Sitka spruce-western hemlock forest
Within the next 15 years, restore and then protect and manage 29 acres of Sitka spruce-western hemlock forest on Bandon Marsh NWR for the benefit of migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander). The desired attributes of the restored Sitka spruce-hemlock forest are the following: • 60-70% canopy cover of Sitka spruce, western hemlock, Port Orford cedar, and shore pine • 600 square feet/acre density of nurse logs • 25-95% (83% average) cover of a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal), ferns, and herbaceous species (e.g., sedges) in understory • <5% cover of invasive plants (e.g., Himalayan blackberry, gorse, Scotch broom) • No English ivy present
Strategies Applied to Achieve Objective
Management Strategies:
a. Initially, control grasses with mechanical/mowing and herbicides to protect establishing trees/shrubs
b. Import and place nurse logs to create diversity of structure
c. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
d. Mechanical removal to thin planted trees as needed to promote survival of desired trees/vegetation
e. Promote understory establishment (e.g., plantings) to aid in understory plant diversity
Monitoring Strategies (see also Objective 5.1 Survey):
f. Monitor migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander) to determine distribution and populations
g. Monitor conifers (e.g., Sitka spruce and western hemlock) to determine growth rate, density, canopy cover and DBH
h. Monitor a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal, wax myrtle), ferns, and herbaceous species (e.g., sedges) to determine understory cover
i. Monitor snags to determine density and location

j. Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, English ivy) to determine infestation percent and distribution
k. Monitor existing and planted trees and shrubs to determine survival rate
Rationale: The long-term target of this objective is production of late-successional Sitka spruce and western hemlock forest characteristics and restoration of up to 100% of historic extent of this forest type within the Refuge. Numerous definitions of late-successional or old growth forest exist and vary by location and dominant tree species. However, most definitions indicate four important structural components: number and minimum size of large live trees; canopy conditions; number and minimum size of snags; and number and size of downed large woody debris (LWD). Late-successional Sitka spruce-western hemlock forests provide nesting habitat, forage, and shelter to a variety of wildlife species. Migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) use the conifer forests because of the presence of other birds and rodents, bark and wood-boring insects, and conifer seeds. This habitat will also benefit a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander). Much of the late-successional forest has been removed from the Oregon coast due to logging and development. Over the life of the CCP (15 years), the Service will restore 29 acres of Sitka spruce-western hemlock forest and set the course towards late-successional or old growth forest characteristics. Nurse logs will remain on-site to create diversity of structure and help establish organic material from decaying woody debris and promote young tree growth and survival. Tree thinning will be accomplished as needed, based upon the survival of planted trees. Grasses will be controlled during the initial phase of restoration to promote survival of Sitka spruce, western hemlock, Port Orford cedar, and shore pine trees. Understory establishment (e.g., plantings) will be promoted and aid in understory plant diversity. In addition, invasive plant species will be controlled using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means as not to compete with desired tree and shrub species.

Objective 1.2 Protect and maintain Sitka spruce-western hemlock forest

Throughout the life of the CCP, protect and maintain 39 acres of Sitka spruce-western hemlock forest on Bandon Marsh NWR for the benefit of migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander). The desired attributes of this forested habitat are the following:

- 30-95% (73% average) canopy cover of Sitka spruce and western hemlock with DBH 24-36 inches with multiple distinct canopy layers also including grand fir, western red cedar, and/or Port Orford cedar
- 25-95% (83% average) cover of a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal), ferns, and herbaceous species (e.g., sedges) in understory
- Shrub height averages 3 meters (10 feet)
- 600 square feet/acre density of nurse logs
- 6/acre density of snags
- One tree per acre with significant structural defect or decadence (e.g., cavities, broken top, mistletoe or fern infestation)
- <5% cover of invasive plants (e.g., Himalayan blackberry, gorse, Scotch broom)
- <1% English ivy

Strategies Applied to Achieve Objective
Management Strategies:
a. Use appropriate forest management techniques (e.g., girdling, falling) to thin trees using multiple entry approach, where needed
b. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
Monitoring Strategies (see also Objective 5.1 Survey):
c. Monitor migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and other forest-dependent species (e.g., black-tailed deer, bald eagle, bobcat, Pacific giant salamander) populations to determine distribution and abundance
d. Estimate canopy cover and DBH of Sitka spruce and western hemlock to determine percent cover by species
e. Estimate understory cover of a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal, wax myrtle), ferns, and herbaceous species (e.g., sedges) to determine percent cover by species
f. Monitor snags to determine density and location
g. Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, English ivy) to determine percent cover, and location
h. Monitor tree density and thinning efforts to determine areas that need attention
i. Monitor bald eagles to determine distribution, population, and reproductive success
Rationale: The long-term target for this objective is production of late-successional Sitka spruce and western hemlock forest characteristics. Much of this habitat type has been removed from the Oregon coast due to extensive logging and development. See the rationale for Objective 1.1 for a definition of this habitat type and its associated species. The Refuge currently contains 39 acres of Sitka spruce-western hemlock forest. Currently, the forested stands exist on the Ni-les'tun Unit upslope of the Fahys Creek riparian corridor. This refuge habitat benefits migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bald eagle, bobcat, Pacific giant salamander). While this objective emphasizes allowing natural processes (e.g., windfall and natural regeneration in openings) to drive vegetative changes, additional techniques such as thinning, girdling, and falling will also be used to promote the development of late-successional characteristics. Thinning (girdling, falling) trees reduces competition for the resources needed for growth thus promoting larger DBH of late-successional Sitka spruce and western hemlock. Snags are also an important component of a late-successional forest, and tree girdling (strip of bark removed from circumference of trunk) can be used to kill trees and create snags. Maintenance measures, primarily invasive plant control, will be regularly implemented using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means. Invasive plants compete with desired tree and shrub species, limit native vegetation production, and cause impacts to food, nesting, and cover for wildlife. Controlling and treating invasive species on a consistent basis will allow the Refuge to continue to provide quality habitat to improve fish and wildlife health and survival.

2.4.2 Goal 2: Restore, protect, and maintain forested wetlands and stream-riparian habitat characteristic of the North Pacific Coastal Ecosystem.

Objective 2.1 Protect and maintain wet-mesic Sitka spruce-western hemlock forest

Throughout the life of the CCP, protect and maintain 79 acres of wet-mesic Sitka spruce-western hemlock forest and adjacent riparian habitat on Bandon Marsh NWR for the benefit of migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander). The desired attributes of wet-mesic Sitka spruce-western hemlock forest are the following (based on Brophy 2009, Brophy et al. 2011, Brophy and van de Wetering 2012, NatureServe 2012):

- Periodic freshwater tidal and/or seasonal riparian flooding
- Flat topography with local microrelief caused by logs, stumps, and buttressed roots of spruce trees
- High organic content of soils (>20% organic matter)
- Woody vegetation dominated by native trees and shrubs (e.g., Sitka spruce, red alder, Hooker willow, Sitka willow, twinberry, Pacific crabapple)
- Dominant herbaceous species include slough sedge and skunk cabbage with non-wetland species (e.g., salal, huckleberry) growing on fallen logs or spruce root platforms
- <5% cover of invasive plants (e.g., blackberry, gorse, Scotch broom)
- No English ivy

Strategies Applied to Achieve Objective

Management Strategies:

a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)

Monitoring Strategies (see also Objective 5.1 Survey):

b. Monitor migratory landbird (e.g., chestnut-backed chickadee, pileated woodpecker) and other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander) population and use

c. Monitor plant community composition (i.e., percent cover of trees, shrubs, ferns, and herbaceous species)

d. Determine woody species stem density and basal area

e. Monitor salmonids and other fish to determine use and distribution

f. Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, reed canarygrass, English ivy) to determine abundance and distribution

g. Monitor inundation frequency, duration, and depth

h. Monitor groundwater input

i. Monitor hydrology to determine beaver effects on water flow

Rationale: For the purposes of this CCP, wet-mesic Sitka spruce-western hemlock forests are defined as woody habitats that consist of valley forested wetlands and riparian forest along rivers, salt marsh, or mudflats (e.g., National Vegetation Classification Standard *Tsuga heterophylla - Picea sitchensis*/*Lysichiton americanus* Hardwood-Conifer Rich Swamp Group, NatureServe 2012). Periodic freshwater tidal and/or seasonal riparian flooding are the major natural processes that drive this system. Soils are perennially wet, usually with high organic content. Historically, many of the areas located in the lower brackish (mesohaline to oligohaline) and freshwater tidal zones of Oregon's estuaries were likely Sitka spruce and/or shrub tidal swamp. Tidal swamps were also found on the margins of the marine salinity zone where freshwater dilutes ocean water, such as along tributary streams, on high natural levees, and in hillslope seepage zones.

Within the Refuge, the 79 acres of wet-mesic Sitka spruce-western hemlock forest and riparian habitat are found along the fringes of the Coquille River, small tributaries of Fahys and Redd creeks, salt marsh and mudflats, with the majority of the acreage being located on the Ni-les'tun Unit. Migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander) are abundant and use the surrounding habitat for hunting, foraging, and resting. Beavers are also abundant in the nearby streams and woodlands and drive the hydrology of the system. This area also provides off-river habitat for salmonids during high waters, including the threatened coho salmon.

Invasive plant species such as Himalayan blackberry, English ivy, and Scotch broom present challenges. Himalayan blackberry readily invades riparian areas, forest edges, oak woodlands, meadows, roadsides, clear-cuts, and any other relatively open area, including all open forest types. Once it becomes well established, it out-competes low stature native vegetation and can prevent establishment of shade intolerant trees, leading to the formation of apparently permanent blackberry thickets with little other vegetation present. Invasive species treatment has been initiated on the Himalayan blackberry that infests much of the refuge uplands, roadsides, and trail edges. English ivy is a vigorous growing vine that impacts all levels of disturbed and undisturbed forested areas, growing both as a ground cover and a climbing vine. As the ivy climbs in search of increased light, it engulfs and kills branches by blocking light from reaching the host tree's leaves. In addition to English ivy, Scotch broom also is being found more frequently on the Refuge. Wherever it grows, this aggressive plant spreads to form pure stands at the expense of desirable forbs, grasses, and young trees. Because it is a threat to native plant species and indirectly to animals that feed on the displaced plants, Scotch broom is a Class B noxious weed in Oregon. Due to lack of funding and staff, to date minimal control efforts have been conducted, and these species continue to invade and spread throughout the Refuge.

Objective 2.2 Restore wet-mesic Sitka spruce-western hemlock forest

By 2027 (within next 15 years), restore, then protect and maintain 11 acres of wet-mesic Sitka spruce-western hemlock forest and riparian habitat on Bandon Marsh NWR for the benefit of migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander). The desired attributes of wet-mesic Sitka spruce-western hemlock forest are the following (based on Brophy 2009, Brophy et al. 2011, Brophy and van de Wetering 2012, NatureServe 2012):

- Periodic freshwater tidal and/or seasonal riparian flooding
- High organic content of soils (>20% organic matter)
- Woody vegetation dominated by native trees and shrubs (e.g., Sitka spruce, red alder, Hooker willow, Sitka willow, twinberry, Pacific crabapple)
- Dominant herbaceous species include slough sedge and skunk cabbage with non-wetland species (e.g., salal, huckleberry) growing on fallen logs or spruce root platforms
- <5% cover of invasive plants (e.g., blackberry, gorse, Scotch broom)
- No English ivy

Strategies Applied to Achieve Objective
Management Strategies:
a. Initially, control grasses with mechanical/mowing and herbicides to protect establishing trees/shrubs
b. Import and place nurse logs to create diversity of structure
c. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
d. Mechanical removal to thin planted trees as needed to promote survival of desired trees/vegetation
e. Promote understory establishment (e.g., plantings) to aid in understory plant diversity
Monitoring Strategies (see also Objective 5.1 Survey):
f. Monitor migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander) to determine distribution and populations
g. Monitor plant community composition (i.e., percent cover of trees, shrubs, ferns, and herbaceous species)
h. Determine woody species stem density and basal area
i. Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, English ivy) to determine infestation percent and distribution
j. Monitor existing and planted trees and shrubs to determine survival rate
k. Monitor salmonids and other fishes to determine use and distribution
l. Monitor hydrology to determine beaver effects on water flow
Rationale: Wet-mesic Sitka spruce-western hemlock forests are defined in the rationale section for Objective 2.1. Historically, the forested wetlands on the Refuge were converted into useable lowland pastures for farming and cattle grazing purposes and for cranberry production. The lowland pastures were restored to tidal action within the Ni-les'tun restoration project, and these lands will be planted and converted back to wet-mesic Sitka spruce-western hemlock forest. The former cranberry bogs (11 acres) were recontoured and hydrologically restored to Fahys Creek and the area planted with a mixture of Sitka spruce and other riparian trees and shrubs (e.g., willows, vine maple, crabapple, twinberry, huckleberry). Strategies are intended to maintain (e.g., water), enhance (e.g., thin trees and control invasives) and connect 11 acres of restored habitat with the existing 79 acres of wet-mesic Sitka spruce-western hemlock forest. Beavers are abundant in the nearby streams and forested wetlands and drive the hydrology of the system. Migratory landbirds (e.g., chestnut-backed chickadee, pileated woodpecker) and a diverse assemblage of other forest-dependent species (e.g., black-tailed deer, bobcat, Pacific giant salamander) are abundant and use the surrounding habitat for foraging, and resting. This area also provides off-river habitat for salmonids during high waters, including the threatened coho salmon. Invasive plant species such as Himalayan blackberry, English ivy, and Scotch broom present the same challenges for this habitat type as discussed in the rationale for Objective 2.1. Invasive species treatment has been initiated on the Himalayan blackberry that infests much of the refuge uplands, roadsides, and trail edges. Scotch broom also is being found more frequently on the newly restored habitat of the Refuge. Some control efforts have been conducted and these species continue to invade and spread throughout the newly restored habitats on the Refuge.

Objective 2.3 Protect and maintain coastal stream-riparian corridor
Throughout the life of the CCP, protect and maintain 0.5 mile of coastal stream-riparian corridor on Bandon Marsh NWR for the benefit of migratory landbirds (e.g., orange-crowned warbler, common yellowthroat), native fishes (e.g., coastal cutthroat trout, coho salmon), amphibians (e.g., northwestern salamander), small mammals (e.g., shrew, deer mouse), and a diverse assemblage of other riparian-dependent species (e.g., beaver). This coastal stream-riparian corridor habitat is characterized by the following attributes: • 30-95% (73% average) overstory riparian corridor characterized by red alder and willows with fewer Port Orford cedar, Sitka spruce, Douglas fir, and western red cedar • 25-95% (83% average) understory cover with native shrubs (e.g., huckleberry, salmonberry, twinberry) and sedges • <5% cover of invasive plants (e.g., Himalayan blackberry, Scotch broom)
Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
Monitoring Strategies (see also Objective 5.1 Survey):
b. Monitor migratory landbird (e.g., chestnut-backed chickadee, pileated woodpecker) and other coastal stream-riparian dependent species (e.g., black-tailed deer, bobcat, beaver, Pacific giant salamander) to determine distribution and populations
c. Monitor stream-edge invertebrates to determine species composition and relative abundance
d. Monitor invasive plant and animal species to determine infestation, abundance, and distribution
Rationale: Riparian and wetland forests are highly variable in their composition, size, and structure. Functioning floodplains are influenced by high-flow events that shape stream channels and riparian vegetation through a process of pulse disturbances. The high density of edges contributes to habitat and species diversity and productivity. The 0.5 mile of stream-riparian corridor on the Refuge benefits migratory landbirds (e.g., orange-crowned warbler, common yellowthroat), native fishes (e.g., coastal cutthroat trout, coho salmon), amphibians (e.g., northwestern salamander), small mammals (e.g., shrew, deer mouse), and a diverse assemblage of other riparian-dependent species (e.g., beaver). This area also provides diversity of low understory habitat for landbirds that provides cover, nesting and foraging areas. For successful production, landbirds that live at the edges of streams or riparian canopy areas depend on the presence of streambank vegetation and abundant invertebrate diversity created by multiple layers of understory and deciduous trees. Large woody debris has been placed in the stream and provides cross-stream corridor and movement habitat which can improve the genetic health and survival of small mammals. Beavers are abundant in the stream and nearby wetland forests and drive the hydrology of the system. Invasive plant species have been noted within the riparian habitat on the Refuge; however, very limited control efforts have been conducted, and these species continue to spread throughout the riparian corridor. Limiting invasive species will provide quality forage to improve fish and wildlife health and survival. Invasive plant species will be controlled using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means as not to compete with desired plant species.

2.4.3 Goal 3: Enhance, protect, and maintain estuarine habitats characteristic of the North Pacific Coastal Ecosystem.

Objective 3.1 Enhance, protect, and maintain salt marsh
Throughout the life of the CCP, enhance, protect, and maintain 650 acres of salt marsh on Bandon Marsh NWR for the benefit of migratory birds (e.g., American wigeon, northern pintail, mallard, sora, merlin, shorebirds), salmonids (e.g., Chinook and coho salmon, coastal cutthroat trout), and diverse assemblage of other species (e.g., river otter, black-tailed deer). Salt marsh is characterized by the following attributes: • Diverse elevations ranging from about 3 feet below mean lower low water (MLLW) to 9 feet above MLLW for tidal flats and tidal marshes • Hydrological flows are affected by high flows in the rivers and tidal cycles • Low elevation areas are a mosaic of native species including salt grass and pickleweed • Upper elevation includes Lyngby's sedge, slough sedge, tufted hairgrass, Pacific silverweed and occasional Henderson's checkermallow • Tidal channels are highly branched, sinuous, and deep-sided of different orders with a large woody debris component • Lands completely submerged during high seasonal tidal cycles • No cordgrass species • No nutria or other non-native mammals (e.g., red fox)
Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
b. Outplanting of rare, native species (e.g., Henderson's checkermallow) to increase native vegetation presence
c. Clean and disinfect clothing and boating equipment before and after entering salt marsh
d. Apply public outreach to inform public about invasive or exotic animal species introductions, transport, and control methods
Monitoring Strategies (see also Objective 5.1 Survey):
e. Monitor migratory birds (e.g., savannah sparrow, great blue heron, northern harrier), and other mammal species (e.g., river otter, black-tailed deer) populations to determine distribution and abundance
f. Monitor waterfowl to determine populations and habitat use
g. Monitor salt marsh to determine stop-over (feeding and loafing) and breeding habitat parameters for waterfowl
h. Monitor hydrological flows and tidal elevations/cycles to understand hydrological influence and parameters
i. Survey native plant species (salt grass, pickleweed, Lyngby's sedge, slough sedge, tufted hairgrass, Pacific silverweed and Henderson's checkermallow) to determine distribution and density
j. Monitor large woody debris to determine location and composition and vegetation response
k. Monitor salmonids and other estuary-dependent fish species to determine distribution, biological characteristics, and use of woody debris installations
l. Monitor water quality to describe water quality parameters

m. Monitor composition and relative abundance of macro invertebrates to determine abundance and distribution
n. Monitor invasive plant (e.g., cordgrass, reed canarygrass, Himalayan blackberry) and animal species (New Zealand mudsnail, nutria, feral cats) to determine percent cover and location
o. Monitor sedimentation rates and vegetation response within the bay or salt marsh
p. Monitor public use programs (i.e., waterfowl hunting, fishing) to determine impacts and response fish and wildlife
q. Work with partners to monitor environmental factors that are climate change related stressors (e.g., changes to hydrology, acidification, storm intensity, floods)
Rationale: Tidal wetlands are of high ecological importance and are considered essential habitat for many marine and anadromous fish (including threatened coho salmon) and migratory birds (ODFW 2006, Seliskar and Gallagher 1983). Salt marshes provide food and nursery areas for numerous young fish, crabs, shrimp, clams, and other invertebrates. Migratory birds use the salt marsh as a breeding, feeding, and resting site. In addition, the estuarine marshland supports large numbers of migratory waterfowl and shorebirds, which in turn provide an important prey base for the recently delisted bald eagle and the peregrine falcon. The salt marsh is functionally connected with mudflat habitat and riverine habitats and act as a transition zone between aquatic and terrestrial sites. These marshes provide shoreline stability against wave and wind erosion, reduce flood peaks, trap nutrients, sediment, and pollutants. Lyngby’s sedge, slough sedge, tufted hairgrass, Pacific silverweed and Henderson’s checkermallow are native salt marsh species and are often associated with unaltered estuarine habitat in Oregon. The 650 acres of salt marsh at Bandon Marsh NWR provide critical ecosystems and ecological processes. In Oregon’s seventeen largest estuaries, tidal wetland acreage has declined considerably based on pre-settlement estimates. Brophy (2011), using information from Scranton (2004) and Hawes et al. (2008), estimated 16,173 acres of tidal marsh statewide in the 1850s and by 2005 80% of those acres were no longer tidal marsh. The Coquille has experienced the greatest loss (>95%) of tidal marsh habitat in the state (ibid.). If unaltered or restored to a more natural hydrologic state (i.e., characterized by sinuous, deeply-incised, and complex tidal channel networks; and the absence of alterations such as ditching, diking, tidegates, restrictive culverts, and roads), salt marsh habitat will maintain itself with very little or no input from land managers. As a result, to accomplish this objective, the Refuge primarily needs to outplant native species and pursue invasive species control. Outplanting of rare, native species, such as Henderson’s checkermallow, is needed to reestablish a healthy population, since this species is nearly absent at Bandon Marsh NWR. Invasive species degrade habitats that support a diverse community of estuarine organisms including aquatic migratory birds and anadromous fish, and the invertebrate and plant communities that support them. For example, the widespread colonization by cordgrass, which is not currently present on the Refuge, would induce major modifications of physical, hydrological, chemical, and biological estuarine functions. Cordgrass displaces eelgrass on mudflats and native vegetation in salt marshes. This invasive plant must be controlled using IPM techniques including mechanical/physical, chemical, biological, and cultural means. One of the largest threats to the wildlife and habitat of the Refuge is pest animals. Introduced

native and non-native animal species (New Zealand mudsnail, nutria, feral cats) are usually in direct competition with native wildlife species for food, shelter, and breeding areas and often cause existing native species populations to decline or become extirpated. Ultimately, animal invasive species can result in considerable impact to native wildlife and the habitat they are dependent upon. Limiting invasive and exotic animal species will provide improved quality habitat and wildlife health and survival. Actions will be taken to reduce competition between native and non-native animal species.

Monitoring sedimentation rates and vegetation response within the bay and salt marsh is important to the understanding of the potential resilience of these habitats to sea level rise, storm surges, and flood events.

Objective 3.2 Protect and maintain intertidal mudflats
Throughout the life of the CCP, protect and maintain 100 acres of intertidal mudflats on Bandon Marsh NWR for the benefit of migratory birds (e.g., American wigeon, mallard, western sandpiper, short-billed dowitcher), salmonids (e.g., Chinook and coho salmon, coastal cutthroat trout), shellfish (e.g., sand shrimp, benthic worms, native clams), and diverse assemblage of intertidal mudflat species (e.g., river otter). Intertidal mudflats are characterized by the following attributes: • Diverse elevations ranging from about 3 feet below MLLW to about 4 feet MLLW that is completely inundated during two daily tidal cycles • Mosaic of tidal channels of variable orders that can remain inundated depending upon the seasonal tides and elevations • Sandy/muddy substrate that is sparsely vegetated by widgeon grass and seasonal algae blooms • Presence of large woody debris • Presence of biofilm on muddy substrate • No Japanese eelgrass • No cordgrass species
Strategies Applied to Achieve Objective
Management Strategies:
a. Utilize appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means (see IPM Appendix)
b. Work with Oregon Division of State Lands to cooperatively manage resources, treat/monitor invasive species
Monitoring Strategies (see also Objective 5.1 Survey):
c. Monitor migratory birds (e.g., American wigeon, mallard, great blue heron, peregrine falcon, western sandpiper, short-billed dowitcher), salmonids (e.g., Chinook, cutthroat, coho), shellfish (e.g., sand shrimp, benthic worms, native clams), and mammal species (e.g., river otter) to determine population and biological characteristics and use of intertidal mudflats
d. Monitor invasive plant species (e.g., Japanese eelgrass, cordgrass) to determine percent cover and location
e. Monitor shorebirds to determine distribution, populations, and habitat use
f. Monitor habitat parameters to determine stop-over feeding and loafing habitat quality for shorebirds

g. Monitor composition and relative abundance of macro invertebrates to determine abundance and distribution
h. Monitor/survey biofilm/algae to determine abundance and composition
i. Monitor sedimentation rates and vegetation response within the bay or intertidal mudflats
j. Monitor water quality on the Refuge to ensure contaminant levels are not exceeded and aquatic resources are protected
k. Monitor large woody debris to determine rate of deposition
l. Work with partners to monitor environmental factors that are climate change related stressors (e.g., changes to hydrology and salinity)
Rationale: The 100 acres of intertidal mudflats are functionally connected with salt marsh and riverine habitats, which contain a rich invertebrate community that supports a diversity of native fishes, shorebirds, and waterfowl. Algae and diatoms are the principal plant types; vascular plants are rare or absent. Invertebrates such as snails, shrimp, clams, worms, and crabs are locally common or abundant. The most common and important non-fish species occupying the mudflats include Dungeness crab, softshell clams, and sand shrimp. Waders such as great blue herons and great egrets, and shorebirds such as least and western sandpiper, dunlin, short and long-billed dowitcher, greater yellowlegs, black-bellied plover, red-necked phalarope, whimbrel, long-billed curlew, and black turnstones make extensive use of the mudflats for foraging on macro-invertebrates and in some cases biofilm. Bandon Marsh provides stop-over habitat for migratory shorebirds and quality habitat to improve wildlife health and survival. Dabbling ducks, diving ducks, gulls, peregrine falcons, and bald eagles also forage there. Harbor seals forage on inundated mudflats at high tide and in the lower bay, or they haul out on the flats and spit to rest. Large woody debris provides perch sites for migratory birds including raptors and waders. Intertidal mudflats tend to maintain their integrity naturally, and managers typically need to conduct very little active management. As a result, to accomplish this objective, the Refuge primarily needs to pursue invasive species control. Invasive species such as Japanese eelgrass and cordgrass are of primary concern; their impacts are discussed in the rationale section for Objective 3.1. Actions will be taken to reduce competition between native and non-native vegetation species. These invasive plants must be controlled using IPM techniques including mechanical/physical, chemical, biological, and cultural means. Since land owned by the state is adjacent to refuge lands, we will work cooperatively with the State of Oregon to control invasive species. Eradication efforts will be attempted on an annual basis on properties within Bandon Marsh NWR to remove and prevent further spread of invasive species. Water quality must also be closely monitored since agricultural lands are nearby and the spread of manure or commercial fertilizer and herbicide is a common practice. If fertilizers or other chemicals enter the water system, they can be deposited within the environment and bio-accumulate in associated organisms. Sedimentation is a natural event that occurs in bays and estuaries and can alter plant communities and hydrology. The rate of sedimentation should be closely monitored and the habitat changes due to sedimentation documented. Monitoring sedimentation rates and vegetation response for

intertidal mudflats is also important to the understanding of the potential resilience of this habitat type to sea level rise, storm surges, and flood events.

2.4.4 Goal 4: Enhance, protect, and maintain instream aquatic habitat for all dependent species including anadromous fish.

Objective 4.1 Enhance, protect, and maintain instream aquatic habitat

Enhance, protect, and maintain instream aquatic habitat within the Refuge throughout the life of the CCP for the benefit of anadromous fish and other estuary-dependent fish common in the lower Coquille River estuary and refuge tributaries including fall Chinook salmon, coho salmon, steelhead, and cutthroat trout. Instream aquatic habitat is characterized by the following attributes:

- Instream and estuary channel presence of woody and organic debris
- Meandering estuary channels and freshwater creeks (e.g., complex and braided) with unimpeded fish access
- Water quality that will meet life-history needs for salmonids (e.g., water temperature 12.8°-17.8°C, dissolved oxygen levels >7.0 milligrams per liter)
- Instream substrate (spawning gravel),<5% cover, pool/riffle ratio suitable for cutthroat trout
- <1% non-native of invasive fish (e.g., smallmouth bass, bluegill) and plants

Strategies Applied to Achieve Objective

Management Strategies:

a. Installation and maintenance of woody debris (i.e., logs and root wads) in estuary and stream channels for cover

b. Provide instream spawning gravel (cutthroat trout) habitat

c. Plant and maintain stream side vegetative cover to reduce water temperatures

d. Work cooperatively with ODFW and adjacent landowners to address fish passage and water quality issues

e. Work cooperatively with ODFW and USFWS Fisheries Program to understand, monitor, and control non-native invasive fish (e.g., smallmouth bass, bluegill, bullhead) that are competitive with native fishes

Monitoring Strategies (see also Objective 5.1 Survey):

f. Monitor salmonids to determine distribution, biological characteristics, and use of woody debris installations

g. Monitor water quality (e.g., temperature, turbidity, dissolve oxygen, pH, toxins, nutrients, organic loading, dissolved and suspended solids)

h. Monitor estuary and instream benthic invertebrates to determine species composition, diversity and abundance

i. Monitor riparian and estuary invasive plant and animal species to determine infestation, abundance, and distribution

Rationale: Protection and enhancement of aquatic habitat is important to anadromous and estuary-dependent fish species. The Coquille River watershed is a productive fishery resource for the state of Oregon. Salmonids common in the lower Coquille River estuary include fall Chinook salmon, coho salmon (threatened species), winter steelhead, and coastal cutthroat trout.

Threats currently facing salmonids and other estuary-dependent fish include the present or threatened destruction, modification, or curtailment of habitat or range. In many Oregon coastal streams, past human activities (e.g., logging, agriculture, gravel mining, urbanization) have resulted in impediments to fish passage, degradation of stream complexity, increased sedimentation, reduced water quality and quantity, loss and degradation of riparian habitats, and loss and degradation of lowland, estuarine, and wetland salmonid rearing habitats. Most anadromous fish species in the Pacific Northwest have been in decline for decades. Spring Chinook salmon, coho salmon, and coastal cutthroat trout all have depressed populations. Coho salmon on the Oregon Coast are listed as “Threatened” on the federal Threatened and Endangered Species List.

Conserving and restoring salmonid populations is an important goal, not only for their own sake, but also because of their cultural, historical, and ecological value. Salmonids are an important food source for numerous other wildlife species. Sixty-seven wildlife species of the Pacific Northwest, including many known to inhabit the Refuge, have been known to have a “strong” or “recurrent” relationship with salmon (Cederholm et al. 2000).

For successful production, juvenile salmonids that live at the edges of streams or in backwater areas depend on the presence of streambank vegetation and abundant instream structure created by logs and root wads. Large woody debris has been placed at the Ni-les’tun Unit restoration site to provide cover and to increase channel diversity quality, which improves health and survival of estuary-dependent and juvenile salmonids.

To control invasive non-native fish (e.g., smallmouth bass, bluegill) the Refuge is working cooperatively with ODFW and other fisheries biologists to remove and control these species to reduce competition between native and non-native fish species. Invasive plant species have been noted on the Refuge; however, very limited control efforts have been conducted, and these species continue to invade and spread throughout the aquatic habitat. Limiting invasive species will provide quality forage to improve fish health and survival. Invasive plant species will be controlled using appropriate IPM techniques including mechanical/physical, chemical, biological, and cultural means as not to compete with desired plant species.

2.4.5 Goal 5: Research and monitoring. Gather scientific information (surveys, research, and assessments) to support adaptive management decisions.

Objective 5.1 Conduct inventory and monitoring surveys

Throughout the life of the CCP, conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public-use activities to facilitate adaptive management. These surveys 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 through 4 in this CCP. These surveys have the following attributes:

- Data collection techniques will 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 will 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, will minimize the potential spread or introduction of invasive species • Projects will adhere to scientifically defensible protocols for data collection, where available and applicable
Strategies Applied to Achieve Objective
a. Prepare inventory and monitoring plan
b. Early detection and rapid response monitoring to identify new or spreading invasive plant and animal problems
c. Collect data and samples of fish, wildlife, and habitat parameters to determine overall health of the Refuge
d. Utilize scientific survey protocols for data collection to ensure quality results
e. Utilize most recent and up-to-date survey equipment to ensure reliable data are collected
f. Implement management strategies as needed as identified by survey data to maintain biological integrity, diversity, and environmental health
g. Monitor invasive/nuisance plant and animal species in mudflats, salt marsh, uplands, and forested habitats to determine distribution and infestation
h. Monitor forest diseases and pests to determine presence and extent
i. Monitor salmonids to determine distribution, biological characteristics, and use of woody debris
j. Monitor mammals, migratory landbirds, shorebirds, waterfowl, invertebrates, and amphibians to determine populations, distributions, and habitat use
k. Conduct long-term hydrological, biological, and physical monitoring to determine effectiveness of salt marsh restoration projects (e.g., Ni-les'tun Unit)
l. Monitor water quality returning to river and bay to determine pollution levels
m. Conduct periodic soil testing to maintain optimal pH levels and soil condition
n. Monitor habitat parameters including vegetation associated with respective habitat types to determine health of ecosystem
o. Monitor sedimentation rates and vegetation response within the bay or salt marsh
p. Monitor public use programs (i.e., waterfowl hunting) to determine waterfowl impact and response
q. Monitor Sitka spruce and western hemlock to determine growth rate, density, canopy cover and DBH
r. Monitor a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal, wax myrtle), ferns, and herbaceous species (e.g., sedges) to determine understory cover
s. Monitor snags to determine density
t. Monitor invasive plant species (e.g., Himalayan blackberry, Scotch broom, English ivy) to determine infestation percent and distribution
u. Monitor existing and planted trees and shrubs to determine survival rate
v. Monitor tree density and thinning efforts to determine areas that need attention
w. Monitor/survey biofilm/algae to determine abundance and composition
x. Monitor hydrological parameters (e.g., flow regime—timing and magnitude) and associated physical attributes (e.g., water temperature, dissolved oxygen levels) to determine if parameters are

within water quality standards
y. Monitor hydrology to determine beaver effects on water flow
z. Monitor hydrological flows and tidal elevations/cycles to understand hydrological influence and parameters
aa. Monitor wetland native vegetation to determine species composition
bb. Monitor vegetation and wildlife to determine response to IPM techniques
cc. Hire an additional permanent full-time (PFT) Wildlife Biologist to identify survey needs, collect scientific data, and meet the needs of the Refuge's biological program
Rationale: National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd-ee) set a requirement to "… monitor the status and trends of fish, wildlife, and plants in each refuge." Surveys will be used primarily to evaluate resource response to assess progress toward achieving refuge management objectives (under Goals 1 through 4) derived from the NWRS Mission, refuge purpose(s), and maintenance of biological integrity, diversity, and environmental health (601 FW 3). Determining resource status and evaluating progress toward achieving objectives is essential to implementing adaptive management on Department of Interior lands as required by policy (522 DM 1). Specifically, results of surveys will be used to refine management strategies, where necessary, over time in order to achieve resource objectives. Surveys will provide the best available scientific information to promote transparent decision-making processes for resource management over time on refuge lands. The Service will provide staff to adequately address biological complexity of the Refuge with the goal of hiring an additional Permanent Full Time (PFT) Wildlife Biologist. Currently, the Complex has only one PFT Wildlife Biologist. The Wildlife Biologist will design and implement scientific studies.

Objective 5.2 Conduct research
Throughout the life of the CCP, conduct high-priority research projects that provide the best science for habitat and wildlife management on- and off-refuge. Scientific findings gained through these projects will expand knowledge regarding life-history needs of species and species groups as well as identify or refine habitat and wildlife management actions. Wildlife and habitat responses to refuge management actions will be monitored through research projects; as a result, resource management objectives and adaptive management will be facilitated to achieve desired outcomes. These research projects have the following attributes: • Adhere to scientifically defensible protocols for data collection, where available and applicable, in order to develop the best science for resource management • Data collection techniques will have minimal animal mortality or disturbance and minimal habitat destruction • Collect the minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements for identification and/or experimentation in order to minimize long-term or cumulative impacts • Utilize proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, to minimize the potential spread or introduction of invasive species • Often result in peer reviewed articles in scientific journals and publications and/or

symposiums
Strategies Applied to Achieve Objective
a. Identify and articulate priority management-oriented research needs to a wide scientific audience
b. Collect data and samples of fish, wildlife, and habitat parameters to meet statistical analysis requirements
c. Utilize scientific survey protocols for data collection to ensure quality results
d. Utilize most recent and up-to-date survey equipment to ensure reliable data are collected
e. Quarantine or clean investigator equipment and clothing to prevent spread of invasive plant and animals
f. Research disturbance of nesting birds to document disturbance type, impacts, and other parameters
g. Research predator prey relationships to document specific parameters and effects to populations
h. Conduct research on salt marshes to determine accretion and subsidence rates
i. Conduct research on the potential effects of climate change and sea level rise on salt marshes
Rationale: Like monitoring, results of research projects will expand the best available scientific information and potentially reduce uncertainties to promote transparent decision-making processes for resource management over time on refuge lands. In combination with results of surveys, research will promote adaptive management on refuge lands. Scientific publications resulting from research on refuge lands will help increase the visibility of the NWRS as leader in the development of the best science for resource conservation and management. Research projects on refuge lands will address a wide range of natural and cultural resource as well as public-use management issues. Examples of management-oriented research projects include habitat use and life-history requirements for specific species/species groups, practical methods for habitat management and restoration, extent and severity of environmental contaminants, techniques to control or eradicate pest species, effects of climate change on environmental conditions and associated habitat/wildlife response, identification and analyses of paleontological specimens, modeling of wildlife populations, and assessing response of habitat/wildlife to disturbance from public uses. Projects may be species specific, refuge-specific, or evaluate the relative contribution of the Refuge to larger landscape (e.g., ecoregion, region, flyway, national, international) issues and trends. The findings from two ongoing projects may elicit new fields of inquiry and research, and influence priorities for inventory and monitoring on the Refuge. The Refuge will monitor the results of coastal and marine species climate sensitivity analyses (in progress, Dr. Deborah Reusser, USGS, lead researcher, funded by the North Pacific Landscape Conservation Cooperative) and a North Pacific birds sensitivity analysis (in progress, PRBO-Conservation Science, funded by the North Pacific Landscape Conservation Cooperative).

Objective 5.3 Conduct scientific assessments
Throughout the life of the CCP, conduct scientific assessments to provide baseline information that will expand our knowledge regarding the status of refuge resources and better inform resource management decisions. The scientific assessments will contribute to the development of refuge resource objectives, and they will also be used to facilitate habitat restoration through selection of appropriate habitat management strategies based upon site-specific conditions.

• Utilize accepted standards, where available, for completion of assessments • Scale and accuracy of assessments will be appropriate for development and implementation of refuge habitat and wildlife management actions
Strategies Applied to Achieve Objective
a. Utilize scientific assessment results to implement management strategies to benefit ecosystems
b. Complete water resource assessment for the Refuge – Division of Engineering, Water Resources Branch
c. Develop a National Vegetation Classification Standard vegetation data layer for use in GIS
d. Conduct hydrological assessment at Bandon Marsh
e. Conduct baseline assessment of water chemistry and monitor changes over time to determine acidification rate
Rationale: In accordance policy for implementing adaptive management on refuge lands (522 DM 1), appropriate and applicable environmental assessments are necessary to determine resource status, promote learning, and evaluate progress toward achieving objectives whenever using adaptive management. These assessments will provide fundamental information about biotic (e.g., vegetation data layer) as well as abiotic processes and conditions (e.g., soils, topography, hydrology) that are necessary to ensure that implementation of on-the-ground resource management actions identified resource management objectives identified under Goals 1 through 4. For example, a baseline estuary water chemistry analysis is lacking and needed to monitor the long-term potential effects of ocean acidification, a high risk to refuge resources.

2.4.6 Goal 6: Provide and manage quality opportunities for visitors of all abilities to spend time outdoors observing and/or photographing freshwater wetland and estuary-dependent wildlife thus fostering an appreciation of and understanding for coastal wildlife and habitat.

Objective 6.1 Provide high quality wildlife observation and wildlife/nature photography opportunities at the Bandon Marsh Unit
Throughout the life of the CCP, provide visitors of all ages and different abilities with a variety of safe and accessible opportunities at the Bandon Marsh Unit to successfully observe or photograph wildlife while limiting the impacts of wildlife and habitat disturbance. Quality wildlife observation and wildlife/nature photography programs are defined by several elements including: • Focus on major wildlife species and groups of wildlife species, including wintering waterfowl, migrating shorebirds, and other estuary-dependent wildlife • Uses appropriate facilities in order to view/photograph wildlife and their habitats • Emphasizing activities on a year-round basis • Satisfying a range of skill sets, from casual and beginning observers/photographers to more advanced observers/photographers
Strategies Applied to Achieve Objective
a. Develop a bird checklist
b. Maintain observation deck and parking lot
c. Allow unrestricted walking to observe and photograph wildlife
d. Work with Friends and partners to provide guided walks
e. Participate in and help coordinate the Annual Oregon Shorebird Festival

Rationale: Observation and photography of wildlife and nature promote public understanding and appreciation for the Refuge's natural resources. The Service will continue to allow wildlife observation and photography to occur on the Bandon Marsh Unit. At the Bandon Marsh Unit infrastructure is already in place for wildlife observation and photography. The Refuge maintains a paved parking lot that can accommodate 10 passenger vehicles or two RVs/buses. The parking lot is located on the west side of Riverside Drive. An elevated boardwalk and deck extend from the parking lot west to the edge of the marsh. There are two interpretive panels on the viewing deck. Across the Coquille River to the north, a boat launch is located at Bullards Beach State Park. This launch can be used by visitors to launch both motorized and non-motorized boats to access the refuge unit during high tides.

All refuge lands on this unit are open to observation and photography year-round; thus visitors can walk or boat, unrestricted, throughout the unit to access the best views of wildlife. Wildlife observation and photography on this unit peaks during the bi-annual migration of shorebirds from mid-April through early May and again from early August through September. During this time the unit receives approximately 10-20 visitors daily, with most visitors remaining on the viewing deck. The highest daily public use of the Bandon Marsh Unit occurs annually during the Oregon Shorebird Festival, usually held in late August, which attracts between 70 and 130 birders.

Objective 6.2 Provide high quality wildlife observation and wildlife/nature photography opportunities at the Ni-les'tun Unit

Throughout the life of the CCP, visitors of all ages and different abilities can safely access the Ni-les'tun Unit of the Refuge and are successful at observing and photographing wildlife in a variety of habitats including tidal and freshwater marsh, and Sitka spruce-western hemlock forest. Quality wildlife observation and wildlife/nature photography programs are defined by several elements including:

- Focus on major wildlife species and groups of wildlife species, including wintering waterfowl, migrating shorebirds, and other estuary-dependent wildlife
- Uses appropriate facilities in order to view/photograph wildlife and their habitats
- Emphasizing activities on a year-round basis
- Satisfying a range of skill sets, from casual and beginning observers/photographers to more advanced observers/photographers

Strategies Applied to Achieve Objective

a. Maintain the Ni-les'tun Marsh Overlook deck and elevated gravel trail that leads visitors from the parking lot to an observation point in the marsh

b. Construct a loop trail that connects the Ni-les'tun parking lot with Fahys Creek and the uplands behind the refuge office. Open year-round

c. Work with volunteers and partners to maintain trails

d. Allow unrestricted walking on the Ni-les'tun Unit daily during from February through September

e. Work with Friends and partners provide guided walks

Rationale: Observation and photography of wildlife and nature promote public understanding and appreciation for the Refuge's natural resources. At the Ni-les'tun Unit the Refuge has infrastructure in place for visitors to engage in wildlife observation and photography. Current facilities include a public parking lot, a short graveled trail that leads out into the marsh and a viewing deck with a series of five interpretive panels.

However, the Service will add additional public use facilities to increase and/or enhance these uses. The Service will construct a loop trail and boardwalk that connects the Ni-les'tun parking lot with Fahys Creek and the uplands north of the refuge office. The loop trail will be open to observation, photography, and interpretation year-round during daylight hours. These recreational activities will be largely self-guided; visitors will be required to remain on the designated trail. At times, users engaged in these activities will be accompanied by refuge staff and/or trained volunteers (i.e., tours conducted during special events, school groups). The Service will also open the Ni-les'tun Unit south of North Bank Lane to unrestricted walking to allow visitors to engage in wildlife observation and photography. The entire unit, with the exception of the Smith Tract residential and administrative area, will be open to these uses during daylight hours from February 1 through September 30. To avoid conflicts between visitors participating in waterfowl hunting and those engaged in wildlife observation or photography, the Ni-les'tun Unit will be closed to unrestricted walking from October 1 through January 31 annually, which coincides with the waterfowl hunting season. However, the viewing deck and marsh trail will remain open to these uses daily throughout the year. Due to the difficulty of walking throughout the marsh because of the presence of multiple tidal channels and downed large woody debris, the Service anticipates very little participation in wildlife observation and photography within the Ni-les'tun tidal marsh area. The closure of the unit to all uses on non-hunting days during the waterfowl hunt season will allow the Refuge to monitor and determine the areas of most value to waterfowl within this still-evolving restored marsh. After five years of monitoring, we will reevaluate the intermittent program and if warranted, we will consider additional wildlife observation access.

2.4.7 Goal 7: In cooperation with our friends and partners, offer scientifically based environmental education and place-based interpretation for all ages that advances a connection with and an appreciation of fish and wildlife that use tidal and freshwater marshes.

Objective 7.1 Provide high quality environmental education opportunities for children and adults.
Throughout the life of the CCP, provide quality hands-on environmental education programs to community groups and schools with an emphasis on the themes of wetland restoration, shorebird and waterfowl ecology, Native American culture, climate change and the salmon life cycle. In addition, a high quality environmental education program at Bandon Marsh NWR will also include the following attributes: • Enjoyable, hands-on, outdoor learning • Appeal to a broad range of learning styles and provide interdisciplinary opportunities that link natural resources through multiple academic subject areas • Be conducted to minimize impacts to fish, wildlife, plants, and their habitats; other compatible public uses; and refuge management programs and facilities • Be directly linked to wildlife observation and interpretation programs
Strategies Applied to Achieve Objective
a. Offering the Shorebird Sister Schools Program to 4th & 5th graders in Coos County
b. Use interns to serve as environmental educators

c. Collaborate with partners to enhance EE opportunities, develop curriculum, and to ensure refuge programming is unique and does not conflict with other programming in the county
d. Work with SEA and Free Flight Wildlife Rehabilitation Center to develop and implement a bird of prey curriculum for all ages
e. Develop and offer citizen science projects for high school students in Coos County
f. Work with SEA to develop an environmental education center on the Anaflor Smith Tract
g. Hire a full-time permanent Environmental Education Specialist
h. Recruit, train and utilize volunteers to assist with delivery of on-site environmental education programs
Rationale: Environmental education plays a key role in encouraging current and future generations to engage in environmentally responsible behavior like supporting the protection of habitat for wildlife through the National Wildlife Refuge System. Currently the Refuge offers one formal environmental education program, the Shorebird Sister Schools Program, but there is demand for additional programming covering different themes and topics. By partnering with SEA (see rationale for Objective 7.2 for a description of SEA's history and role), Free Flight Wildlife Rehabilitation Center and others to develop and implement refuge-based curriculum for all ages the Refuge will be able to reach more students and community groups with a goal of developing an aware and environmentally literate citizenry. The current environmental education program promotes an understanding of the importance of shorebirds, the need for quality wetland habitat, and the role the USFWS plays in managing and protecting their habitat. The program, called the Shorebird Sister Schools Program, targets students in grades 4-6. Annually, the program's teachers, interns, and volunteers reach approximately 700 students from schools in three coastal counties. The field component of the five-week program brings students to Bandon Marsh NWR or other estuaries, where the students (~ 75) spend two hours rotating through three field experience stations. The Refuge will continue the Shorebird Sister Schools Program, including bringing students to the Bandon Marsh Unit to view shorebirds. The Refuge will also develop citizen science projects for high school students in Coos County and when possible work with students in other grades to promote hands-on learning and an understanding and appreciation for the Refuge's natural resources. The Service will require advance reservations for all groups participating in environmental education, and all groups will be instructed on refuge etiquette and ways to reduce wildlife and habitat disturbance.

Objective 7.2 Provide high quality interpretive opportunities
Throughout the life of the CCP, provide visitors with opportunities for self-guided and refuge-led interpretation at Bandon Marsh NWR. A high quality interpretive program will consist of the following features: • Emphasizes learning about shorebirds, salmonids, cultural resources, and habitat restoration • Emphasizes non-guided activities but also periodic guided programs
Strategies Applied to Achieve Objective
a. Maintain interpretive panels at the Bandon Marsh Unit
b. Maintain interpretive panels at the Ni-les'tun Unit
c. Develop additional interpretive panels for the marsh/forest boardwalk trail

d. Determine feasibility of offering seasonally guided paddle trips along the Coquille River adjacent to Bandon Marsh NWR
e. Partner with OPRD to offer campground programs that focus on refuge resources
f. Recruit and train volunteers to assist with delivery of campground programs
g. Hire a permanent, full-time Volunteer Coordinator & Interpreter
h. Work with SEA to expand their role in interpretation at Bandon Marsh NWR
Rationale: Interpretation is identified as one of the priority public uses of the National Wildlife Refuge System. Interpretation will be used at Bandon Marsh NWR as a way to provide information, either through a self-guided experience or one that is led by refuge staff, to visitors about shorebirds, salmon, cultural resources, and habitat restoration with an ultimate goal of enhancing their appreciation, understanding, and enjoyment of the Refuge's natural resources. Interpretation will also be used to help in visitor management by sharing refuge rules and regulations in a manner that encourages visitors to care for the Refuge and its wildlife. A successful interpretive program depends on the help of volunteers and partnerships. They are key components of the successful management of refuge lands and are vital to refuge biological and public use programs and projects. This is especially true in times of static or declining budgets. Currently the Refuge makes extensive use of volunteers in public use programs and to a lesser degree in habitat management and biological inventory and monitoring. In the future, successful implementation of environmental education and interpretation programs will require the use of partnerships, including expanding work with the refuge friends group and recruiting more volunteers. Thus it is important that the Refuge have a volunteer coordinator on staff to manage these critical partnerships. The Friends of Southern Oregon Coastal Refuges is an official National Wildlife Refuge friends group to both Bandon Marsh and Oregon Islands National Wildlife Refuges. The group officially goes by the name Shoreline Education for Awareness (SEA). SEA currently has over 100 members. SEA projects have included assisting with management of the volunteer program for the South Coast Refuge Office, providing financial and volunteer support to the Raptors in the Classroom program, providing support to the Shorebird Sister Schools Program, providing seasonal interpretation for Oregon Islands NWR, holding special events, giving presentations to community groups and state parks, co-sponsoring a regional Friends Conference, serving as treasurer for the Oregon Shorebird Festival, and applying for grants to expand the refuge volunteer and EE programs. In the future the Service will continue to support the efforts of SEA and work to expand their role in the interpretive program.

2.4.8 Goal 8: Provide and manage safe, enjoyable, and high quality hunting and fishing opportunities for people of all ages that furthers the tradition of wildlife conservation and stewardship.

Objective 8.1 Provide opportunities for quality waterfowl hunting on the Bandon Marsh Unit
Throughout the life of the CCP, provide an opportunity for waterfowl hunters to hunt geese, a variety ducks, and coots on 256 acres while minimizing impacts to other wildlife, and other recreational users. Provide a quality, safe waterfowl hunt program that: • Places a priority on safety • Includes clear and concise regulations and makes them readily available.

• Poses minimal conflict with wildlife and habitat objectives • Poses minimal conflict with other priority public use activities • Poses minimal conflict with neighboring lands
Strategies Applied to Achieve Objective
a. Allow hunting, via boat or walk-in, seven days per week in accordance with ODFW hunting regulations
b. Work with partners to participate in waterfowl hunting workshops
c. Conduct outreach that provides hunters with information on refuge-specific, state and national hunting regulations
d. Develop an informational tear sheet on the rules and regulations of waterfowl hunting at Bandon Marsh NWR
e. Hire one full-time permanent Law Enforcement Officer
f. Conduct law enforcement patrols on a regular basis to ensure compliance with state and federal waterfowl hunting regulations
Rationale: Hunting is identified as a priority public use by the NWRS Improvement Act because it promotes appreciation for and conservation of natural resources. Public waterfowl hunting opportunities in the area surrounding Bandon Marsh NWR and in the Coquille River Valley are extremely limited, with the Bandon Marsh Unit representing the only public land open to hunting. Private lands offer waterfowl hunting opportunities in the area but only to those who are granted permission and/or those willing and able to purchase hunting rights or leases. There is a demand for public hunting in the Coquille River Valley and Estuary, especially in areas that have walk-in access and do not require the use of a boat. The Service will continue to allow the hunting of waterfowl, defined here as geese, ducks, and coots. Hunting will be permitted in accordance with State and Federal regulations and seasons. Waterfowl hunting will continue to be allowed seven days per week on the 256 acre Bandon Marsh Unit on refuge lands that fall outside of Bandon city limits. Access to refuge lands for hunting will be allowed from one hour before sunrise to one hour after sunset. The use of lead ammunition to hunt waterfowl has been banned in the United States since 1991. In addition, Oregon State gamebird regulations state that the possession and use of shot other than federally-approved nontoxic shot is always prohibited while hunting waterfowl. For the Bandon Marsh Unit hunters will access the area by using the paved public parking lot associated with this unit located on the west side of Riverside Drive. The public may also access the Bandon Marsh Unit by boat during higher tides from the Coquille River. There are two boat launches nearby that hunters occasionally use to launch their watercraft.

Objective 8.2 Provide opportunities for quality waterfowl hunting on the Ni-les'tun Unit
Throughout the life of the CCP, increase opportunities for duck hunters to hunt geese, ducks, and coots on 299 acres. A quality, safe hunting program on the Ni-les'tun Unit is described by the same elements as in Objective 8.1.
Strategies Applied to Achieve Objective
a. Prepare waterfowl hunt plan and opening package for the Ni-les'tun Unit
b. Open a portion of the Ni-les'tun Unit to hunting three days per week in accordance with ODFW hunting regulations

c. Provide hunters with walk-in or boat access
d. Develop an informational tear sheet on the rules and regulations of waterfowl hunting at Bandon Marsh NWR
e. Conduct law enforcement patrols on a regular basis to ensure compliance with state and federal waterfowl hunting regulations
f. Develop a parking lot to accommodate 3-4 vehicles along North Bank Lane at the NE corner of the Coquille River RV Park
g. Develop and sign a boat parking area along the Coquille River bank
Rationale: Hunting is identified as a priority public use by the NWRS Improvement Act because it promotes appreciation for and conservation of natural resources. During the public scoping process there were many requests to allow waterfowl hunting on this unit of the Refuge. There are limited waterfowl hunting opportunities on the Oregon Coast, and there was specific interest in having walk-in opportunities for hunters without boats. The Service will expand waterfowl hunting, with specific conditions, on Bandon Marsh NWR to include the Ni-les'tun Unit. Hunting will be permitted in accordance with State and Federal regulations and seasons. Hunters will be allowed to hunt geese, ducks, and coots within 299 acres of the 400-acre Ni-les'tun Unit tidal marsh (Figure 2-1) 3 days per week. The established days for hunting on the Ni-les'tun Unit will be Wednesday, Saturday, and Sunday. Access to refuge lands for hunting will be allowed from one hour before sunrise to one hour after sunset. The use of lead ammunition to hunt waterfowl has been banned in the United States since 1991. In addition, Oregon State gamebird regulations state that the possession and use of shot other than federally-approved nontoxic shot is always prohibited while hunting waterfowl. For the Ni-les'tun Unit, hunters can either use the two boat launches mentioned previously, the boat launch at Rocky Point or they can use the refuge parking lot located on North Bank Lane across from the refuge office until the parking lot further west is developed. Near the northeast corner of the Coquille River RV Park, the Refuge will construct a small graveled parking area to accommodate three to four vehicles and this will serve as the hunter walk in access site when completed. All boats will be required to abide by "no wake" within refuge waters. Boats parking on the riverbank of the Coquille River will be required to park within a designated location.

Objective 8.3 Provide opportunities for quality fishing and clamming
Throughout the life of the CCP, provide opportunities for visitors to dig for clams and fish from refuge lands in accordance with state and refuge fishing regulations, while minimizing impacts to other resources. Provide a quality fishing program that: • Includes clear and concise regulations that are readily available • Poses minimal conflict with wildlife and habitat objectives • Poses minimal conflict with other priority public use activities
Strategies Applied to Achieve Objective
a. Work with partners to offer programs to anglers that increase their understanding of the importance of estuarine habitat to juvenile salmonids
b. Allow fishing on the Bandon Marsh Unit in accordance with ODFW fishing regulations
c. Allow clamming on the Bandon Marsh Unit in accordance with ODFW shellfishing regulations and subject to ODA and ODFW shellfish safety closures

d. Prepare fishing plan and opening package for tidal portions of Fahys, No Name, and Redd Creeks on the Ni-les'tun Unit
e. Allow artificial fly and lure fishing for cutthroat trout only, in accordance with refuge and ODFW regulations regarding allowable methods, on the tidal portions of Fahys, No Name, and Redd Creeks on the Ni-les'tun Unit
f. Attend angler and outdoor sport enthusiasts' venues to present information on the importance of estuarine habitat and restoration for juvenile salmonids
g. Conduct law enforcement patrols on a regular basis to ensure compliance with state and federal fishing regulations
h. Develop a parking lot to accommodate 3-4 vehicles along North Bank Lane at the northeast corner of the Coquille River RV Park (also see Objective 8.2)
Rationale: Fishing is identified as a priority public use, and it is a popular visitor activity that occurs at many locations along the Oregon coast. The Service will continue to allow recreational fishing and clamming on the Bandon Marsh Unit (Figure 2-1). The continuation of allowing fishing within the Bandon Marsh Unit along the southern bank of the Coquille River provides an opportunity for people who do not own or have access to a boat. In addition, the Service will open a portion of the Ni-les'tun Unit to coastal cutthroat trout fishing with artificial lures only. Opening this area to cutthroat trout fishing, by boat or on foot, provides a wildlife-dependent form of recreation to all age groups and additionally provides an opportunity for people who do not own or have access to a boat. All recreational fishing and clamming will be permitted in accordance with State, Federal, and refuge-specific regulations and seasons to ensure that it does not interfere with the conservation of fish and wildlife and their habitats, or conflict with other public use activities. On the Bandon Marsh Unit two types of recreational fishing occur: fishing and clamming. Fishing for riverine fishes (e.g., salmonids, surfperch, sturgeon) is allowed along the Coquille River on the Bandon Marsh Unit. Anglers will be permitted to use pole and line or rod and reel while fishing, and in accordance with ODFW regulations for fishing in bays and tidelands. Anglers will be allowed to use either bait or artificial lures. As used here, the term clamming encompasses the harvest of clams as well as the harvest of shrimp and other marine invertebrates for bait. Softshell clams can be harvested by digging with a hand shovel or using a clam gun (i.e., aluminum or PVC piped suction device). The entire mudflat habitat within the Bandon Marsh Unit is open to clamming under ODFW sport fishing regulations. If the Service is notified by the Oregon Department of Agriculture (ODA) and ODFW of a shellfish safety closure or contaminant issue that threatens human health, the Refuge will take corrective action (e.g., closure of fishing/hunting). The locations where fishing and clamming are allowed on the Unit are not on designated trails; reaching these areas requires users to walk across mudflats, over tidal creeks with large woody debris or driftwood, or along the narrow edge of the Coquille River. All of these estuary and riverine habitats are affected by tidal waters which limit access and availability of mudflat habitat for clamming. Anglers can access fishing areas of the Bandon Marsh Unit by using the paved public parking lot associated with this unit located on the west side of Riverside Drive. Anglers may also access the Unit by boat during higher tides from the Coquille River.

The Service will allow fishing for cutthroat trout in the tidal creeks south of North Bank Lane within the Ni-les'tun Unit (Figure 2-1). The waters within Redd, No Name, and Fahys Creeks will be open to cutthroat trout fishing. The season for cutthroat trout fishing will coincide with ODFW's season for trout fishing, which typically begins the last weekend in May. The season on the Refuge will end on September 30 to avoid conflicts with the waterfowl hunting season, which begins in early October and continues through January.

Fishing access to these tidally influenced creeks south of North Bank Lane is limited and challenging due to tidal conditions and the presence of large woody debris or driftwood within the tidal creeks. To access fishing opportunities in the Ni-les'tun Unit, anglers can either use the boat launches at Bullards Beach, Port of Bandon, or Rocky Point, or they can use the refuge parking lot located on North Bank Lane across from the refuge office. Boats parking on the riverbank of the Coquille River will be required to park within a designated location. In addition, a small graveled parking area will be developed on refuge lands adjacent to North Bank Lane near the western edge of the Ni-les'tun Unit and will accommodate three to four vehicles for walk in access to Fahys Creek.

2.4.9 Goal 9: Provide facilities and materials that welcome and orient children and adults to the natural wonders of the fish and wildlife that use tidal and freshwater marshes, Sitka spruce forest, and riparian habitats.

Objective 9.1 Provide facilities that welcome and orient visitors
Throughout the life of the CCP, provide an integrated set of welcome and orientation facilities for visitors to: • Feel welcomed • Easily find accurate, timely, and appropriate orientation materials and information • Be aware of their options (available activities and experiences, where and when to go, how to get there, etc.) • Safely pursue self-guided activities
Strategies Applied to Achieve Objective
a. Remove or remodel current office and replace with a small administrative office/visitor contact station with multi-purpose and environmental education rooms
b. Participate in a community based visitor center within the city of Bandon through the development and maintenance of refuge-themed interpretive panels, exhibits and brochures
c. Build a 15 space parking lot by administrative office/visitor contact station to accommodate staff and visitors
d. Maintain existing maintenance shop with office
e. Maintain the two existing RV pads for refuge volunteers
f. Maintain refuge bunkhouse for use by staff, interns, volunteers, partners and researchers
g. Continue to provide SEA with office and storage space
h. Maintain existing 14 space parking lot by the Ni-les'tun Overlook
i. Add two additional RV sites for volunteers on the Smith Tract where the current residence is located
j. Replace current residence on Smith Tract with a small bunkhouse/office for friends group and

locate it on higher ground
k. Utilize habitat-appropriate native plants for landscaping around buildings, kiosks and other public use facilities
Rationale: As described in the Oregon State Parks Regional Interpretive Framework (OPRD 2005), the Oregon Coast is considered one of the world's most stunning landscapes. It features dramatic rocky shoreline, historic lighthouses, endless beaches, quaint seaside towns, and scenic bridges. The U.S. Highway 101 National Scenic Byway follows the shoreline and is the main route used by visitors who come to the coast from Portland and other inland population centers including Corvallis, Eugene, Roseburg, Medford, and Grants Pass. Bandon Dunes Golf Resort also draws visitors who access the area by plane using the North Bend Airport. According to OPRD, bird watching, walking, and day hiking will be the most popular recreation activities over the next 10 years (OPRD 2008). Consequently, the USFWS is expecting visitation to the Bandon Marsh NWR to increase. Facilities to support additional and increased tourism are essential. Visitors to the Oregon Coast NWR Complex including Bandon Marsh NWR will likely stop for a couple of reasons: a short 20-minute stop made to look at a view and take a picture, or a longer, one- to three-hour, stop allowing visitors to leave the car and stretch their legs. Interpretive signs and spotting scopes may enhance observation, interpretation, and education during short stops. Visitors making longer stops may be more interested in learning about the site, taking in a short program, or taking a short walk. Short loop trails, kiosks, signs, and spotting scopes are well suited in these locations and will serve to welcome and orient visitors to the Refuge once they are constructed. The road from U.S. Highway 101 to the South Coast Office at the Ni-les'tun Unit of Bandon Marsh NWR slows visitors down and provides a good transition for those arriving at the Refuge. The current South Coast Refuge Office location is well suited to visitor facilities. The site is north of North Bank Road across from the from the Ni-les'tun tidal marsh restoration site. The restoration site has an existing visitor parking lot, overlook and trail and offers great opportunities for bird watching and environmental education. The marsh restoration was completed in 2011 and is the largest in Oregon. A second trail, connecting the parking lot to the office was also completed in 2011. The Service will remove or remodel the current office and replace it with a small administrative office/visitor contact station with multi-purpose and EE rooms. To accommodate the refuge friends group, SEA, the Service will replace the current residence on Smith Tract with a small bunkhouse/office and locate it on higher ground.

Objective 9.2 Conduct public outreach
Throughout the life of the CCP, conduct outreach to the public in an effort to: • Describe the Refuge and its place as part of the National Wildlife Refuge System • Provide current information about refuge management, biology, volunteer opportunities, public use events, and rules and regulations
Strategies Applied to Achieve Objective
a. Maintain an up-to-date brochure on the Refuge Complex
b. Partner with media outlets in Oregon to market public use opportunities on the Refuge
c. Participate in social media outreach

d. Maintain a refuge website
e. Maintain an online photo sharing database
f. Partner with non-profit conservation organizations and appropriate media outlets in Oregon to disseminate information about refuge wildlife and habitats
g. Maintain a refuge presence at community events that have high potential to deliver refuge messages to key audiences
h. Maintain a quarterly refuge newsletter
i. Evaluate the potential to develop digital trail guides for use on MP3 players and/or smartphones
Rationale: Outreach is critical in educating the public, volunteers, and partners about how refuges protect and conserve natural resources and what we are doing to provide economic benefits to communities. When people know and understand about the mission of the Service and the NWRS they are more likely to support the Refuge. Outreach can also improve visitors' awareness of regulations and policies and the reasons behind them. Our outreach efforts will focus on providing specific information about Bandon Marsh NWR including important news and events, and outreach will be used as a means of building an online community of support for the Oregon coast refuges. Specific examples of outreach will involve maintaining a refuge website and utilizing social media to advertise volunteer opportunities, announce interpretative and environmental education events, relate news releases, distribute the refuge newsletter, share photos and videos, and provide an engaging view of what employees and volunteers do for the U.S. Fish and Wildlife Service's Oregon Coast NWR Complex.

Objective 9.3 Continue partnership with Refuge Friends Group
Throughout the life of the CCP, strengthen the partnership with the refuge friends group Shoreline Education for Awareness (SEA).
Strategies Applied to Achieve Objective
a. Continue to support SEA and provide technical support to them regarding refuge policies, regulations and needs
b. Every five years, review and if necessary revise the MOA between the Service and SEA
c. In conjunction with the friends group, develop habitat related projects that support refuge public use, monitoring, research and maintenance needs
d. Dedicate a refuge staff member to serve as the liaison between the friends group and the Refuge, including attendance at friends group board meetings
e. Work with friends group to recruit volunteers to conduct monitoring projects on the Refuge
f. Work with SEA to expand their role in communicating with visitors about refuge policies and wildlife resources
g. Work with friends group and volunteers to assist with maintenance of public use facilities and trails
Rationale: In the past 15 years a network of groups, called Friends, have adopted individual refuges or refuge complexes and have begun to advocate for the needs of the refuges by providing both financial and volunteer support. Support of friends groups and extensive use of volunteers are recognized as key components of the successful management of public lands and are vital to implementation of refuge wildlife and habitat programs. During these times of declining budgets, the National Wildlife Refuge System faces a growing shortage of staff, and in many cases funding for key conservation programs has been reduced.

Shoreline Education for Awareness, Inc. or SEA was founded in Bandon, Oregon in 1990, and it has been an all-volunteer organization supported by membership dues and donations received while interpreting the marine environment for visitors. In 2005, SEA entered into an MOA with the Complex to make SEA an official refuge Friends Group known as the Friends of the Southern Oregon Coast Refuges (Bandon Marsh and Oregon Islands NWRs). The MOA formalized the relationship between the Refuge Complex and SEA and facilitated open communication between both. It is important for the Complex to continue to support SEA as they play a critical role in providing volunteer interpretive support for the Refuge and are an advocate for protecting refuge wildlife and habitat.

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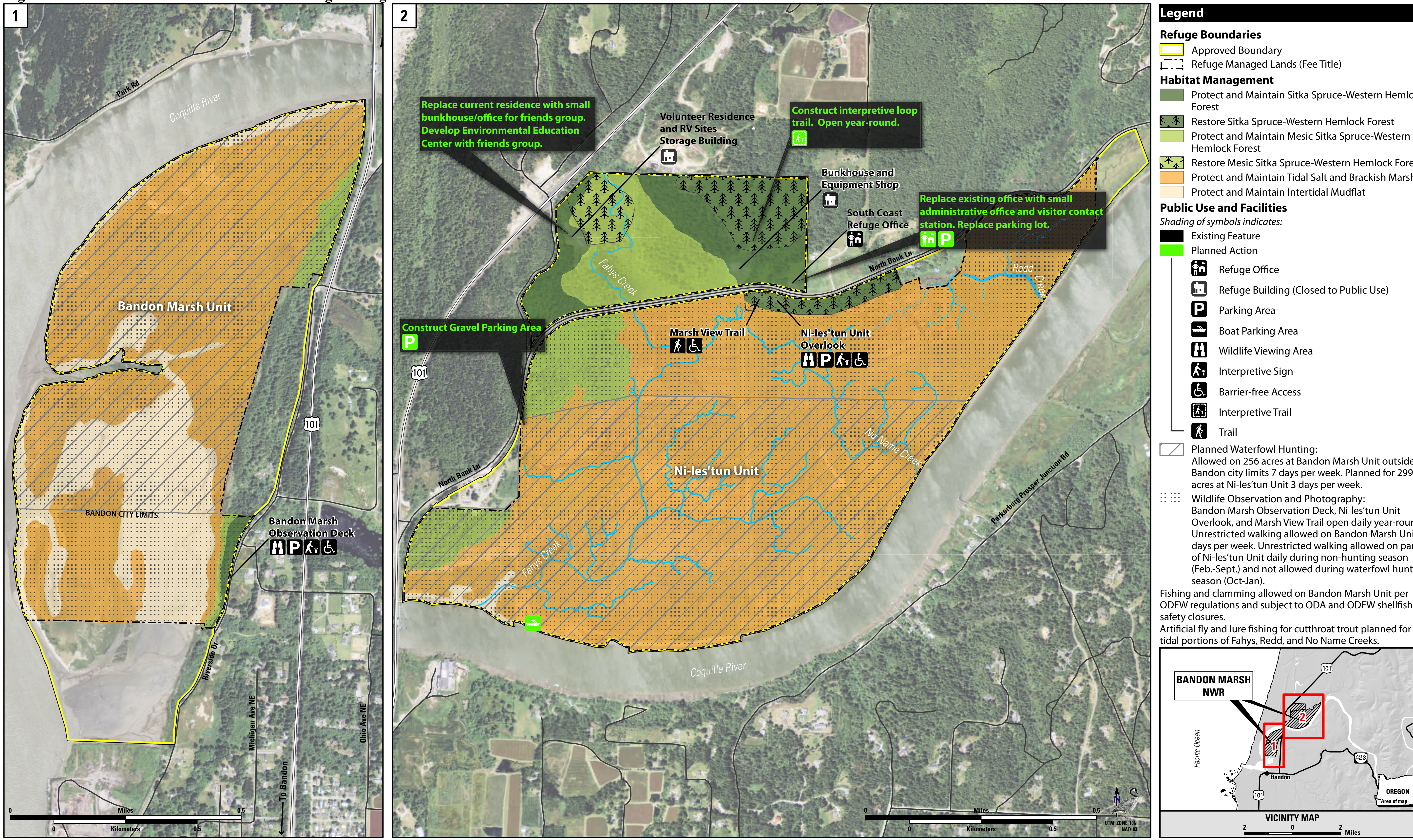
Figure 2-1. Bandon Marsh National Wildlife Refuge management direction.



Data Sources: Refuge Boundaries from USFWS/R1; Roads from ESRI; Imagery from 2012 NAIP

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Chapter 3
Physical Environment

Roy W. Lowe/USFWS

Chapter 3. Physical Environment

3.1 Climate and Climate Change

3.1.1 General Climate Conditions

The climate at Bandon Marsh National Wildlife Refuge (NWR) is greatly influenced by the Pacific Ocean on the west and the Coast Range to the east. The Coast Range rises between 2,000 and 3,000 feet (610-914 meters) above sea level in the north and between 3,000 and 4,000 feet (914-1,219 meters) in the southwestern portion of the state with occasional mountain peaks rising an additional 1,000 to 1,500 feet (305-457 meters). The southern Oregon coastal zone is characterized by wet winters, relatively dry summers, and mild temperatures throughout the year. Because of the moderating influence of the Pacific Ocean, extremely high or low temperatures are rare and the annual temperature range is lower here than in any other Oregon climate zone. Precipitation is heavier and more persistent during the winter but regular moisture occurs from rain and fog throughout the year (WRCC 2011a). The area's heavy precipitation during winter results from moist air masses moving from the Pacific Ocean onto land. The lower elevations along the coast receive annual precipitation of 65 to 90 inches (165-229 centimeters), which can cause flood events if abundant rainfall is consistent for several days. Occasional strong winds (50-70 mph) occur along the coast, usually in advance of winter storms. Wind speeds have been recorded to exceed hurricane force and have caused substantial damage to structures and vegetation in exposed coastal locations (Taylor and Hannan 1999, Taylor 2008). Skies are usually cloudy in the winter during the frequent storms and clear to partly cloudy during summer, with localized fog along the coastline. As a result of persistent cloudiness, total solar radiation is lower along the coast than in any other region of the state.

Climate Change Trends

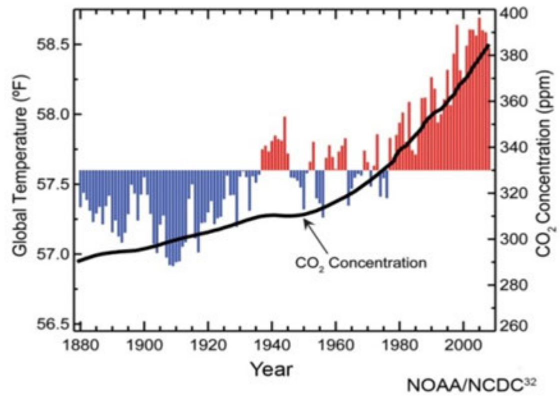
The greenhouse effect is a natural phenomenon that assists in regulating and warming the temperature of our planet. Just as a glass ceiling traps heat inside a greenhouse, certain gases in the atmosphere, called greenhouse gases (GHG), absorb and emit infrared radiation from sunlight. The primary greenhouse gases occurring in the atmosphere include carbon dioxide (CO_2), water vapor, methane, and nitrous oxide. CO_2 is produced in the largest quantities, accounting for more than half of the current impact on the Earth's climate.

A growing body of scientific evidence has emerged to support the fact that the Earth's climate has been rapidly changing during the 20th century and the magnitude of these alterations is largely due to human activities (IPCC 2007a, NAS 2008, USGCRP 2009). Increasingly, the role of human activities in the concentrations of heat-trapping greenhouse gases have increased significantly over the last several hundred years due to human activities such as deforestation and the burning of fossil fuels (Ibid).

Although climate variations are well documented in the Earth's history, even in relatively recent geologic time (e.g., the Ice Age of 10,000 years ago), the current warming trend differs from shifts earlier in geologic time in two ways. First, this climate change appears to be driven primarily by human activity which results in a higher concentration of atmospheric GHG. Second, atmospheric CO_2 and other greenhouse gases, levels of which are strongly correlated with Earth temperature, are now higher than at any time during the last 800,000 years (USGCRP 2009). Prior to the start of the

Industrial Revolution in 1750, the amount of CO_2 in the atmosphere was about 280 parts per million (ppm). Current levels are about 390 ppm and are increasing at a rate of about 2 ppm/year (DOE 2012). The current concentration of CO_2 and other greenhouse gases as well as the rapid rate of increase in recent decades are unprecedented in the prehistoric record (Ibid).

Figure 3-1. Global annual average temperature and CO_2 from 1880-2008 (NOAA 2012).



Global annual average temperature (as measured over both land and oceans). Red bars indicate temperatures above and blue bars indicate temperatures below the average temperature for the period 1901-2000. The black line shows atmospheric carbon dioxide (CO_2) concentration in parts per million (ppm). While there is a clear long-term global warming trend, each individual year does not show a temperature increase relative to the previous year, and some years show greater changes than others.[33] These year-to-year fluctuations in temperature are due to natural processes, such as the effects of El Niños, La Niñas, and the eruption of large volcanoes.

The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007b). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (Ibid).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s (Figure 3-1). Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions (e.g., IPCC 2007b and Solomon et al. 2007). In the Pacific Northwest, increased greenhouse gases and warmer temperatures have resulted in a number of physical and chemical impacts. These include changes in snowpack, stream flow timing and volume, flooding and landslides, sea levels, ocean temperatures and acidity, and disturbance regimes such as wildfires, insect, and disease outbreaks (USGCRP 2009). All of these changes will cause major perturbations to ecosystem conditions, possibly imperiling species that evolved in response to local conditions.

Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is "very likely" (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007b, Solomon et al. 2007). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011), who concluded that it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

In the Northern Hemisphere, recent decades appear to be the warmest since at least about A.D. 1000, and the warming since the late 19th century is unprecedented over the last 1000 years. Globally, including 2011, all 11 years in the 21st century so far (2001 to 2011) rank among the 13 warmest years in the 130-year instrumental record (1880 to present) according to independent analyses by NOAA and NASA. 2010 and 2005 are tied as the warmest years in the instrumental record and the new 2010 record is particularly noteworthy because it occurred in the presence of a La Niña and a period of low solar activity, two factors that have a cooling influence on the planet. However, in general, decadal trends are far more important than any particular year's ranking.

Trends in global precipitation are more difficult to detect than changes in temperature because precipitation is generally more variable and subject to local topography. However, while there is not an overall trend in precipitation for the globe, significant changes at regional scales can be found. Over the last century, there have been increases in annual precipitation in the higher latitudes of both hemispheres and decreases in the tropical regions of Africa and southern Asia (USGCRP 2009). Most of the increases have occurred in the first half of the 20th century and it is not clear that this trend is due to increasing greenhouse gas concentrations.

Just as important as precipitation totals are changes in the intensity, frequency, and type of precipitation. Warmer climates, owing to increased water vapor, lead to more intense precipitation events, including more snowstorms and possibly more flooding, even with no change in total precipitation (Dominguez et al. 2012). The frequency of extreme single-day precipitation events has increased, especially in the last two decades. Paradoxically more droughts and heat waves have occurred because of hotter, longer-lasting high pressure systems.

3.1.2 Air Temperatures

As a result of the ocean's proximity, winter minimum and summer maximum temperatures along the coast are moderated. It is rare for Bandon Marsh NWR to experience temperatures below freezing. No days are on record with temperatures at or below 0°F. Also, it is only in the extreme occurrences that temperatures have been recorded to exceed 90°F (WRCC 2011b).

There is no climate/weather station established on Bandon Marsh NWR; however, temperature data have been consistently collected since June 1897 at the Bandon 2 NNE station (number 350471) located less than a mile west from the Refuge at Bullards Beach State Park. Table 3-1 provides a summary of the period of record.

Table 3-1. Air Temperature Summaries near Bandon Marsh NWR (WRCC 2011b)

Temperatures (°F)	**Bandon 2 NNE June 1897 – Sept. 2010**
Average Monthly Temperature – High	60.1
Average Monthly Temperature – Low	43.9
Monthly Mean Winter Temperature – High	54.2
Monthly Mean Winter Temperature – Low	39
Monthly Mean Summer Temperature – High	65.7
Monthly Mean Summer Temperature – Low	49.9
Daily Maximum Extreme – High	100
Daily Maximum Extreme – Low	75
Daily Minimum Extreme – High	37
Daily Minimum Extreme – Low	8

Mote (2003) observed that the Pacific Northwest region experienced warming of approximately 1.5°F during the 20th century. For trends local to the Refuge we turn to the United States Historical Climatology Network (USHCN) which provides a high-quality data set of daily and monthly records of basic meteorological variables from 1,218 observing stations throughout the continental U.S. The data have been corrected to remove biases or heterogeneities from non-climatic effects such as urbanization or other landscape changes, station moves, and instrument and time of observation changes. The closest station is North Bend and trends are provided in Table 3-2 and Figures 3-2 through 3-4 below. The average yearly temperature change has increased 0.51°F over the past 30 years, and more striking are the seasonal trends which show warmer winters and summer than the yearly trends, and cooler springs (Table 3-2).

Table 3-2. Seasonal Temperature Trends, 1981-2010 (USHCN 2012)

North Bend, Oregon United States Historical Climatology Network Observation Station			
Monthly Absolute Change	**Maximum Temp.**	**Average Temp.**	**Minimum Temp.**
Winter (Dec-Feb)	+1.18°F	+1.05°F	+0.93°F
Spring (March-May)	-0.05°F	-0.3°F	-0.52°F
Summer (Jun-Aug)	+0.73°F	+0.68°F	+0.61°F
Fall (Sept-Nov)	+0.4°F	+0.55°F	+0.7°F

The graphs below illustrate a sample of these temperature trends using monthly data. The most recent 30-year period is calculated using the slope of the linear trendline, and temperature change is shown as an absolute change over the 30-year period. A water year is defined as the 12-month period from October 1, for any given year, through September 30 of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months.

Figure 3-2. Water year temperature 1925-2010 at North Bend, Oregon (USHCN 2012).

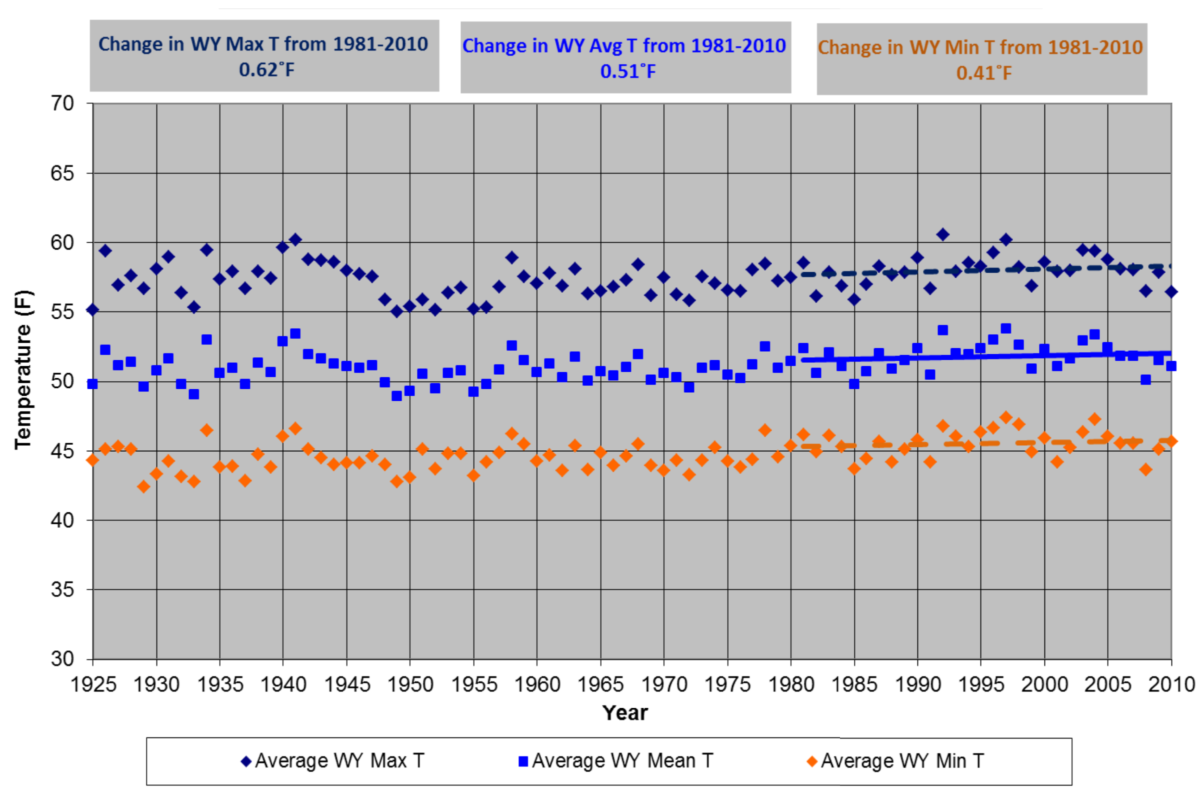


Figure 3-3. Winter (Dec-Feb) temperature 1925-2010 at North Bend, Oregon (USHCN 2012).

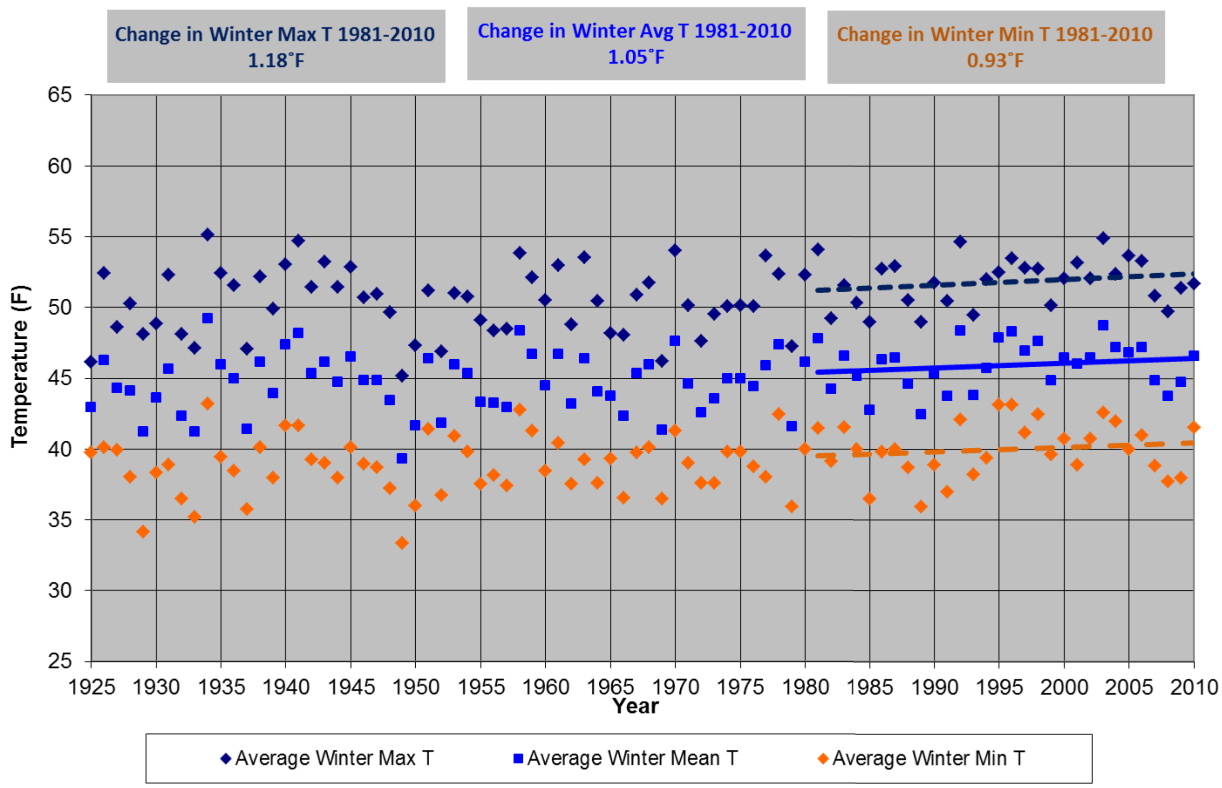
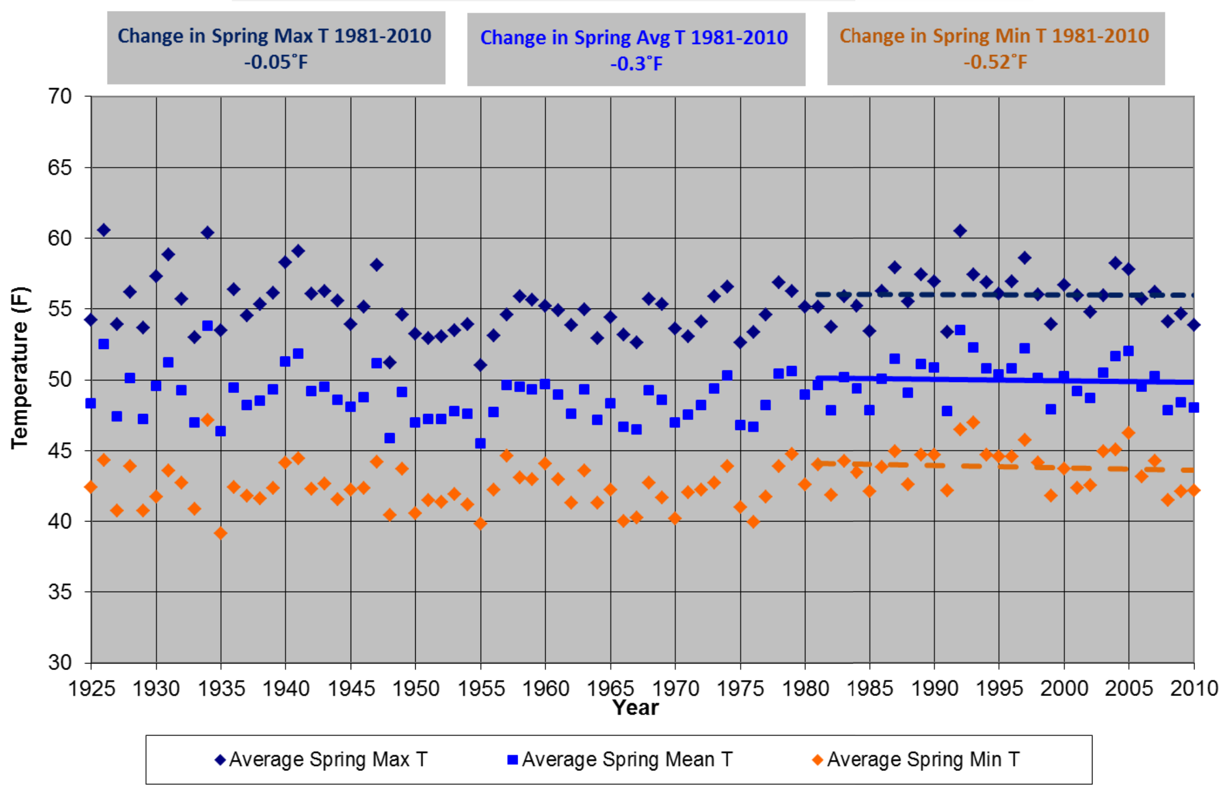


Figure 3-4. Spring (Mar-May) temperature 1925-2010 at North Bend, Oregon (USHCN 2012).



Future Trends

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (e.g., Meehl et al. 2007, Ganguly et al. 2009, Prinn et al. 2011). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007c, Meehl et al. 2007, Ganguly et al. 2009, Prinn et al. 2011).

Statistical downscaling methods first derive empirically-based relationships between coarse-scale (e.g., the altitude of the 700 hPa pressure level) and observed local (e.g., precipitation or temperature) climate variables. Predicted values of the coarse-scale variables obtained from global climate models are then used to drive the statistical relationships in order to estimate the regional and/or local scale details of future climate (see Mote and Salathé 2010 for more on downscaling methods). The statistical downscaling of 20 global climate models (Mote and Salathé, 2009 and 2010) projects average annual temperature to increase 2.0°F by the decade of the 2020s for the Pacific Northwest, 3.2°F by the decade of the 2040s, and 5.3°F by the decade of the 2080s, relative to the 1970-1999 average temperature. The projected changes in average annual temperature are substantially greater than the 1.5°F increase in average annual temperature observed in the Pacific Northwest during the 20th century. Seasonally, summer temperatures are projected to increase the most. Actual global emissions of greenhouse gases in the past decade have so far exceeded the emissions scenarios used in projections of Mote and Salathé. Consequently, if these emissions trends continue, the climate projections referenced herein likely represent a conservative estimate of future climatic changes. Figure 3-5 shows these modeled, downscaled temperature projections for the Coquille watershed (Hydrologic Unit Code 17100305) (Hamlet et al. 2010).

3.1.3 Precipitation

The discussion below concerning precipitation includes data collected from the climate station, located adjacent to the Refuge at Bullards Beach State Park (Bandon 2 NNE). Roughly 61 percent of the annual precipitation occurs during late fall and winter, in the months of November, December, January, and February. By comparison, the summer months of June, July, and August receive 4 percent of the annual precipitation with the remaining 35 percent falling in spring and early fall. On average, 38 days per year experience more than 0.50 inch of precipitation and 13 days greater than 1.00 inch (WRCC 2011c). Snow events are infrequent. Fog (water vapor condensing into tiny liquid water droplets in the air) is a common phenomenon along the Oregon coast because of contrasting differences between air, land, and ocean temperatures and humidity. Fog is common for along the Oregon south coast during the months of June and July; however, fog records were not recorded at the weather station at Bullards Beach State Park. Precipitation data for Bandon are summarized in Table 3-3.

Figure 3-5. Projected temperature changes for the Coquille Watershed under two emission scenarios. A1B is a higher emission scenario than B1. Current rates are higher than both A1B and B1. (Hamlet et al. 2010)

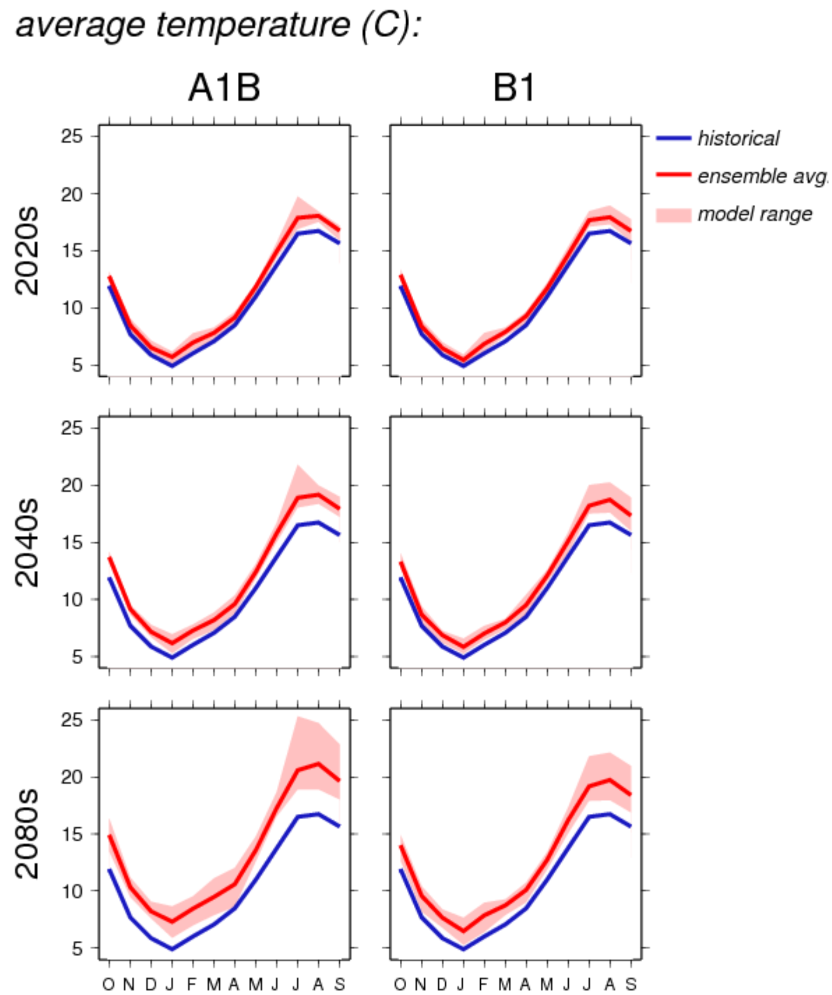


Table 3-3. Precipitation Summaries near Bandon Marsh NWR (WRCC 2011c)

Precipitation (inches)	Bandon 2 NNE June 1897 – Sept. 2010
Average Annual Precipitation	55.53
Average Annual Snowfall	0.7
Average Monthly Snowfall Range (winter)	0.1 to 0.5
Highest Annual Snowfall	18.0(1969)
Highest Monthly Snowfall	18.0 (January 1969)
Wettest Year on Record	91.00 (1996)
Driest Year on Record	32.22 (1976)
Wettest Season on Record	40.13 (winter 1982)
Driest Season on Record	0.16 (2003)

Longer-term precipitation trends in the Pacific Northwest are more variable than temperature and vary with the period of record analyzed (Mote et al. 2005). The Pacific Northwest experiences wide precipitation variability based on geography and seasonal and year-to-year variability (Salathé et al. 2010). Looking at the period 1920 to 2000, total annual precipitation has increased almost everywhere in the region, though not in a uniform fashion. Most of that increase occurred during the first part of the record with decreases more recently (Mote et al. 2005).

Precipitation trends from the North Bend USHCN observation station shows the average yearly precipitation change has decreased more than 15% over the past 30 years, with more striking decreases in the summer and fall (Table 3-4 and Figures 3-6 to 3-8).

Table 3-4. Seasonal Precipitation Trends, 1981-2010 (USHCN 2012)

North Bend, Oregon, United States Historical Climatology Network Observation Station	
Monthly Precipitation	**30-yr Change % from 1981 Value**
Winter (Dec-Feb)	-4.1%
Spring (March-May)	-15.7%
Summer (Jun-Aug)	-47.2%
Fall (Sept-Nov)	-29.3%

Figure 3-6. Water year total precipitation 1925-2010 at North Bend, Oregon (USHCN 2012).

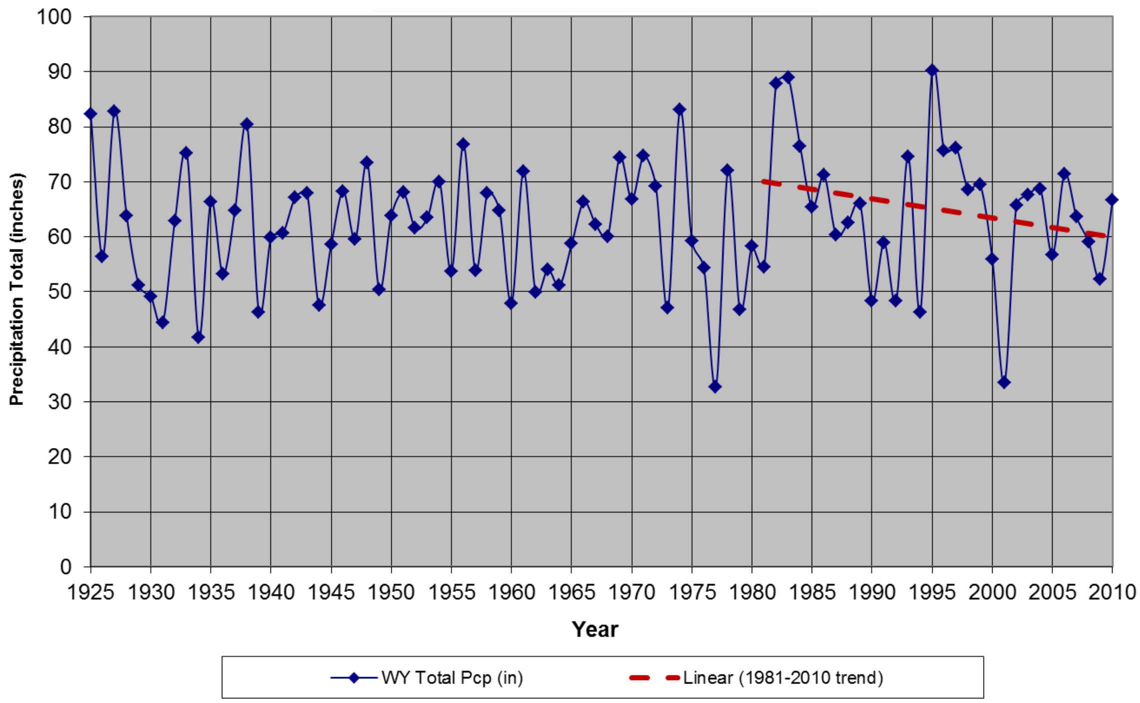


Figure 3-7. Summer (Jun-Aug) total precipitation 1925-2010 at North Bend, Oregon (USHCN 2012).

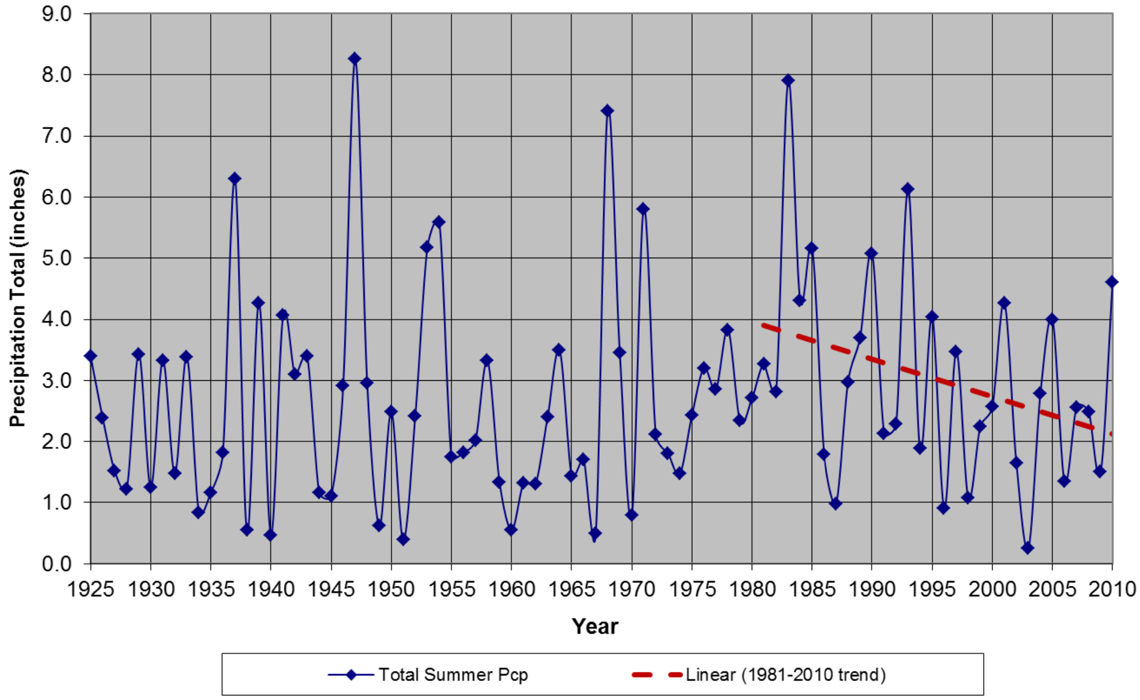
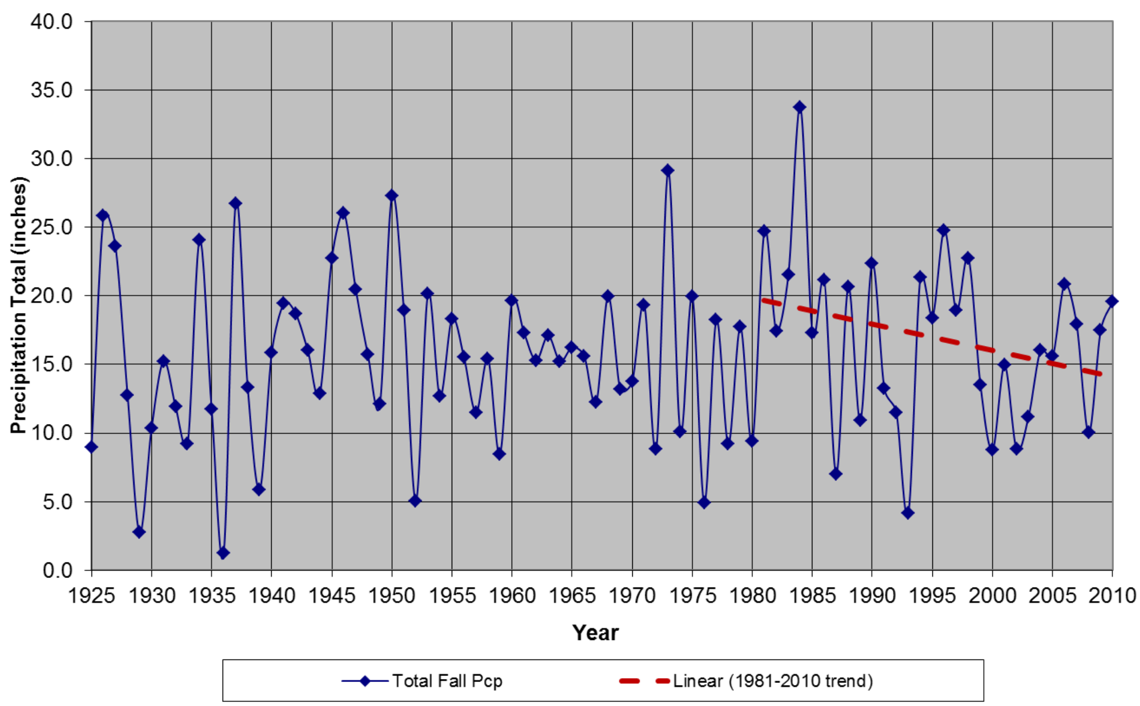


Figure 3-8. Fall (Sept-Nov) total precipitation 1925-2010 at North Bend, Oregon (USHCN 2012).



Future Trends

On a global scale, warmer temperatures are predicted to lead to a more vigorous hydrologic cycle, translating to more severe droughts and/or floods (IPCC 1996). Using data derived from the statistical downscaling of 20 global climate models, projected changes in annual precipitation within the Pacific Northwest throughout the twenty-first century, averaged over all models, are small (+1% to +2%) though individual models produce changes of as much as -10% or +20% by the 2080s. Some models project an enhanced seasonal cycle with changes toward wetter autumns and winters and drier summers (Mote and Salathé 2010). However, even small changes in seasonal precipitation could have impacts on streamflow flooding, summer water demand, drought stress, and forest fire frequency. Additionally, researchers have consistently found that regional climate model simulations yield an increase in the measures of extreme precipitation. This finding suggests that extreme precipitation changes are more related to increased moisture availability in a warmer climate than to increases in climate-mean precipitation (Leung et al. 2004, Salathé et al. 2010). It is important to note that the one conclusion shared by researchers is that there is greater uncertainty in precipitation projections than that of temperature predictions and models (Leung and Qian 2003, CIG 2004, Salathé et al. 2010). Figure 3-9 shows these modeled, downscaled precipitation projections for the Coquille watershed (Hydrologic Unit Code 17100305) (Hamlet et al. 2010).

3.1.4 Wind

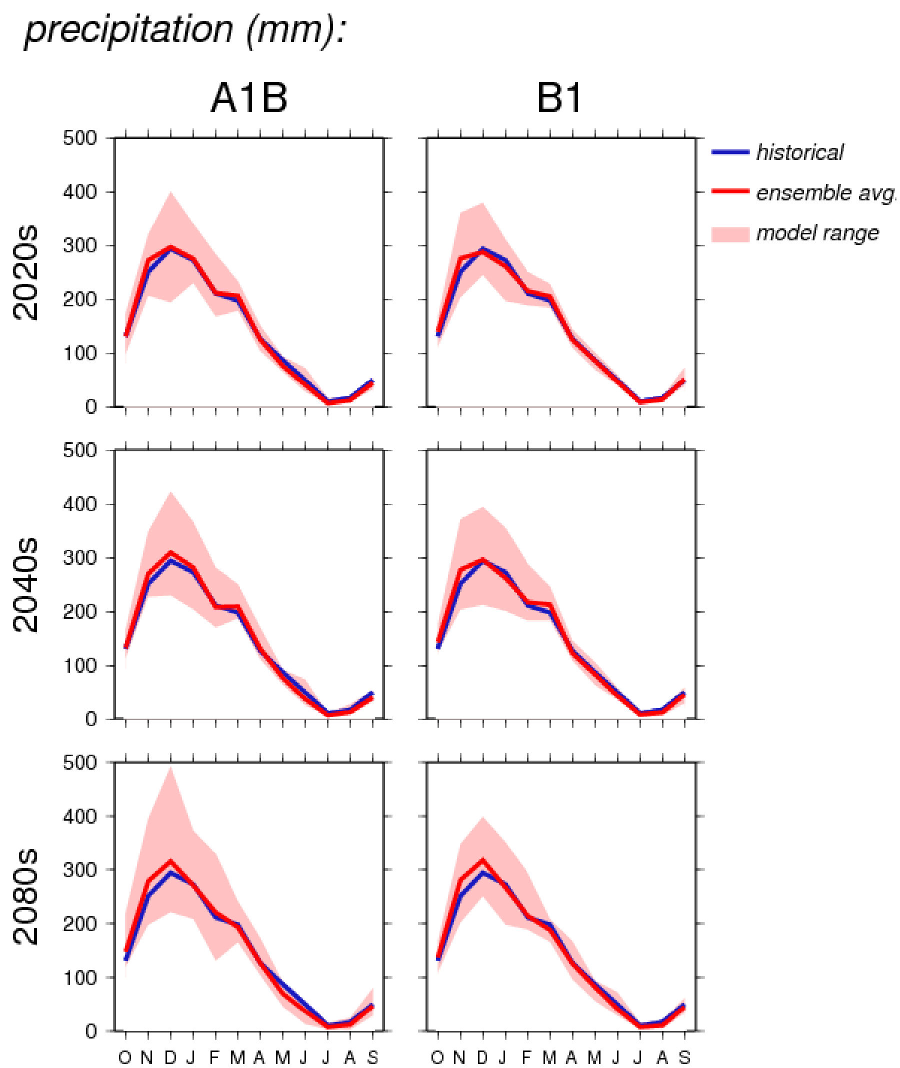
During the spring and summer, the semi-permanent low-pressure cell over the North Pacific Ocean becomes weak and moves north beyond the Aleutian Islands. Meanwhile, a high-pressure area spreads over the North Pacific Ocean. Air circulates in a clockwise direction around the high-pressure cell bringing prevailing westerly and northwesterly winds. This seasonal flow is comparatively dry, cool, and stable (WRCC 2011d).

In the fall and winter, the high-pressure cell weakens and moves southward while the Aleutian low-pressure cell intensifies and migrates southward as well (WRCC 2011d). It reaches its maximum intensity in midwinter. Wind direction switches to primarily southeasterly or easterly prevailing winds. The air mass over the ocean is moist and near the temperature of the water. As it moves inland, it cools and condenses, bringing the beginning of the wet season by the end of October (Taylor and Hannan 1999).

Wind data collected hourly from automated stations at reporting airports on the Oregon coast have been used to draw generalizations about wind activity in/on Bandon Marsh Refuge (Table 3-5). Average wind speeds have been calculated on hourly data collected from 1996 to 2006. The highest average wind speeds at Astoria and Newport occurred during the winter months of December, January, and February. At North Bend, the highest average wind speeds occurred during the summer months of June, July, and August. The calmest months at Astoria and Newport were during the late-summer/early-fall months of August, September, and October. At North Bend, the calmest months were October, November, and February.

Prevailing wind direction, or the direction with the highest percent of frequency, was calculated from hourly data during 1992 to 2002. In Astoria, easterly winds occur from October through March, switching to southerly winds in April, and then to west and northwest winds from May through September. In Newport, winds from the east occur in December through February, from the south during fall and spring, and north-northwest during the summer months. In North Bend, winds blow from the south-southeast from November to April and are northerly for the remainder of the year.

Figure 3-9. Projected precipitation changes for the Coquille Watershed under two emission scenarios. A1B is a higher emission scenario than B1. Current rates are higher than both A1B and B1. (Hamlet et al. 2010)



Several times each year, very strong winds hit the Oregon coast (Taylor and Hannan 1999). Wantz and Sinclair (1981) published estimates of extreme winds in the Northwest. They estimate that speeds along the coast sustained for an average of one minute and recurring on average every two years are as high as 56 mph, while fifty-year events would produce winds of approximately 74 mph. Peak gusts would be about 40% higher.

As a rule, Oregon does not experience hurricanes, and tornadoes are infrequent and generally small in the northwestern part of the United States. However, the National Weather Service issued a hurricane warning for the first time for the Oregon coast during an extremely powerful storm that slammed into the Pacific Northwest during December 2–4, 2007, during which winds topped out at 130 mph (209 kilometers per hour) along coastal Oregon (Read 2008). The National Climatic Data Center maintains a database that provides information on the incidence of tornadoes reported in each county in the United States. This database reports that 100 tornadoes were reported in Oregon from 1950 to 2010. No tornadoes have ever been reported in Coos County (NCDC 2011).

Table 3-5. Wind Data Summaries for Three Locations along the Oregon Coast (WRCC 2011e, WRCC 2011f)

	Astoria	Newport	North Bend
Prevailing Wind Direction	E	S	N
Average Annual Wind Speed	7.7 mph	8.8 mph	8.9 mph
Average Monthly Wind Speed Range	6.7 (Sept.) – 8.7 (Dec.) mph	6.5 (Sept.) – 11.2 (Dec.) mph	7.3 (Oct.) – 11.2 (Jul.) mph

3.1.5 Climate Cycles in the Pacific Northwest

Two climate cycles have major influences on the climate and hydrologic cycles in the Pacific Northwest: the El Niño/Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). In El Niño years, average sea surface temperatures in the central and eastern equatorial Pacific Ocean are warmer than average and easterly trade winds in the tropical Pacific are weakened. A La Niña is characterized by the opposite – cooler than average sea surface temperatures and stronger than normal easterly trade winds. These changes in the wind and ocean circulation can have global impacts to weather events. The ENSO influence on Pacific Northwest climate is strongest from October to March. During an El Niño event, the winters tend to be warmer and drier than average. La Niña winters tend to be cooler and wetter than average. Each ENSO phase typically lasts 6 to 18 months and the shift between the two conditions takes about four years (CIG 2011, Conlan and Service 2000).

Like ENSO, the PDO is characterized by changes in sea surface temperature, sea level pressure, and wind patterns. The PDO is described as being in one of two phases: warm and cool. During a warm phase, sea surface temperatures near the equator and along the coast of North America are warmer while in the central north Pacific they are cooler. During a cool phase, the patterns are opposite. Within the Pacific Northwest, warm phase PDO winters tend to be warmer and drier than average while cool phase PDO winters tend to be cooler and wetter than average. A single warm or cool PDO phase lasts 20-30 years. The triggering cause of the PDO phase shift is not understood.

The potential for temperature and precipitation extremes increases when ENSO and PDO are in the same phases and thereby reinforce each other. When ENSO and PDO are in opposite phases, their opposite effects on temperature and precipitation can cancel each other out, but not in all cases and not always in the same direction (CIG 2011).

Future Trends

Based on the evidence of the history of ENSO and PDO events, it is likely that these cycles will continue to occur far into the future. However, the potential influence of anthropogenic climate change on ENSO and PDO is unknown because more information is needed.

3.2 Hydrology

3.2.1 Refuge Hydrology

Bandon Marsh NWR is located within the Coquille River estuary, which covers approximately 5,682 acres, including diked and filled lands, and has a watershed of 1,058 square miles (Good 2000, Adamus et al. 2005). Although the watershed is large, the estuary is one of the smaller in the state for the size of its watershed and is characterized by a relatively narrow coastal plain and narrow alluvial valleys. Head of tide is about 38 miles from the mouth, the farthest inland of any of Oregon's coastal estuaries (Oregon DSL 1989). The Coquille also is one of the most extensively diked and drained estuaries of the Oregon coast, suffering a 94% loss in tidal marshes and swamps from 1870 to 1970 (Good 2000). Revised estimates by Brophy (2011) using Scranton (2004) and Hawes et al. (2008) indicate a 95% loss of tidal marsh and 93% loss of tidal swamp within the estuary.

The Bandon Marsh Unit currently consists of 307 acres of tidally influenced habitats, including salt marsh and mudflats, a narrow fringe of forested wetlands and upland forest along its east (landward) boundary, and a high marsh natural levee along its west and north boundary with the Coquille River. The entirety of the Unit is within the boundary of the 100-year floodplain (FEMA 2009a, FEMA 2009b, FEMA 2009c, FEMA 2009d). The intertidal marsh ranges from low marsh and mudflats exposed only at low tide, to high marsh inundated only at seasonally high tides combined with high river flows. Two small freshwater streams draining primarily residential and agricultural areas, Spring Creek and Simpson Creek, enter the marsh from the east. However, the hydrology is dominated by the ocean tides and the tidally influenced Coquille River, which enters the marsh via a network of tidal channels. Typically, the highest tides that cover the entire marsh occur in the winter when they combine with elevated winter river flows.

The Ni-les'tun Unit is 582 acres and bounded on the south and east by the Coquille River. The Unit consists largely of restored tidal marsh with small acreages of forested wetlands, natural tidal marsh, and riparian corridors. Except for the higher elevation areas just east of the former cranberry bogs, including the refuge administrative sites and upland pasture, the majority of the Ni-les'tun Unit lies within the boundary of the 100-year floodplain (FEMA 2009a, FEMA 2009b, FEMA 2009c, FEMA 2009d). A tidal marsh restoration project initiated in 2009 and completed in 2011 filled and removed all of the 15 miles of interior drainage ditches, constructed 5 miles of tidal channels, and removed all of the artificial river levees, tide gates, and water control structures to facilitate full tidal function of the Unit.

Four stream courses run through the Ni-les'tun Unit: Fahys Creek, Redd Creek, Blue Barn Creek, and No Name Creek. Prior to restoration, three of these creeks (Fahys, Redd, and No Name) were primary drainage ditches that dewatered the historic tidal and forested wetlands for agricultural purposes. Restoration, completed in 2011, re-connected the mouth of Fahys Creek to the Coquille River in its historical location and excavated a new north Redd Creek channel to connect the upland watershed drainage. No Name Creek was opened to tidal exchange through the removal of a tide gate. Now, No Name Creek is a tidally driven system without a true creek entering it. The fresh water input is associated with subsurface discharge from the north marine terrace.

According to a hydrogeologic characterization of the Ni-les'tun Unit performed in 2005 prior to restoration, the shallow groundwater on the Ni-les'tun Unit fluctuated between approximately 4 feet below the ground surface during late summer and early fall to 0.5 foot above the ground surface during wet winter months. The average depth to groundwater was between 1 and 2 feet below the ground surface (Kocourek 2006a). After the restoration, normal tidal regime on the site essentially matches the tidal water level on the adjacent Coquille River. The restored tidal water levels currently flood a large portion of the site daily and the entire site is flooded one or more times every month. At mean higher high water (MHHW; 7.0 feet), groundwater depths are approximately 2 feet above ground surface on the west end of the project area, and soils are saturated on the higher east end of the project area. At the high monthly tide of 8.8 feet, the entire site floods from the base of the marine terrace to the river, with the exception of the higher eastern end of the natural river levee (USFWS and FHA 2009).

Future Trends

One of the most important responses to warmer winter temperatures in the Pacific Northwest has been the loss of spring snowpack (Mote et al. 2005). Climate impacts on snow hydrology in the Pacific Northwest are particularly sensitive because total annual precipitation is highly concentrated in the winter months and the region includes a large amount of snow cover that accumulates at temperatures near 0°C; areas at greater risk to climate warming than cold climate snowpacks because temperature affects both precipitation phase (snow versus rain) and the rate of snowpack ablation (Nolin and Daly 2006). As temperatures rise, the likelihood of winter precipitation falling as rain rather than snow increases. This is especially true in upper Coquille watershed where areas of snow accumulation are at relatively low elevation and winter temperatures are near freezing. Small increases in average winter temperatures can lead to increased rains, reduced snowpack, and earlier snowmelt.

Also, the changes in precipitation described in Section 3.1.3, above, foretell lower freshwater flows to the Refuge especially in the spring, summer and fall months.

3.2.2 Tides and Salinity

The National Ocean Survey tidal benchmark information for the Coquille River in Bandon for the 1983-2001 period is summarized in Table 3-6. The nearest NOAA tide station locations to the Refuge are in Charleston, approximately 14 miles north, and in Port Orford, approximately 28 miles south. Historic records of tides and water levels from these two tide stations are summarized in Table 3-7. Data for each station include mean ranges, diurnal ranges, and the minimum and maximum water levels on record. The mean range is the difference in height between the mean high water and the mean low water. The diurnal range is the difference between the mean higher high water (MHHW) and the mean lower low water (MLLW) of each tidal day.

Table 3-6. Tidal Benchmark Summary for Bandon, Oregon, at the Coquille River (NOAA 2011a)

Station Information	Bandon, Coquille River Sta. ID 9419750
Mean Higher High Water (MHHW) (feet)	7.09
Mean High Water (MHW) (feet)	6.37
Mean Tide Level (MTL) (feet)	3.78
Mean Sea Level (MSL) (feet)	3.75
Mean Low Water (MLW) (feet)	1.19
North American Vertical Datum 1988 (NAVD88)	0.10
Mean Lower Low Water (MLLW)	0.00

Table 3-7. Historic Tidal Data Summary for Charleston and Port Orford (NOAA 2011b, NOAA 2011c).

Station Information	Charleston Sta. ID 9432780	Port Orford Sta. ID 9431647
Mean Range (feet)	5.69	5.21
Diurnal Range (feet)	7.62	7.28
Minimum Water Level (feet below MLLW)	-3.1 (06/01/1973)	-2.8 (11/14/1989)
Maximum Water Level (feet above MHHW)	11.2 (01/26/1983)	11.5 (02/17/1978)

Tide water is brackish: more salty during the growing season, and more fresh during high winter river flows. Mean salinities recorded for the Coquille River estuary at the location nearest to the Bandon Marsh Unit for January-March, April-June, and July-September are 8, 22, and 31 parts per thousand (ppt). At the mouth of Fahys Creek, adjacent to the Ni-les'tun Unit, mean salinities for January-March, April-June, and July-September are 1, 14, and 30 ppt (Hamilton 1984). These measurements indicate that during winter and spring, the freshwater flow down the Coquille River and its tributaries strongly limits the intrusion of marine water. Freshwater flow, measured at North, Middle, and South forks of the Coquille, is usually lowest in August and September and highest during January (Kraeg 1979).

Future Trends

It is anticipated that the warming of Oregon's temperate climate will contribute to fundamental changes along the coast, including but not limited to shifts in the timing and intensity of coastal storms, changes in precipitation and the delivery of freshwater inputs, sea level rise, and increased inundation of the shallow tidal basins. Regional coastal climate change may also result in changes in the intensity and timing of coastal upwelling, shifts in temperatures and dissolved oxygen concentrations, and alteration of the carbonate chemistry of nearshore waters. The combination of these changes will alter chemical concentrations in estuaries (Ruggiero et al. 2010). As a highly river-dominated drowned river mouth estuary (Lee and Brown 2009), the Coquille River estuary may experience changes in the salinity regime in response to changes in precipitation and snow melt in the watershed (resulting in changes in freshwater inflows) and increased intrusion of seawater associated with rising sea levels. However, the effect of climate change on estuarine salinity will vary with location inside the estuary and the magnitude of the relative sea level rise rate in the vicinity of the estuary.

3.2.3 Sea Level Rise

Sea level rise on the Oregon coast is the result of three major forces: global mean sea level rise driven by the melting of land-based ice, local dynamical sea level rise driven by changes in wind which pushes coastal waters toward or away from shore, and localized vertical land movements driven primarily by tectonic forces (Mote et al. 2008, McKay et al. 2011). Mean sea level is defined as the average sea level over a 19-year period, about which other fluctuations (e.g., tides, storm surges, etc.) occur (Smerling et al. 2005). Global mean sea level rise has been in the range of 1.3 to 2.3 millimeters per year (0.05 to 0.09 inch) between 1961 and 2003 (IPCC 2007a). But since 1993 the rate has increased about 50% above the 20th century rise rate to 3 millimeters per year (0.12 inch per year; Bromirski et al. 2011) and the latest global satellite sea level observations measure a rate of

3.19 millimeters per year (0.13 inch per year; NASA 2012). This acceleration is primarily the result of ice field and glacier melt-off (McKay et al. 2011). For example, the total global ice mass lost from Greenland, Antarctica and Earth's glaciers and ice caps between 2003 and 2010 was about 4.3 trillion tons (1,000 cubic miles), adding about 0.5 inch (12 millimeters) to global sea level in a seven year period (Jacob et al. 2012).

Based on monthly mean sea level data from 1970 to 2006, the mean sea level trend at Charleston is 1.29 millimeters per year (0.050 inch per year) with a 95% confidence interval of ±1.15 millimeters per year (0.045 inch per year), which is equivalent to a change of approximately +0.42 foot per century (NOAA 2011d). Data for Port Orford were recorded from 1977 to 2006 and indicates a mean sea level trend 0.18 millimeter per year (0.007 inch per year) with a 95% confidence interval of ±2.18 millimeters per year (0.086 inch per year), which is equivalent to a change of +0.06 foot per century (NOAA 2011d). Located in between Charleston and Port Orford, the Bandon Marsh NWR experiences some degree of emergent, upward vertical land movement. Additionally, positive sediment and vegetative accretion rates could help buffer the Refuge from global sea level rise rates.

Vertical land movements are occurring as the North American plate and the off-shore Juan de Fuca and Gorda plates collide (see Section 3.4). Uplift, which may offset local sea level rise, occurs along the southern Oregon coast while subsidence occurs off-shore. Komar et al. (2011) estimate than the Refuge's geography currently is tectonically rising faster than the regional rise in sea level with a net relative sea level decrease of approximately 0.5 millimeter per year (0.02 inch per year).

Also, mineral sedimentation rates and organic matter (vegetative) accretion rates also need to be taken into account for inland marine influenced ecosystems such as the Refuge's marshes. Nyman et al. (2006) find that the vegetative component is the more significant of the two factors (i.e., accretion varied with organic accumulation rather than mineral sedimentation). Salt-marsh accretion rate was investigated by Thom (1992) at six sites that spanned a gradient in relative rate of sea level rise in Washington and Oregon. Mean accretion rate over all sites was found to be 3.6 millimeters per year, or 0.14 inch per year (95% confidence interval of 2.4 to 4.8 millimeters per year; 0.09 to 0.19 inch per year).

Future Trends

While the impacts of global sea level rise on the Refuge will likely be limited, this may change if global rates continue to increase and these increases are magnified by storm surges.

The IPCC Special Report on Emissions Scenarios (SRES) forecasted that global sea level would increase by approximately 12 inches (30 centimeters) to 39 inches (100 centimeters) by 2100 (IPCC 2001). However, more recent analyses (Chen et al. 2006, Monaghan et al. 2006) indicate that the eustatic rise in sea levels is progressing more rapidly than was previously assumed, perhaps due to the dynamic changes in ice flow omitted within the IPCC report's calculations. Vermeer and Rahmstorf (2009) suggest that, taking into account possible model error, a feasible range by 2100 might be 30 inches (75 centimeters) to 75 inches (190 centimeters).

Tebaldi et al. (2012) show that even seemingly low increases in sea level will have significant impacts in the short term when storm surges are taken into account. An analysis of historic data and future projections of sea level rise are used to estimate future return periods for what today are considered 50-year and 100-year events. This magnifies sea level rise by a factor of five, on average, as shown below and dramatically increases the occurrence, or return periods, of storm surge events.

The closest area to the Refuge that was analyzed is the Charleston tide station. The return period for storm surges currently qualifying as 100-year events is projected to change to every 5 years at this site by 2050. The analysis shows that 50-yr storm surges events are projected to increase by approximately 50 inches at the tide gauge, and 100-yr storm surges events are projected to increase approximately 52 inches.

Rising sea levels and storm surges may result in tidal marsh submergence (Moorhead and Brinson 1995) and habitat migration as salt marshes transgress landward and replace tidal freshwater and brackish marsh (Park et al. 1991). Changes in tidal marsh area and habitat type in response to sea level rise were modeled using the Sea Level Affecting Marshes Model (SLAMM 6), which accounts for the dominant processes involved in wetland conversion and shoreline modifications during long-term sea level rise (Park et al. 1989, Clough et al. 2010, Clough and Larson 2010). Within SLAMM, there are five primary processes that affect wetland fate under different scenarios of sea level rise: inundation, erosion, overwash, saturation, and accretion. For Bandon Marsh NWR, a SLAMM 6 analysis has been completed however, refined topographic elevation data were not available at the time and the analysis did not incorporate the recent restoration at the Ni-les'tun Unit. The Refuge is also monitoring sediment and vegetative accretion rates. We look forward to future SLAMM results with these new data inputs.

3.3 Ocean Chemistry

The ocean will eventually absorb most carbon dioxide released into the atmosphere as a result of the burning of fossil fuels and other sources. Current rates of carbon dioxide emissions are causing and an increase in the acidity of ocean surface waters and a decrease the saturation of calcium carbonate ($CaCO_3$), a compound necessary for most marine organisms' development of shells and skeletons (Hönisch et al. 2012). Oceanic absorption of CO_2 from fossil fuels may result in larger acidification changes over the next several centuries than any inferred from the geological record of the past 300 million years (with the possible exception of those resulting from rare, extreme events such as meteor impacts). In the past 300 million years, three analogous ocean acidification events have been identified and these events coincided with mass extinctions of marine organisms, however it should be noted that warming and corresponding oxygen depletion co-occurred during these events and contributed to the extinctions (Hönisch et al. 2012).

Virtually every major biological function of marine organisms has been shown to respond to acidification changes in seawater, including photosynthesis, respiration rate, growth rates, calcification rates, reproduction, and recruitment. Much of the attention has focused on carbonate-based animals and plants which form the foundation of our marine ecosystems. An increase in ocean acidity has been shown to impact shell-forming marine organisms from plankton to benthic mollusks, echinoderms, and corals (Doney et al. 2009). Many calcifying species exhibit reduced calcification and growth rates in laboratory experiments under high-CO_2 conditions. Ocean acidification also causes an increase in carbon fixation rates in some photosynthetic organisms (both calcifying and noncalcifying) (Doney et al. 2009, Smith and Baker 2008, OCBP 2008). These potential impacts to the marine food web may obviously negatively affect refuge resources such as seabirds, shorebirds and salmonids. Localized acidification rates within the Coquille River estuary have not been evaluated.

3.4 Topography and Bathymetry

The topography of the Bandon Marsh NWR is largely flat, with most areas below 11.0 feet North American Vertical Datum 1988 (NAVD88) in elevation (OLC 2010) and within the intertidal zone of the estuary. The majority of the Bandon Marsh Unit is composed of intertidal areas which range from low marsh and mudflats exposed only at low tide, to high marsh inundated only at seasonally high tides combined with high river flows. Tidal sloughs drain into the river channel to the west. A natural levee, ranging from 7.5 to 9.0 feet NAVD88, fringes along the west and north boundaries with the Coquille River. Former dredge material placed on or near the natural levee raises the elevation in some areas to between 11.0 and 13.0 feet NAVD 88. The elevation of the forested wetlands and upland forest along the Unit's east (landward) boundary is between 9.0 and 14.0 feet NAVD88.

The topography of the Ni-les'tun Unit is generally sloping from the north to the Coquille River on the south. The northeastern section of the Unit, encompassing the upland pasture, refuge headquarters, bunkhouse, shop, and Ni-les'tun overlook is located on a marine terrace. Elevations on the marine terrace range from about 20.0 to 104.5 feet NAVD88 with the highest elevation areas occurring on the northeast corner of the upland pasture. The southern extent and lowest elevations of the marine terrace are found at the Ni-les'tun overlook. Elevations within the restored forested wetland (former cranberry bog) range from 14.0 to 17.0 feet NAVD88. Elevations within the forested wetlands and upland forests along the western edge of the Unit range from 10.0 to 13.0 feet NAVD88. Normal ground elevation of the restored salt marsh ranges from 7 feet NAVD88 at the eastern end to 5 feet NAVD88 at the western end. Eighty percent of the restoration site is below 7.0 feet NAVD88 (MHHW). The natural levee along the river ranges from 9 feet NAVD88 at the east (upstream) end to 8 feet NAVD88 at the west (downstream) end (Ducks Unlimited 2009).

3.5 Geology and Geomorphology

3.5.1 Tectonic Context

The Oregon coast is located on the western margin of the North American continental plate near its junction with two small sections of denser oceanic crust: the Juan de Fuca and the Gorda plates. Where the latter plates move eastward and collide with the North American plate, they slide underneath and descend into the earth's mantle in an area known as the Cascadia Subduction Zone (Orr et al. 1992, Nelson et al. 1995). Although the subduction process is very gradual, proceeding at a relative velocity of 4 centimeters per year, the massive forces that drive the converging plates cause strain to accumulate at the edge of the North American plate (Douglas 1991). Over time, the accumulation of strain causes the edge of the continental plate to bend and rise in elevation in a process known as uplift. Periodically, this strain is released during an earthquake and the edge of the North American plate rapidly drops downwards, suddenly lowering the coastline, and correspondingly raising the relative sea level. The elevation drop which occurs during an earthquake is termed subsidence. These processes of regional plate tectonics have had substantial influence in shaping the physical features and geographic characteristics of the Oregon coast.

Bandon Marsh NWR is within the Coastal Range physiographic province described by Orr et al. (1992). The Coast Range, a long narrow belt of moderately high mountains and coastal headlands, extends southward from the Columbia River to approximately the middle fork of the Coquille River, and inland from the continental shelf and slope to the western edge of the Willamette Valley. Over 200 miles long, and 30 to 60 miles wide, the province averages 1,500 feet in altitude with a maximum elevation of 4,097 feet at Mary's Peak. The south fork of the Coquille River, which joins with the middle fork near Myrtle Point, is within the Klamath Mountains Physiographic province.

The Coast Range has its origins in accreted oceanic sediments born from volcanic activity approximately 64 million years ago. These Roseburg volcanics in the southern portions of the range were followed by the Siletz River and Tillamook volcanics in the northern portions of the range, formed mostly during the Paleocene to middle Eocene (about 60 to 45 million years ago). Deposited with these volcanics but also overlying them and intruded by them are regionally extensive marine sandstone and siltstone. Successively younger deposits of sediments and volcanics are found to the east of the Coast Range and along the coast. During the Oligocene (-25 million years ago), uplift of sedimentary basins in Oregon resulted in the westward migration of the coastline from as far east as Idaho towards the present position. As the western edge of the North American plate was uplifted by pressure from the subducting Juan de Fuca plate, a series of basalt flows from fissures in eastern Oregon began to reach the coast. During the Miocene, Columbia River lavas invaded the northern coastal area. By the Pliocene, the current coastline was approximately in place and rivers continued to cut deep valleys through igneous and sedimentary rocks.

Subduction of the Juan de Fuca plate under North America is continuing to push the Coast Range upwards, albeit at varying rates along the coast. For example, Cape Blanco is being uplifted at a rate of 1 inch every 3 years while Astoria is only being uplifted at a rate of 1 inch every 36 years (Orr et al. 1992). Even within the Coquille estuary there appears to be variation in subsidence and uplift rates. The southern edge of the estuary near Bandon may undergo less subsidence during earthquakes than the northern portion of the lower estuary. This may relate to the presence of the Coquille fault, which extends offshore from the Coquille River mouth northwest along the floor of the Pacific, or to shifts in an upper plate fold which underlies the region (McInelly and Kelsey 1990, Witter 1999).

3.5.2 Geologic and Geomorphologic Overview

The geomorphology of the Oregon Coast "is shaped by tectonic uplift and warping, the effects of eustatic sea level changes, wave and wind action, and fluvial and tidal processes in estuaries" (McDowell 1987). Continued uplift and tilting of the coastal mountains, combined with Pleistocene sea level changes, has created raised marine terraces up to 1,600 feet high in the southwestern part of the Coastal Range province. These marine terraces consist of uplifted beach and dune deposits, composed primarily of poorly sorted, unconsolidated sands, silts, clays and gravels. The northeastern section of the Ni-les'tun Unit, encompassing the upland pasture, refuge headquarters, bunkhouse, shop, and Ni-les'tun overlook, is located on the 80,000-year old Whisky Run terrace (McInelly and Kelsey 1990). This relatively thick marine terrace (3-20 meters, or 10-66 feet) is made up of deposited marine and stream sediments, composed of coarse to fine grained quartz, various plagioclases, opaque mica, amphiboles, pyroxenes, and other minor silicates. The marine terrace rests atop the Jurassic bedrock of the Otter Point formation, deposited about 150 million years ago, which is composed primarily of sheared sedimentary rocks with smaller amount of volcanic material, chert and blueschist (Baldwin et al. 1973a).

Excluding the areas of the Refuge on the Whisky Run marine terrace, the remainder was formed during the Holocene (12,000 years ago to present), following series of sea level rise, subsidence, and uplift events. During the early Holocene (11,000-8,000 years ago), the portion of the Coquille Valley now tidally influenced was likely drained by a nontidal, freshwater river. Stratigraphic records from Sevenmile Creek indicate that the current location of the Coquille estuary was under tidal influence by 7,000 years ago, forming a "drowned river" estuary. Global sea level rise following the most recent glaciation caused rapid sea level rise in the estuary before 3,500 years ago. However, a slower rate of global sea level rise combined with infilling sedimentation led to a decrease in the size of the estuary since 3,500 years ago. Gradual uplift in the period between earthquakes may also reduce the size of the estuary, but this effect is temporary, being offset by episodic subsidence during the earthquakes (Nelson 1992, Nelson et al. 1995, Witter 1999, Byram and Witter 2000, Witter et al. 2003). The last great (moment magnitude >8) Cascadia Subduction Zone earthquake occurred on January 26, 1700 (Atwater et al. 2005). The average earthquake recurrence interval for the Cascadia Subduction Zone at the latitude of the Coquille River estuary is 570 to 590 years. However, Goldfinger et al. (2010) determined an average recurrence interval of about 240 years, leading to a 37% probability of a great earthquake occurring somewhere along the Cascadia fault in the next 50 years. The elevation drop during these events is estimated at 0.5 meter (1.6 feet) or more (Witter 1999, Witter et al. 2003).

Infilling of the estuary and marsh development occurs as runoff from precipitation washes sediments from slopes into streams or their flood plains. These sediments are then transported downstream to the estuary where they settle and become influenced by tides (Simenstad 1983). Most of the present-day Refuge is located on this alluvium (Baldwin et al. 1973b). Much of the coarser sediment settles out near the banks of the river, forming natural levees. The finer materials remain suspended longer and settle throughout the intertidal zone and flooded lowlands. Additionally, sediments are moved into the lower estuary from the ocean shore by tsunamis, storm surges, and dune building.

The Bandon Marsh Unit has formed relatively recently (Baldwin et al. 1973a). Prior to 1895, most of the marsh did not exist. Early maps indicate this marsh barely existed prior to 1895, and since that time has grown due to rapid sediment accretion and minor dumping of dredge spoil along its external edge. The marsh expanded laterally at a rate of about 70 feet per year between 1887 and 1916, and 5 feet per year between then and 1939 (Johannessen 1961), with most of that expansion occurred along the southern edge. However, comparison of a 2002 aerial photograph with the USGS topographic maps printed in 1970 suggests the marsh might have eroded somewhat at the southerly (seaward) end, perhaps as a result of erosion and/or excavation. The marsh occupies the inner bend of a meander, formerly an area of slack water. The brackish water site was ideal for deposition of flocculated clays and other fine-grained sediments. The slack-water area probably formed when the Coquille River cut westward into the easily eroded spit, leaving its former channel.

3.6 Soils

With the exception of Pleistocene marine terrace deposits on the upland pasture area of the Ni-les'tun Unit, the present-day Refuge is primarily overlain with alluvium deposited by the Coquille River after the last glacial period (Beaulieu and Hughes 1975, Muhs et al. 1990). Refuge soils are mapped and described in the Soil Survey of Coos County, Oregon (USDA NRCS 1989).

The principal soil types on the Bandon Marsh Unit are Clatsop mucky peat in the tidal flat areas and Coquille silt loam along the northern edge of the marsh adjacent to the river channel. Clatsop mucky peat is typically composed of dark brown, mucky, fibrous peat overlaid upon very dark grayish brown silty clay. Below the layer of Clatsop mucky peat is a substratum of silty clay and clay. Permeability is slow with a water capacity of about 3 to 6 inches. This soil is subject to frequent periods of flooding during high tides. The water table fluctuates between the surface and a depth of 24 inches from November to June. Coquille silt loam is a deep, poorly drained soil with slow permeability, water capacity of about 4 to 8.5 inches, and slopes of 0 to 1 percent. Effective rooting depth is 60 inches for water-tolerant plants, but it is limited by the water table for non-water-tolerant plants. The water table fluctuates between the surface and a depth of 24 inches from October to June.

Heceta fine sand is found in the upland areas on the east side of the Bandon Marsh Unit. In contrast to Clatsop mucky peat and Coquille silt loam, which were both formed in alluvium, Heceta fine sand was formed in eolian material. Permeability is rapid with available water capacity of about 1 to 2 inches. The water table fluctuates from 12 inches above the surface to 6 inches below the surface from October to May.

Most of the lowlands within the Ni-les'tun Unit are Coquille silt loam and Willanch fine sandy loam. Willanch fine sandy loam differs from Coquille silt loam in that typically, the surface layer is mottled, very dark grayish brown and dark brown fine sandy loam 13 inches thick. Permeability is moderately rapid with an available water capacity of about 2.5 to 4.5 inches. This soil is subject to frequent winter flooding.

On the west end of the Unit by the mouth of Fahys Creek, Fluvaquents-Histosols are found. This soil complex is saturated with water that is high in content of soluble salts. Fluvaquents are in areas normally covered by average high tides and in surge channels whereas histosols are on higher elevations that are covered by extreme high tides. The surface layer of fluvaquents generally is mineral and is sandy, silty, or clayey, depending on the velocity of the tides in a given area. Histosols are made up of a layer of organic material that is 16 inches thick or more and overlies alternating layers of mineral and organic material.

Heceta fine sand, Waldport fine sand (0 to 30 percent slopes), and Heceta-Waldport fine sands (55 percent Heceta fine sand, 25 percent Waldport fine sand, 0 to 7 percent slopes) underlie the forested areas. The Heceta soil is on nearly level deflation plains and the Waldport soil is on small, stabilized sand dunes. These soil types are deep, poorly drained, and have rapid permeability and low moisture capacity.

The riparian areas adjacent to Fahys Creek are Clatsop mucky peat and Brallier mucky peat. As opposed to Clatsop mucky peat, which has a significant fine mineral soil component, Brallier mucky peat is formed in partially decomposed fibrous organic residue derived dominantly from water-tolerant plants. This soil type is saturated with water throughout the year and is affected by the tide. The thickness of the organic material ranges from 53 inches to more than 10 feet. These soils are strongly acid to extremely acid.

The areas around the Ni-les'tun Unit overlook are composed of Wintley silt loam (15 to 30 percent slopes) and Chismore silt loam (3 to 7 percent slopes). Wintley silt loam is a deep, well-drained soil formed in mixed alluvium. Permeability is moderately slow and available water capacity is about 8.0 to 9.5 inches. Chismore silt loam is a deep, moderately well drained soil that formed in old clayey alluvium. Permeability is slow with an available water capacity of about 3.5 to 7.5 inches.

The forested areas immediately to the east of East Fahy Road are underlain with Waldport fine sand (0 to 30 percent slopes) and Waldport-Heceta fine sands (0 to 30 percent slopes). Heceta fine sand is found in the former cranberry bog site and adjacent forested riparian areas. Deep, well-drained marine and stream terrace soils are found east of the Fahys Creek riparian area. Wintley silt loam occurs near the bunkhouse and shop and extends northward through the southern half of the upland pasture. Bullards sandy loam (7 to 12 percent slopes), a well-drained and moderately permeable soil formed in mixed eolian marine deposits, is found on the northern half of the upland pasture. Chismore silt loam is found at the office location.

3.7 Fire

3.7.1 Pre-settlement Fire History

There is little published information available describing the specific historic role of fire on lands that are now within Bandon Marsh NWR. Wildland fires on the Oregon coast have always been infrequent and do not exhibit any predictable cycle. The forested refuge areas are dominated by Sitka spruce and located in the “near coastal zone” where climatic conditions limit the frequency and intensity of naturally occurring fires. The limited data available indicate that fires in this zone were very infrequent and tended to burn wide areas but only under very rare, extremely dry and windy conditions in late summer and fall. In the tidal and freshwater marsh ecosystems that comprise much of the Refuge, fire was likely very infrequent. However, based on accounts from nearby Willamette Valley which has meadow habitat similar to that at Bandon Marsh, it is likely that Native Americans burned upland grasslands.

3.7.2 Post-settlement Fire History

The city of Bandon, adjacent to Bandon Marsh NWR, has experienced two major fires, which shaped the local community. The first occurred in 1913 and the second in 1936. The 1936 fire destroyed all but 16 of the nearly 500 buildings in town and is thought to have spread so rapidly because of the prevalence of the noxious plant gorse throughout the town. Major rebuilding efforts followed both fires. There are no other recorded incidents of wildland fire on the area of Bandon Marsh prior to or since the establishment of the Refuge in 1983. Prior to 1900 it is estimated that very little if any marsh existed where the original Bandon Marsh Unit is located today and that it has developed since then due to increased sediment loads in the Coquille River. Since the majority of the area is subtidal to intertidal there was and is very little opportunity for wildland fire to occur from natural or human causes, except in areas of heavy gorse infestation adjacent to residential developments.

The normal fire season recognized by the U.S. Forest Service and the Oregon Department of Forestry (ODF) Coos District is June through October, although exact dates within the month vary by year and are weather-dependent. On the Oregon coast, fire season has begun as early as May 27 and as late as July 18; it has been declared officially over as early as September 14 in a year of heavy rainfall and as late as November 12 in a drier year. From 1993-2003, there has been only one recorded fire on Bandon Marsh refuge lands. It was human-caused (unextinguished campfire) and was recorded as 0.01 acre.

Under the current refuge fire management plan, guidelines for appropriate wildland fire suppression, hazard fuel reduction, and pile burning are detailed. Mechanical treatment may be used as a fire management strategy for hazard fuels reduction. Pile burning as a limited prescribed fire technique may be used to reduce hazard fuels; however, no prescribed burning has been conducted on the Refuge. ODF Coos District has numerous prescribed burns occurring each year near the coast, although not adjacent to refuge lands. Typical “prescribed fire season” is fall and spring and is weather-dependent. Pile burning can occur year-round depending on weather conditions and restrictions placed by the Oregon Smoke Management Plan. There is no formally established “prescribed burning season” as any domestic pile or barrel burning is allowed all year depending on weather conditions. Larger scale burning such as forestry slash burning requires a permit and a pre-burn inspection by ODF. The Bandon Fire Department strictly regulates controlled burning within its jurisdiction and cancels all burning activities when weather conditions warrant. The city of Bandon also imposes local burn bans when conditions warrant.

3.8 Environmental Contaminants

3.8.1 Air Quality

The Oregon Department of Environmental Quality (ODEQ) does not have any ambient air quality monitoring stations located on the Oregon Coast. The majority of ODEQ's air quality monitoring stations are located within the interior valleys between the Coast and Cascade Mountain Ranges where the majority of Oregon's population resides. The lack of ambient air quality monitoring on the Oregon Coast makes it difficult to assess baseline air quality conditions.

Bandon Marsh NWR is located within the Oregon Coast Airshed which is generally well mixed year around due to the influence of the Pacific Ocean. Low pressure systems move through the airshed throughout the year and usually bring wind, clouds, and rain. The intensity and frequency of these low pressure systems increases during the fall through winter resulting in sometimes very rainy and windy conditions. In between these low pressure systems high pressure systems move in resulting in drying trends. High pressure systems generally dominant the airshed during late spring, summer, and early fall. Coastal fog due to inland heating is common during the summer months. In general, the Oregon Coast Airshed remains relatively unstable resulting in a well-mixed airshed with suspected good air quality.

Locally, air quality may be affected by various activities on and adjacent to the Refuge including: 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/diesel powered equipment, motorboats). The refuge staff uses various types of equipment and transportation methods to achieve the refuge habitat conservation projects, monitoring, and research. Habitat improvement projects and daily monitoring activities may include the use of tractors, heavy equipment (bulldozer, backhoe, and excavator) and/or the operation of trucks, boats, or other vehicles. Refuge visitors generally drive their automobiles to visit the various units of the Refuge and others operate motor boats on the Coquille River to participate in fish and wildlife-dependent recreation opportunities in the estuary (hunting, fishing, wildlife observation).

3.8.2 Water Quality and Contaminants

A state is required to identify waters that do not meet that state's water quality standards under Section 303(d) of the Clean Water Act (CWA). These waters are considered "water quality limited" and placed on the state's 303(d) impaired waters list. Section 303(d) requires the state to develop Total Maximum Daily Loads (TMDLs) for impaired waterbodies. TMDLs are the amount of each pollutant a waterbody can receive and not exceed water quality standards. Water quality standards for Oregon include beneficial uses, narrative and numeric criteria, and antidegradation policies. The Oregon Department of Environmental Quality (ODEQ) lists impaired water segments by designated fish uses; therefore, entire tributaries can be listed after one assessment event. Parameters included in the assessment are aquatic weeds or algae, bacteria (E. coli), bacteria (fecal coliform), biological criteria, chlorophyll a, dissolved oxygen, pH, sedimentation, temperature, total dissolved gas, toxic substances, and turbidity.

No waters within the Bandon Marsh NWR boundary (i.e., Fahys, Redd, Blue Barn, and No Name Creeks) were listed as impaired because these waters have not been assessed under the CWA. However, the Coquille River adjacent to the Refuge was listed as impaired in the 2002 and 2004/2006 303(d) reporting cycles. The Coquille River was also listed as impaired in Oregon's 2010 Section 303(d) List of Category 5 Water Quality Limited Waters Needing a TMDL submitted by ODEQ to EPA for review and approval in January 2011. Many parameters and beneficial uses are impaired on the Coquille River. Significant impairments include chlorophyll a, dissolved oxygen, fecal coliform, and temperature. These impairments affect the beneficial uses of aesthetics, water contact recreation, cold-water aquatic life, trout spawning, shellfish growing, anadromous fish passage, and salmonid fish rearing (ODEQ 2002, ODEQ 2006, ODEQ 2011). While not State-listed, the local creeks likely collect waste products from the cattle that graze the pasturelands. These nutrient loads would be added to the existing loads within the Coquille River, potentially further degrading water quality. Additionally, if a large coastal oil spill occurred in the vicinity of the Refuge, the estuary could be contaminated with material carried in with the tide. U.S. Highway 101 also runs adjacent to the Refuge and could be a source for a spill or pollution resulting from an auto accident.

ODEQ has initiated (initial scoping and data collection phase) a TMDL in the Coquille River adjacent to the Refuge. The upper South Fork of the Coquille basin has TMDLs for temperature and habitat mediation that have been approved since 2001.

The primary contaminant issue at Bandon Marsh NWR is the abandoned wood treatment facility, formally owned by Moore Mill and Lumber Company (Moore Lumber), and located adjacent to the southern boundary of the Bandon Marsh Unit. Beginning its operation in 1909, the mill disposed of wastes at the dump site until its closure in 1986. The dump site covers approximately 10 to 15 acres with an average depth of 8 to 10 feet. Part of the dump site is inundated by tidal flows on a daily basis.

In 1985, the Oregon Department of Environmental Quality (ODEQ) collected soil and water samples at the mill and found elevated concentrations of several phenol compounds. Moore Lumber closed the sawmill in 1986, citing economic reasons. At the time of closure, no assessment activities had been initiated. In 1986, a revised assessment proposal by Riedel Environmental Services, Inc. (Riedel) was submitted by Moore Lumber. In August of 1987, a fire destroyed the sawmill. Following the fire, Ecology and Environmental, Inc. Technical Assistance Team (TAT), sent by the U.S. Environmental Protection Agency Superfund Response and Investigations Sections, and Riedel (contracted by Moore Lumber) conducted independent site assessments at the facilities. Riedel installed three shallow monitoring wells to assess the seasonal impact of contaminants on subsurface water. Results of water and sediment samples indicated that phenolic compounds were moving into the estuary. Dioxin and furan compounds were also detected on the premises. Although both groups found decreased levels of phenolic compounds relative to the 1985 sampling, certain areas of the property still contained measurable or elevated concentrations of contaminants. The Ecology and Environment TAT determined that the site did not warrant emergency removal actions under Superfund, but they expressed concern over the uncontrolled nature of the site. Since TAT noted that phenolic compounds were migrating into the estuary primarily from either surface runoff or infiltration, there was concern that waste products at the dump site could pose a threat to the Refuge and to natural resources in the area.

In 1997, the U.S. Fish and Wildlife Service collected surface water and sediment samples from six sites and clam tissue was collected from four sites. Additionally, two sampling sites furthest from the dump site on the Bandon Marsh Unit were used as reference sites. Elevated concentrations of several trace elements were observed in water, sediment and tissue samples. Cadmium, chromium, iron, lead, and nickel concentrations in water samples exceeded Federal and State freshwater or marine chronic criteria for the protection of aquatic life. Trace element concentrations in the intermediate sediment sample were generally greater than those in sediments associated with the Refuge or dump. Sediment concentrations of arsenic, chromium, and nickel concentrations in the intermediate sample exceeded most guidelines. Barium concentrations in one dump sediment sample slightly exceeded Environmental Protection Agency (EPA) guidelines. Copper and iron concentrations were elevated relative to sediment criteria used by the Ontario Ministry of Environment. The distribution of trace elements in water and sediment samples suggests that there are localized areas in which contaminants may pose a threat to fish and wildlife, though the dump does not appear to be the source. Sixteen trace elements were detected in clam tissue samples; however, few guidelines were available to assist in the interpretation of these residue levels. In general, water and sediment organochlorine (OC) pesticide concentrations did not appear to be at levels harmful to aquatic resources, yet the presence of these compounds in water indicated a relatively recent exposure. Tissue concentrations of heptachlor epoxide and total DDT in dump samples exceeded their respective criteria and may represent a hazard to fish and wildlife using the area. The presence and distribution of organochlorine pesticides in water and tissue samples indicated the dump was the probable contaminant source. Although the concentrations of total polychlorinated biphenyls (PCBs) in sediment were negligible, total PCB residues in water and tissue samples were well above available guidelines. Bioaccumulation of total PCBs in animal tissue could present a serious threat to fish and wildlife resources. Total PCB concentrations were found in tissue from all sampling locations, with dump samples being 5 to 8 times higher than those from the Refuge. This pattern of contamination suggests a potential movement from the dump location. Detection limits used in the analysis of congener-specific PCBs in water were above recommended guidelines for freshwater and marine systems. Any detection of congener-specific PCBs in water samples suggests a potential hazard to aquatic organisms. Results from this investigation indicate that total PCBs and some OC pesticides are moving from the dump to adjacent areas (Thomas et al. 1997).

3.9 Surrounding Land Use

Bandon Marsh NWR is located within the long and narrow Coquille River estuary in Coos County along the southern Oregon Coast. Two cities are located on the shores of this estuary: Bandon (population about 3,000) is at the mouth and Coquille (population about 4,200). The Bandon Marsh Unit is bordered by the Coquille River to the north and west, Riverside Drive to the east, and a log transfer station (formerly a wood treatment facility) to the south. The North Spit of the Coquille River, including Bullards Beach State Park, is directly across the river from the Bandon Marsh Unit. The southernmost portions of the Bandon Marsh Unit are also within Bandon city limits. The Ni-les'tun Unit is on the north bank of the Coquille River and bounded by an RV park to the west; North Bank Lane, East Fahy Road, and a quarry, small tracts of rural residential, or forestland to the north, and private agricultural land to the east.

The estuary has historically been the hub of agriculture, navigation, commerce, recreation, and fisheries in the Coquille River Valley. Forest products, tourism, fishing and agriculture dominate the Coos County economy. Consequently, the forested uplands have historically been utilized for timber production and cranberry operations, while the alluvial valleys support agricultural operations, including beef, sheep, and dairy.

Approximately 40% of the Coquille watershed is private industrial forest land. Federal, state, and county lands occupy about 30% of the watershed. The Bureau of Land Management and the U.S. Forest Service administer the largest of these public holdings. Another 30% of the watershed is in smaller nonindustrial private holdings. Agriculture and range comprise 7%. Tribal ownership is 1%. There are 748 farms in Coos County (Peters 2005). Because many farms also include range and timber lands, they comprise a total of approximately 144,000 acres or 14% of the area of Coos County (Coquille Indian Tribe 2007).

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Chapter 4
Biological Environment

Chapter 4. Biological Environment

This chapter addresses the biological resources and habitats on the Bandon Marsh National Wildlife Refuge (NWR); however, it is not an exhaustive overview of all species and habitats. The chapter begins with a discussion of biological integrity (historic conditions and ecosystem function), as required by the Refuge Administration Act. The bulk of the chapter is then focused on the presentation of pertinent background information for the priority habitats and species that the refuge personnel will actively manage to accomplish biological conservation and/or restoration. The priority habitats and species are collectively known as the Priority Resources of Concern (ROCs) designated under this CCP. Background information includes description, location, condition, trends, key ecological attributes, and threats (stresses and sources of stress) associated with each ROC. The information presented herein was used to develop goals and objectives for the CCP (see Chapter 2).

4.1 Biological Integrity, Diversity, and Environmental Health

The National Wildlife Refuge System Administration Act, as amended, 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. The BIDEH policy (601 FW 3) defines *biological integrity* as "the 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." *Biological diversity* is defined as "the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur." *Environmental health* is defined as the "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." 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 the Refuge and in associated ecosystems that represents BIDEH.

4.1.1 Historic Conditions

The mainstem portion of the Coquille River and adjacent bottomlands were historically tidally influenced for approximately 40 miles, from the city of Bandon on the Pacific coast to immediately upstream of the town of Myrtle Point. Prior to influences of Euro-American settlement (mid-1800s), it is estimated that 14,440 acres of vegetated wetland were tidally influenced within the bottomlands of the Coquille River watershed from Myrtle Point to the mouth of the river (Benner 1991). The tidal section of the Coquille River at that time was linked with over 20,500 acres of bottomlands (Benner 1991). In some instances, the bottom swampland was covered with a dense thicket of willow and alder brush, rather than trees.

The tidally influenced mainstem of the Coquille River was historically deep channeled and bordered by a mosaic of fresh, brackish, and marine-driven wetlands covered with a rich riparian bottomland forest habitat (Benner 1991). This riverine and estuarine habitat was also hydraulically and biologically driven by numerous freshwater streams and beaver activity. These elements shaped the riparian communities to foster a mosaic of vegetative diversity of patchy open water and timbered scrub habitats that were bedded in saturated soils rich in nutrients. Flooding was annual and lasted up to 9 months on the upper bottomlands, generally following an annual pattern of high flows as winter rains saturated the adjacent coastal mountains. Flooding of the lower estuary was more frequent when high river flows combined with the high tides of the winter. Freshwater creek and stream flows into the bottomlands were perennial in all but the driest times. Riparian vegetative response to flooding was variable depending on flooding intervals and intensity. Floods provided the soil disturbance and high water levels required for transport of large amounts of sediments and woody debris to the lower estuary. Flooding alternately created and destroyed estuaries and brackish wetlands. Newly created tidal flats and low marsh supported plant and animal communities that moved successionally toward higher elevation communities.

The lower Coquille River estuary is the remains of an ancient submerged river mouth that was bordered by dynamic sand dunes (Peterson et al. 2005, Byram and Witter 2000). The effects of anthropogenic, climatic and geological forces have occurred and continue to occur on a variety of temporal and spatial scales. Sea level variations, major Cascadian subduction zone seismic events (e.g., uplifting, subsidence, and tsunami waves), climatic change, and cultural and natural fire have altered the region over time (Tveskov and Cohen 2007, Witter et al. 2003, Byram and Witter 2000). Between 6,500-6,700 years ago and the present there have been 12 large earthquakes (on average, every 570-590 years) which dropped the tidal marshes and low wetland forests, resulting in reduced local elevations and more flooding of the area. More recently, accretion of fine sediments and the accumulation of woody and vegetative debris have resulted in the development of our current tidally influenced tidal mudflat and salt marsh system (Brophy 2005, Byram and Witter 2000).

The Coquille River estuary was historically described in writing and with maps developed by the first Oregon land surveys. Generally, the area was depicted as a deep channel river bordered by a tidally influenced bottomland that was swampy or marshy in nature (Oregon Original Land Cadastral Survey Notes 1857-1872; in Benner 1991). The Bandon Marsh NWR was described in these surveys as “marsh prairie” in the area of the Ni-les’tun Unit and the Bandon Marsh Unit was mainly open water or “low, flat tidal land” with the northern portion described as a “tide prairie”, and both units being bordered by “spruce swamp.” The streams in the area were described by Aiken in 1871 as “mostly thick growth of vine-brush (e.g., crab apple, vine maple, willow, salmon-brier brush) and timber, on them is mostly alder myrtle and maple and some spruce.” The upland forest located to the north of the Coquille River as mapped in these early accounts as shore pine forest. This survey interpretation from the early 1850s of the estuary and surrounding uplands was done by a variety of individuals that may have had varying levels of skill in interpreting vegetation types and the primary purpose of the exploration was for potential settlement and conversion of land to agriculture.

4.1.2 Habitat Alterations

The Coquille River native people (the Nasomah) hunted, fished, and created river shoreline settlements for thousands of years (Byram and Shindruk 2010, Tveskov and Cohen 2007). Use of the estuary and tidal wetland forests by Native peoples most likely had little effect on the functioning of estuarine and forest ecological systems. There is evidence that early Native people of the region intentionally used fire to manipulate vegetation at the landscape scale (LaLande and Pullen 1999). They likely used other land management techniques, but little evidence remains. The culture and location of settlements within the Coquille estuary were driven by oral traditions and an understanding of the dynamic nature of the landscape (Don Ivy, Coquille Indian Tribe, personal communication) The locations of villages and use of natural resources shifted with the subsidence and uplift that affected suitable sites for settlement and canoe access (Byram and Shindruk 2010, Hall 2001).

The mid-1800s ushered in the beginning of ecologically significant land alterations for the wetlands of the Coquille River watershed. Over the past 150 years, the estuary and wetland forests have been physically altered to provide land for agricultural purposes (e.g., diking and draining), timber production (timber harvest, land clearing, log and milled wood transport), development of communities, roads and infrastructure (filling of marsh habitat), river navigation and shipping commerce (stabilization and deepening of the river mouth and channel with jetties and dredging).

The earliest European inhabitants of the Coquille watershed were believed to be fur trappers, traders and explorers. The Coquille River Valley was flooded timber scrub woodland and provided abundant beaver for the fur trading industry. Early surveyors reported using boats and canoes to make their way up the Coquille River Valley by moving from one beaver pond to the next (Benner 1991). European settlement began in the mid-1850s. As the Euro-American population increased, it moved away from fur trading and diversified into resource extraction industries of fishing and forestry, and large-scale land manipulation for agriculture. In addition, the hydrology of the riverine and tidally influenced portions of the Coquille River was altered by dredging and maintenance for commerce and travel. By 1878, steamboats could travel from Bandon to the population centers of Myrtle Point and Coquille (Benner 1991).

When European settlers began inhabiting the Coquille Valley and coastal plain, the extent and pace of human disturbance to the aquatic and terrestrial environments increased rapidly. Early logging practices focused on the removal of riparian timber in order to facilitate removal of higher elevation old growth timber. Upper watershed streams were used to transport logs by the stream altering methods of splash damming. Harvested timber was released and transported in torrents of water to the mainstem of the river where logs were rafted together to be processed in the mills downstream. This technique of flushing the tributary system reduced stream habitat complexity, destabilized banks, incised and scoured channels, destroyed riparian habitat and transported large amounts of sediment into the lower estuary habitat. As logging technology progressed into the internal combustion engine era and transportation (e.g., narrow gauge railroad, trucks and bulldozers) improved, timber harvest proceeded to progressively harder-to-reach areas, including riparian areas in steep first and second order drainages, leaving few areas in a natural state (USFS 1994). The substantial bank erosion and stream scouring from this large scale exploitation of the forests elicited concern from landowners and the practice was eventually abandoned.

Since the mid to late 1800s, a large portion of scrub-timber dominated middle and lower Coquille River Valley was diked, rip rapped or hard banked then cleared for pasture and crop production (USFS 1994). Beaver were considered a nuisance in the maintenance of dikes, drainage culverts and tide gates, agricultural fields, and roads due to their natural habits of digging soil and harvesting vegetation for dam construction, which flooded or destroyed this new infrastructure. Eventually, this keystone species was trapped out and their ecologically important effects of impounding water were eliminated throughout most of the watershed.

One of the greatest ecological effects of human disturbance within the Coquille watershed has been the construction of an extensive road network for transportation of agricultural products (e.g., timber, cattle) and commerce. The road network, estimated to be 2,383 miles, permeates throughout the watershed (Ecotrust 1997). Dirt, gravel, and asphalted roads that are poorly constructed in unstable or steep locations and/or unmaintained cause many adverse impacts downstream. The physical characteristics of the hard surface of roads increase the volume and rate of precipitation runoff, which can compound into increased sediment, pollutants and an increase in water temperature. This in turn can cause direct and indirect mortality to fish and wildlife and fragment their habitats downstream. Much of the mainstem and major tributary channels are impinged upon by road fills. This caused many streams to deeply down-cut and become separated from their floodplains, thus increasing flow velocities, simplifying the hydrological characteristics within the channels, and expediting the flow of once-retained woody debris, sediments and nutrients out of the system. In addition, roads become conduits for the range expansion and dispersal of invasive plant and animal species by inadvertently opening new habitat and increasing the rate of colonization by people, vehicles, domestic animals and other physical and biological factors favorable to these invasive species (USFS 2003, Trombulak and Frissell 2000).

Between 1884 and the present, the U.S. Army Corps of Engineers (USACE or Corps) conducted dredging and jetty operations to improve watercraft navigability of the Coquille River above the City of Coquille and at the mouth within the City of Bandon (Osborne 2011). The Corps ceased dredging operations in the upper portion of the river after 1902 (Coquille Indian Tribe 1997). Further, local efforts to improve navigability facilitated the establishment of the Port of Coquille in 1911. The Port conducted stream-clearing operations that included riparian vegetation removal and intentional bank destabilization and incision to enable navigation between the cities of Coquille and Myrtle Point from 1915 to 1923. These activities continued on the North Fork of the Coquille River until the advent of World War II and did not resume until the mid-1960s. While these more recent actions were primarily intended to prevent flooding of adjacent towns and agricultural fields, they permitted two-way boat traffic on selected segments of the Coquille River. Up to the early 1990s, the Coquille River was navigable for commodity and recreational transport up to the town of Coquille (Gina Dearth, Port of Bandon, personal communication).

Historic commerce activities in the lower Coquille River, in the proximity of the town of Prosper, south of Bandon Marsh NWR’s Ni-les’tun Unit, consisted of shipyards, lumber mills, salmon canneries, schools, and residential buildings (Byram and Shindruk 2010, Reid and Stroud 2003). These industries and activities produced quantities of debris that were deposited in local dump sites. These dump sites exist within the lower watershed and have been determined to produce contamination that is potentially hazardous to fish and wildlife (Thomas et al. 1997).

Many federal, state, county and private organizations and individuals have recently undertaken efforts to reverse the negative effects of historical alterations. Restoration of fish and wildlife in the upper Coquille River watershed has been implemented through direct restoration activities (e.g., fish and wildlife habitat enhancement) and through the development of new forest management plans and regulations that has included road construction standards, habitat buffers, and replanting efforts. The U.S. Forest Service, Bureau of Land Management, and private timber companies have implemented many of these actions. In the upper reaches of the river system, the Coquille Watershed Association (CWA) has dedicated their mission to the health of the watershed and its fish and wildlife resources. This conservation group has built fences to exclude cattle and planted hundreds of miles of riparian buffer habitat. In addition, they have replaced culverts for improved fish passage and created in-stream structures (e.g., rock weirs, large wood placement) to create pools, catch spawning gravel, increase stream complexity and create juvenile rearing habitat (Kelly Miles, personal communication). The CWA has largely worked with private landowners to implement these various projects on their lands.

From 1994 to 2002, the Port of Bandon enhanced 9 acres of historic estuarine habitat in the lower Coquille estuary by the creation of new tidal channels, placement of large wood and revegetation efforts (Port of Bandon 2002, Port of Bandon 2003). This effort has resulted in nursery habitat for coho and Chinook salmon, increased shorebird use, and also provided the public with an example of restored estuary habitat (Port of Bandon 2006). From 2005 to 2011, Bandon Biota, Ducks Unlimited and Oregon Trout (now Freshwater Trust) completed restoration of 80 acres of tidal wetlands in the estuary and the lower portion of Lowe Creek across the river from Parkersburg. This effort reconnected the historic estuary with the Coquille River and involved breaching a dike system and excavating the degraded sinuous channel to recreate tidal function (Randy Van Hoy, personal communication). These projects and others completed by the U.S. Fish and Wildlife Service's Oregon Coastal Program, Oregon Watershed Enhancement Board, Oregon Department of Fish and Wildlife Fish Restoration and Enhancement Program, Coquille Watershed Association, The Nature Conservancy, Coquille Indian Tribe, and private landowners are contributing to the restoration of the Coquille River system and estuary that will provide fish and wildlife for future generations.

4.1.3 Early Refuge Management

Bandon Marsh NWR was established to protect one of the few remaining unspoiled salt marshes in Oregon in 1983 (USFWS 1981). Soon after the Refuge was established, Refuge Management, Habitat, and Public Use plans were developed detailing the need of monitoring activities that may affect the unaltered nature of the salt marsh. From 1983 to 1999 the Refuge was included in the Western Oregon National Wildlife Refuge Complex administered out of the headquarters office at William L. Finley NWR near Corvallis, Oregon. Management involved posting of refuge boundaries, biological surveys, and monitoring by refuge staff (Roy Lowe, personal communication). A one-person coastal refuge office was established at the Hatfield Marine Science Center, Newport, Oregon in 1985. In 1992, the Refuge was expanded and the adjacent second growth forested wetland west of Riverside Drive was acquired (USFWS 1990b). In November 1999, the six National Wildlife Refuges along the Oregon Coast including Bandon Marsh NWR were separated from the refuges in the Willamette Valley and the new Coastal Refuges administrative office established in Newport, Oregon. Visitor use facilities at the Refuge including a parking lot, boardwalk, and overlook deck on the edge of salt marsh were completed in early 2002. In June 2003, a full-time staffed office was opened on Bandon Marsh NWR (Roy Lowe, personal communication).

During the late 1990s, the City of Bandon and the surrounding coastal area had a growth and development period that included the subdivision of large parcels of land within the lower Coquille River watershed. In 1998-1999, plans were developed to expand the Refuge by up to 700 acres upstream or east of the Bandon Marsh Unit. This new unit, named the Ni-les'tun Unit, was established in January 2000 with the acquisition of the 408-acre Bussmann Ranch. The Ni-les'tun Unit was established to assist the Refuge in protecting, conserving, and restoring fish, wildlife, salt marsh, and rare forested wetland habitat within the estuary (USFWS 1999a). From 2000 to 2004, 582 acres comprised of five ownerships was acquired in the Ni-les'tun Unit, with the assistance of The Nature Conservancy and the Archaeological Conservancy. The new unit was comprised mostly of diked historic salt marsh (degraded pasture) and forested wetlands (~450 acres) and second growth upland forest and pasture (~100 acres). New facilities were constructed on the Ni-les'tun Unit including an office and shop in 2002 and a bunkhouse was added in 2005.

To fully restore tidal influence to the more than 400 acres of historic salt marsh, freshwater marsh and forested wetlands within the Ni-les'tun Unit, the Service partnered during 2007-2011 with The Nature Conservancy, Federal Highway Administration, Ducks Unlimited, Oregon Watershed

Enhancement Board, Natural Resource Trustees for the M/V New Carissa Oil Spill, Coquille Indian Tribe, Confederated Tribes of the Siletz Indians, and others to implement the largest tidal marsh restoration to date within the state of Oregon. This effort restored tidal inundation to existing degraded pasture by removing artificial levees, eliminating 15 miles of interior drainage ditches, removal of three tide gates, construction of 5 miles of sinuous tidal channel, relocation of utilities, reconstruction and raising of North Bank Lane including adding fish friendly oversized culverts, installation of in-channel large wood and reestablishment of small coastal streams to the Coquille River and estuary (USFWS and FHA 2009).

4.2 Selection of Priority Resources of Concern

4.2.1 Analysis of Priority Resources of Concern

Refuge management priorities are derived from the National Wildlife Refuge System (NWRS) Mission, individual refuge purpose(s), NWRS policy that identifies NWRS Resources of Concern, and the mandate to maintain the BIDEH of the Refuge. These mandates are consistent with the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997. The management direction of Bandon Marsh NWR is driven by refuge purposes and statutory mandates, coupled with species and habitat priorities. The latter are identified in various USFWS conservation plans, as well as those developed by our state, federal, and private partners (USFWS 2008b). The step-by-step process to prioritize Resources of Concern and management priorities for a refuge is displayed in Figure 4-1.

Wildlife and habitat goals and objectives were designed directly around the habitat requirements of species designated as Priority Resources of Concern (ROCs). Resources of concern are called conservation targets in conservation planning methodologies used by other agencies and non-governmental organizations. In developing objectives, the team followed the process outlined in the Service’s draft Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook (USFWS 2008b). As defined in the Service’s Policy on Habitat Management Plans (620 FW 1), resources of concern are:

> all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect ‘migrating waterfowl and shorebirds.’ Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW 1.4G)…
>
> Habitats or plant communities are resources of concern when they are specifically identified in refuge purposes, when they support species or species groups identified in refuge purposes, when they support NWRS resources of concern, and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health.

Therefore, resources of concern for a refuge may be a species or species group, or the habitat/plant community that supports a priority species/species group.

In developing its listing of Priority ROCs, the planning team selected not only species mentioned in establishing documents for the Refuge, but also species that captured the ecological attributes of habitats required by larger suites of species. The ecological attributes of habitats should be analyzed to meet the life history requirements of ROCs, and are therefore critical to sustain the long-term viability of the ROC and other benefitting species. Ecological attributes of habitats include vegetation structure, species composition, age class, patch size and/or contiguity with other habitats; hydrologic regime; and disturbance events (e.g., flooding, fire). These provide measurable indicators that strongly correlate with the ability of a habitat to support a given species. Tables listing the desired conditions for habitat types found on the Refuge incorporate “Desired” conditions that were based on scientific literature review and team members’ professional judgment. These desired conditions for specific ecological attributes were then used to help design habitat objectives, as presented in Chapter 2. However, not all ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. Other factors, such as feasibility and the Refuge’s ability to reasonably influence or measure certain indicators, played a role in determining the ultimate parameters chosen for each habitat objective. Thus, ecological attributes should be viewed as a step in the planning process. The ultimate design of objectives was subject to further discussion and consideration.

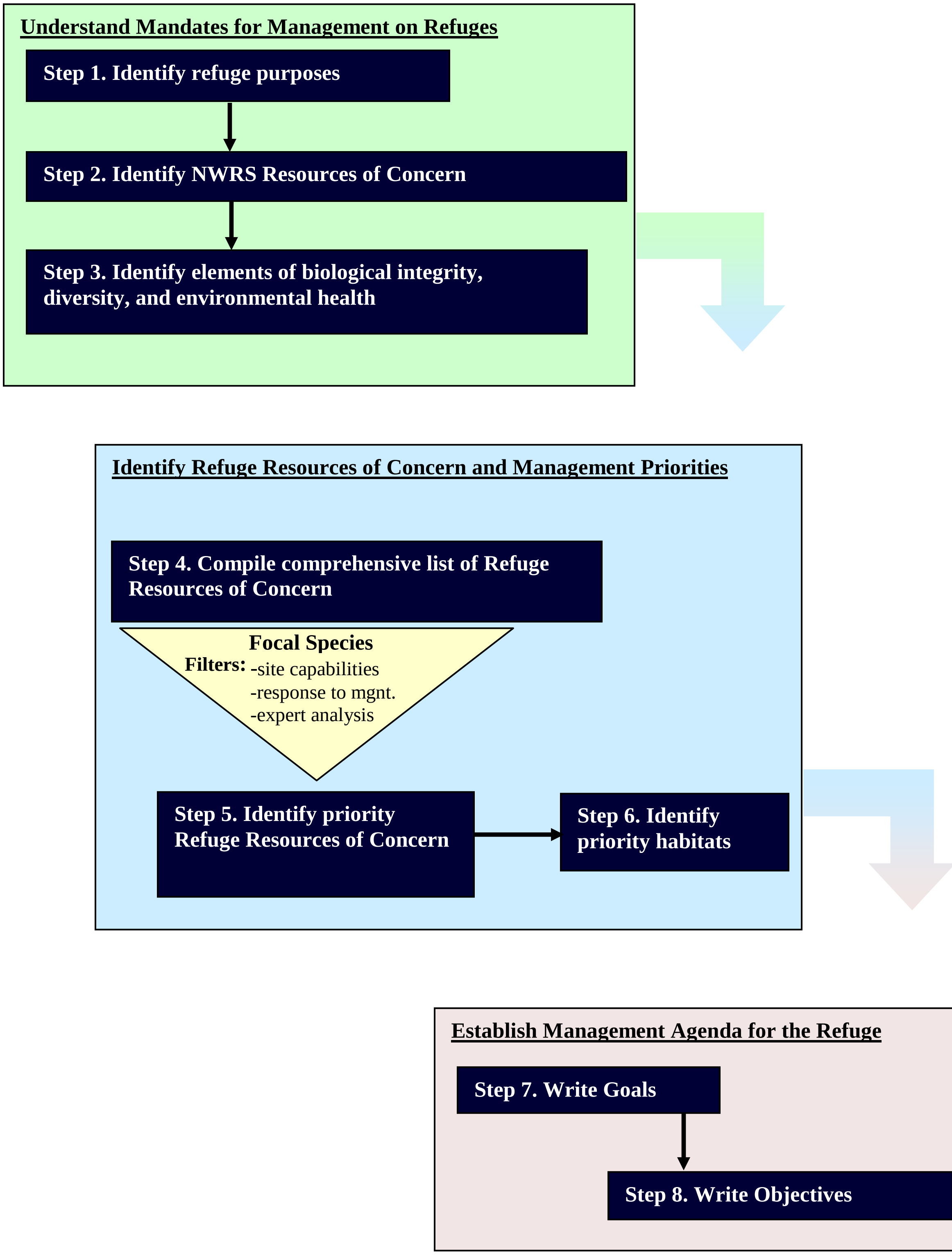
Limiting factors were also considered in developing objectives. A limiting factor is a threat to, or an impairment or degradation of, the natural processes responsible for creating and maintaining plant and animal communities. In developing objectives and strategies, the team gave priority to mitigating or abating limiting factors that presented high risk to ROCs. In many cases, limiting factors occur on a regional or landscape scale and are beyond the control of individual refuges. Therefore, objectives and strategies may seek to mimic, rather than restore, natural processes. The structure of plant communities utilized by ROCs can be created, rather than restoring the original native species composition. For example, mowing and/or grazing may be used to maintain a desirable vegetation structure, when restoring native grassland communities may be impractical. Through the consideration of BIDEH, the Refuge 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.

Early in the planning process, the planning team cooperatively identified priority species for the Refuge, as recommended under the Service’s Habitat Management Planning policy (620 FW1). These ROCs frame the development of goals and objectives for wildlife and habitat. ROCs may be species, species groups, or features that the Refuge will actively manage to conserve and restore over the life of the CCP, or species that are indicators of habitat quality for a larger suite of species. Negative features of the landscape, such as invasive plants, may demand a large part of the refuge management effort, but are not designated as ROCs.

The main criteria for selecting priority ROCs included the following requirements:

- The resource must be reflective of the Refuge’s establishing purposes and the Refuge System mission;
- The resource must include the main natural habitat types found at the Refuge;
- The resource must be recommended as a conservation priority in the Wildlife and Habitat Management Review; or
- The resource must be federally or state listed as a candidate for listing, or a species of concern.

Figure 4-1. Overview of the process to prioritize resources of concern and management priorities for a refuge (USFWS 2008b).



Other criteria that were considered in the selection of the resources of concern included the following:

- Species groups and/or refuge features of special management concern;
- Species contributing to the biological diversity, integrity, and environmental health of the ecosystem;
- Species where it is feasible to estimate abundance (needed for future monitoring and adaptive management).

4.2.2 Priority Resources of Concern Selection

In preparing this plan, the Service reviewed other local, regional, and national plans that pertain to the wildlife and habitats of Bandon Marsh NWR (see Chapter 1). The Service also sought input from Oregon State conservation agencies, non-governmental organizations, and the general public. The refuge purposes, as stated in the enabling legislation for each refuge (see Chapter 1) were carefully reviewed as was the Refuge's contribution to maintenance of BIDEH (Appendix E) within the ecoregion. As a result of this information gathering and review process, a comprehensive list of potential ROCs was developed. From this list, those species and habitats that are most representative of refuge purposes and habitats, BIDEH, as well as other FWS and ecosystem priorities, were chosen as ROCs (habitat types) and focal resources (plant and animal species). Habitats selected as ROCs include: (1) Estuarine Habitats (Temperate Pacific Tidal Salt and Brackish Marsh, Temperate Pacific Intertidal Mudflat, and North Pacific Intertidal Freshwater Wetland), (2) Forested Wetland and Stream-Riparian Habitat (North Pacific Hardwood-Conifer Swamp, North Pacific Intertidal Freshwater Wetland, North Pacific Lowland Riparian Forest and Shrubland), and (3) Upland Forests (North Pacific Hypermaritime Sitka Spruce Forest). Vegetation type descriptions according to the International Terrestrial Ecological System Classification under development by NatureServe and its natural heritage program members (Comer et al. 2003, NatureServe 2012) are listed in parentheses.

Priority resources of concern and focal resources consist of habitats and species 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 the priority resources of concern. However, many native species that are present on the Refuge will also benefit. They are referred to here as other benefiting species. See Appendix E for a completed list of priority resources of concern, focal resources, and other benefiting species.

4.3 Estuarine Habitats

One goal of the Refuge System is to conserve and restore, where appropriate, critical ecosystems and ecological processes characteristic of those ecosystems. One such critical ecosystem in the Pacific Northwest and elsewhere includes estuaries and the associated tidal wetlands. Tidal wetlands are of high ecological importance and are considered essential habitat for many marine and anadromous fish, crabs and other shellfish, and migratory birds (ODFW 2006, Seliskar and Gallagher 1983). In Oregon's seventeen largest estuaries, tidal wetland acreage has declined considerably based on pre-European-settlement (pre-1850s) estimates. Fourteen of these estuaries have experienced tidal wetland decreases of 40 percent or more (Good 2000). The Coquille River estuary has suffered the largest percentage loss of tidal marsh habitat in Oregon at 95% (Brophy 2011 using Scranton 2004 and Hawes et al. 2008). Consequently, federal, state, and local jurisdictions consider tidal wetlands a high priority for protection, enhancement, and restoration, and many have established programs to conserve or restore this critical resource (e.g., OWJV 1994, ODFW 2006).

4.3.1 Description of Salt Marsh and Intertidal Mudflats

Salt marshes and estuaries occur where freshwater rivers meet the salty waters of the ocean. This dynamic habitat is greatly influenced by twice daily tidal flooding that affects the water levels, salinity, temperature and the amounts of sunlight penetration, which in turn relates to oxygen levels. Salt marshes provide food and nursery areas for numerous young fish, crabs, shrimp, clams, and other invertebrates when flooded (USFWS 1990b). Plant communities indicative of a salt marsh or tidal wetland include Lyngby's sedge, seashore saltgrass, pickleweed, Pacific silverweed, and tufted hairgrass. These plant communities are often associated with unaltered estuarine tidal wetlands in Oregon (USFWS 2006). Desired conditions of salt marsh are characterized by the following attributes:

- Diverse elevations ranging from about 3 feet below MLLW to 9 feet above MLLW for tidal flats and tidal marshes. Hydrological flows are affected by high flows in the rivers and tidal cycles.
- Subtidal and low elevation estuarine habitats include channel and slope bottoms and have open water above them.
- Low marsh vegetation is a mosaic of species including salt grass and pickleweed.
- High marsh vegetation includes Lyngby's sedge, slough sedge, tufted hairgrass, Pacific silverweed and Henderson's checkermallow.
- Tidal channels are highly branched, sinuous, and deep-sided of different orders with a large woody debris component.
- Completely submerged during high river flows and seasonal tidal cycles
- No *Spartina* species
- No nutria or other non-native mammals (e.g., red fox)

Diked pastures within the lower Coquille watershed are former salt marshes, which have been cut off from tidal action by the construction of levees but may retain the attributes of freshwater wetlands. Acting as a transition zone between aquatic and terrestrial sites, salt marshes and diked marshes are examples of natural vs. manipulated habitat that are in the former case, beneficial and in the latter case, detrimental to wildlife resources. Natural (undiked) marshes provide shoreline stability against wave and wind erosion, reduce flood peaks, trap nutrients, sediment, and pollutants, and sequester carbon. As one of the most productive ecosystems on earth, tidally influenced salt marshes are highly important to fish, wildlife, and society.

Intertidal mudflats are substrates flooded and exposed by tidal action. Each type of mudflat (sand, mud, gravel or combination of these) has a slightly different plant and animal composition. Algae and diatoms are the principal plant types; vascular plants are rare or absent. Species such a native eelgrass are rare within the lower Coquille estuary's mudflats, but bands of widgeon grass are common along the margins of the flats. These native intertidal grasses and algae are important habitat components within mudflats for a multitude of native fishes, smaller forms of gastropods, bivalves and crustaceans (Swayne 2004), and waterfowl. Intertidal mudflats are characterized by the following attributes:

- Diverse elevations ranging from about 3 feet below MLLW to about 4 feet MLLW that is completely inundated during two daily tidal cycles.
- Mosaic of tidal channels of variable orders that can remain inundated depending upon the seasonal tides and elevations.
- Sandy/muddy substrate that is sparsely vegetated by widgeon grass and seasonal algae blooms.
- Presence of large woody debris
- Presence of bio-film on muddy substrate
- No Japanese eelgrass
- No cordgrass (*Spartina spp*.)

4.3.2. Historic and Current Distribution

The Coquille also is one of the most extensively diked and drained estuaries of the Oregon coast, suffering a 94% loss in tidal marshes and swamps from 1870 to 1970 (Good 2000). Revised estimates by Brophy (2011) using Scranton (2004) and Hawes et al. (2008) indicate a 95% loss of tidal marsh and 93% loss of tidal swamp within the estuary. The Bandon Marsh Unit is one of the few remaining natural salt marsh ecosystems in the state of Oregon. This 289-acre salt marsh represents 3.3 percent of Oregon's fourteen major estuaries (USFWS 1980). The 582 acres within the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge provided an important opportunity for large-scale restoration of tidal wetlands. Restoration of the Ni-les'tun Unit resulted in a more than 400-acre net increase in tidal wetland habitat in the Coquille Estuary and an additional 4.3 percent of estuary within the state. Together, the Bandon Marsh NWR units represent 7.6 percent of Oregon's estuary habitat.

Most of the historic salt marsh in the lower watershed that has been diked is now in a hydrological condition such that it would be classified as palustrine emergent seasonally flooded diked wetland (Cowardin et al. 1979). The National Wetland Inventory maps most of the lower Coquille as freshwater emergent wetland. Regardless of classification, the habitat quality of these freshwater wetlands has been degraded by more than 100 years of grazing and dewatering and the wetlands are affected by a preponderance of non-native plant species.

4.3.3 Refuge-specific Sites

The only remaining large natural salt marshes in the lower Coquille watershed are located within Bandon Marsh NWR. The Refuge contains 650 acres of salt marsh (Figure 2-1). The salt marsh habitat of the Bandon Marsh Unit is a natural system that supports salt tolerant plant species such as tufted hairgrass, pickleweed, three-square bulrush, seaside arrowgrass, Lyngby's and slough sedge, Pacific silverweed, and Baltic rush. These plant communities are often associated with unaltered estuarine tidal wetlands in Oregon.

Historically, the diked marshes of the Ni-les'tun Unit were maintained for nearly 100 years (late 1800s or early 1900s to 2011) as pasture for cattle grazing and agricultural purposes. The Ni-les'tun Unit was a mixture of native and non-native plants that existed in a semi-disturbed unnatural ecological regime and habitat (Brophy 2005). Artificial levees and ditches were constructed in the past for the purpose of creating dry agricultural pastures from tidally influenced wetland. In 2011, the artificial levees and tidegates were removed to allow a natural tidal regime to re-establish within a newly created system of tidal channels. During the agricultural period, non-native plants for dairy and cattle forage were planted; hence, the ongoing transition from degraded wetlands, un-maintained pastures, and ditches that supported a mix of native and nonnative plants, to a more natural tidally influenced habitat rich in high salinity tolerant plants. Within the Ni-les'tun Unit there is a mixture of non-native species including creeping bentgrass, tall fescue, and reed canarygrass and the native plant species found within the Bandon Marsh Unit.

A large portion of the intertidal habitat within Bandon Marsh NWR is comprised of intertidal mudflats. The Refuge contains approximately 100 acres of intertidal mudflat, located primarily at the Bandon Marsh Unit (Figure 2-1).

4.3.4 Condition, Trends, and Threats

Based on historic vegetation mapping, the Bandon Marsh Unit appears to have developed only in the past 150 years (Brophy 2005). Increased sediment loads from timber and agricultural practices in the Coquille River watershed, as well as hydrologic changes such as construction of the Highway 101 Bullard's Bridge in 1954 and historic diking of upstream pastures, may have contributed to this rapid accretion of new salt marsh. Historic riverine and estuary wetlands would have slowed floodwaters and retained large amounts of sediment. After diking, higher quantities of sediments could have been flushed downstream during flood events, later to be deposited along the edge of the wide riverbed in the vicinity of the Bandon Marsh Unit. The accretion rate of sediments in the past 50 years has continued to be high (Jones et al. 2012). The plant communities and soil characteristics at the Bandon Marsh Unit support its characterization as a young, dynamic marsh (Brophy 2005). Comparison of current plant communities to mid-1970s description of the marsh described as "low sand marsh" are now occupied by the plant community classified as "immature high marsh," dominated by a broad mixture of low and high marsh species including pickleweed, Lyngby's sedge, seashore saltgrass, and tufted hairgrass (Brophy 2005, Jefferson 1975).

In 2011, the Ni-les'tun Unit was restored, allowing the natural processes of tidal flow and sediment deposition to return to the former diked pastures where tidal flows had been blocked for nearly 100 years. The goal of this large-scale restoration effort was to restore natural processes (tidal exchange, salinity, natural temperature regimes), which in turn create the desired terrestrial and aquatic habitats, allowing native fish, wildlife, plant and invertebrate species to return to the site. The restoration project reconnected tidal flows to over 400 acres, filled nearly 15 miles of drainage ditches, restored and created over 5 miles of meandering tidal channels. The project also removed nearly 2 miles of dikes and three tidegates that blocked the tides from entering the historic wetlands and two freshwater salmonid-bearing streams. The creation of sinuous tidal channels and re-meandering of straight-line ditched tributary creeks is now allowing unimpaired conveyance of sediment from the project area to the Coquille River and tidal sediment deposition onto the Ni-les'tun Unit. The increase in tidal sediment deposition and the likelihood of increased inundation creates an eventual rise in land elevation and a return to anoxic soil conditions, which promotes the formation of productive wetlands and mudflats for fish and wildlife habitat.

Current fish and wildlife species composition of the Coquille River estuary is similar to that of 100 - 150 years ago, but with much greater reduced populations. Monitoring fish and wildlife and their habitat at both refuge units has focused on documenting key physical and biological functions integral to the salt marsh ecosystem. Refuge monitoring of key components measures responses by biological communities to large-scale management actions. Monitoring helps managers analyze linkages between restoration actions, recovery of site structure and function, native species recovery, and non-native species abundance and distribution. The results from these efforts are broadly disseminated to assist in developing restoration plans and management for others within the estuary management community (e.g., private and public land managers). In addition, the short-term objective of these monitoring efforts is to determine the extent to which the management action has achieved its goal and to make recommendations for adaptive management should monitoring results indicate the need.

Specific salt marsh monitoring parameters have included marsh surface and channel morphology (Guntenspergen et al. 2009, Witter et al. 2003, Adamus 2005), plant communities (Brophy 2005, Bilderback and Bilderback, personal communication), non-native and invasive plant species (Dudoit 2006, Bilderback and Bilderback, personal comm.), salmonid populations and behavior (Hudson et al. 2010, van de Wetering unpublished data), avian populations and habitat use (Castelein and Lauten 2007, Hodder and Graybill 1984, USFWS unpublished data), macro invertebrates (van de Wetering, personal communication), and nutrient transport, site productivity and water quality (EPA unpublished data, Punke 2005).

The Clean Water Act of 1972 and the Safe Drinking Water Act of 1974 are the main statues regulating water quality in the United States. These acts are administered by the Environmental Protection Agency (EPA). Recent amendments to these acts, including the creation of the National Estuary Program as part of the 1987 Clean Water Act amendment, further direct the EPA and the State of Oregon to manage the Coquille River watershed in a comprehensive manner and to identify and assess nonpoint sources of pollution. The Oregon Department of Environmental Quality has identified waters that do not meet water quality standards under Section 303(d) of the Clean Water Act. The waters identified are considered to be “water quality limited.” In the 2002 and 2004/2006 reporting cycles the Coquille River was listed as “water quality limited” because it exceeded the total maximum daily load of pollutant a waterbody can contain (ODEQ 2011). The Coquille River is affected by nonpoint source pollution from water-based or land use activities including atmospheric deposition; surface water runoff from agricultural lands, urban areas (Bandon, Coquille, and Myrtle Point), and forest lands; subsurface and underground sources; and discharges from boats. These pollutants include aquatic weeds or algae, E. coli bacteria, fecal coliform bacteria, chlorophyll, levels of dissolved oxygen, pH, sedimentation, temperature, total dissolved gas, toxic substances, and turbidity. The waters within the boundary of Bandon Marsh NWR were not assessed by the state under the Clean Water Act and were not listed as impaired. The threat of impaired waters within Bandon Marsh NWR is of concern, as these waters must be of sufficient quality to support aquatic species without detrimental changes in resident biological communities.

In 2010, the presence of non-native nutria was documented at Bandon Marsh (USFWS unpublished observations). Native to South America, this semi-aquatic mammal is tolerant of mild coastal winters. Nutria is known to be expanding their range in southern coastal Oregon and within the Coquille River system (Sheffels and Sytsma 2007, Stuart Love, ODFW, personal communication). This rodent is capable of extensive damage as a result of its foraging and burrowing behaviors, which adversely impact the root mass of wetland plants that holds the wetland together. In addition to direct habitat damage to salt marshes and competition with native species (e.g., muskrat, beaver), this large rodent is capable of transporting parasites and pathogens communicable to wildlife, domestic animals and humans (Sheffels and Sytsma 2007). The high reproductive rate of the animal is a concern, as one breeding pair can result in a population of more than 16,000 after only 3 years and if left unchecked the numbers are capable of increasing to tens of thousands within a 30 year period (Sheffels and Sytsma 2007, CBNWG 2003).

The continued threat of contamination by a variety of persistent, bioaccumulative toxic chemicals and oils used in wood treatment, transportation, and processing of natural resources has been documented in the soils, sediments and animals adjacent to the Bandon Marsh Unit (Thomas et al. 1997). These toxic chemicals include trace elements and heavy metals such as cadmium, chromium, iron, lead, copper and nickel as well as total and congener-specific polychlorinated biphenyls (PCB), dioxins and furans, polyaromatic and aliphatic hydrocarbons, total petroleum hydrocarbons and pentachlorophenol. While primarily concentrated in areas around urban and industrial developments, these contaminants affect a much larger area of the ecosystem. When resident or migratory organisms live or eat within these areas of contamination, not only are they directly harmed, but they accumulate contaminants in their tissues and transfer them throughout the food web.

Large scale oil spills from offshore tankers, road gas and oil transport, as well as smaller spills from recreational and commercial boat use within the watershed, can have dramatic and significant adverse impacts (Pezeshki et al. 2000). For the lower Coquille River estuary's salt marsh and mudflats, these adverse impacts are heightened because the inherently low wave energy of the salt marsh does not physically remove oil effectively. Bandon Marsh is flooded twice daily at high tides and the complex surface of the salt marsh can trap large amounts of oil. Once these habitats are impacted by oil spills, the effort to combat the spill in many instances causes extensive damage to the habitat (Sell et al. 1995) and if heavily impacted with oil, the dense vegetation and complex structure of the marsh elongates the recovery time (Teal et al. 1992). In addition to habitat damage, the contamination of fish and wildlife by oil can have direct impacts such as mortality of animals due to smothering and toxic effects, as well as indirect adverse effects and more subtle long-term negative consequences. Oil can affect estuary-dependent marine and anadromous fish populations by both direct toxicity and by a reduction in the benthic species on which they feed (NAS 1985). Migratory and resident seabirds, shorebirds, wading birds and waterfowl that congregate on Bandon Marsh may suffer from destruction of breeding and feeding grounds.

Historic use of the Coquille River and southern Oregon estuaries for the maritime industries and aquaculture has introduced and been a vector for the transport of marine invasive species which threaten the biological diversity of Bandon Marsh (Bax et al. 2003). Due to difficulties in monitoring and jurisdictional controls, marine invasive species are some of the newest and least understood threats to Bandon Marsh NWR. Invasive plants and invertebrates such as Japanese eelgrass, smooth cordgrass, Asian tunicate, lacy crust bryozoan, Japanese orange-striped sea anemone, Harris mud crab, European green crab, Chinese mitten crab, New Zealand burrowing isopod, New Zealand mud snail, Griffen's isopod, and a variety of Asian and eastern United States clams have been recorded within the southern Oregon estuaries and within the lower Coquille watershed (Dudoit 2006, Bilderback and Bilderback personal communication, Davidson et al. 2007, USGS 2009). Many of these species have infested large areas along the outer coast of Oregon and removal has been costly. The refuge staff has begun monitoring for cordgrass and ODFW plans to expand monitoring efforts to include other exotic marine invertebrates, particularly at the nearby boat docks and marinas within the lower watershed.

A non-native invasive marine grass, Japanese eelgrass, was first observed in 1992 on the Refuge. It is currently rare at Bandon Marsh but can be found in small isolated patches along the edge of the Coquille River within both refuge units and may have an effect on native benthic communities (Dudoit 2006, Crombie 1993, Posey and Rudy 1987). Bandon Marsh NWR is the only major Oregon estuary in which Japanese eelgrass does not form contiguous meadows (Dudoit et al. 2006).

Alteration and management of the state-owned banks and waters within the Coquille River estuary is delegated to the Department of Land Conservation and Development (DLCD). Through the Land Use Planning Act, the DLCD works with and oversees the Port of Bandon and City of Bandon comprehensive plans that incorporate applicable planning goals (e.g., Goal 16 Estuary Resources) for the estuary. The Bandon Comprehensive Plan recognizes the Coquille River estuary (including Bandon Marsh NWR) as a Shallow Draft Development Estuary and the Plan requires that activities and uses remain consistent with the shallow-draft development designation and the estuarine management unit requirements of Goal 16 (City of Bandon 2011). The City protects and implements control of allowed uses and activities in the estuary through the Bandon Municipal Code (Chapter 17.64, Water Zone). Without these protection and conservation measures, the threat of adverse alterations would potentially affect the dynamic, natural, geological, and evolutionary processes of the estuary.

4.3.5 Key Species Supported

The estuarine salt marsh and tidal flats of Bandon Marsh NWR contain rich beds of algae, marine invertebrates and plant life that support hundreds of wading birds, thousands of migratory waterfowl and hundreds of thousands of shorebirds, which in turn provide an important prey base for numerous raptors (i.e., birds of prey) including the recently delisted bald eagle and the peregrine falcon (Hodder and Graybill 1984, Castelein and Lauten 2007, USFWS unpublished data). In addition, the sinuous tidal channels and mudflats, twice flooded by daily tides, provide essential habitat for numerous marine species of fish including flounders, English sole, and shiner perch, as well as important nursery habitat for anadromous species such as Chinook and coho salmon, steelhead, and coastal cutthroat trout (USFWS and FHA 2009).

Invertebrates such as snails, shrimp, clams, worms, and crabs are locally common or abundant (Simenstad 1983). The most common and important invertebrate species occupying the Bandon Marsh NWR mudflats include Dungeness crab, softshell clams, ghost shrimp, mud shrimp, and a variety of worms (Rudy and Rudy 1983, USFWS unpublished observations). Ghost and mud shrimp within the tidal flats, which are important filter feeders that affect water quality, are also being invaded in Oregon’s estuaries by a non-native species, a predator called Griffen’s isopod (USGS 2009). The direct effect on the food chain from the loss of the ghost shrimp is unknown, but is indicative of change with increased human actions and climate change. Wading birds such as great blue heron and great egret, and shorebirds such as black-bellied plover, killdeer, least and western sandpiper, dunlin, and long-billed and short-billed dowitcher make extensive use of the mudflats for foraging on macro-invertebrates and in some cases biofilm (Mathot et al. 2010, Skagen and Oman 1996). Dabbling ducks and diving ducks, gulls, and raptors such as northern harrier, peregrine falcon, and bald eagle also forage there (USFWS 2011a, Castelein and Lauten 2007, Hodder and Graybill 1984). Harbor seals forage within the waters that are present over the mudflats when they are inundated at high tide and in the lower bay they haul out on the low marsh edges to rest during the day.

4.4 Forested Wetland and Stream-Riparian Habitat

4.4.1 Description of Wet-Mesic Sitka Spruce-Western Hemlock Forest

For the purposes of this CCP, wet-mesic Sitka spruce-western hemlock forests are defined as woody habitats that consist of valley forested wetlands and riparian forest along rivers, salt marsh, or mudflats (e.g., National Vegetation Classification Standard *Tsuga heterophylla - Picea sitchensis*/*Lysichiton americanus* Hardwood-Conifer Rich Swamp Group, NatureServe 2012). Periodic freshwater tidal and/or seasonal riparian flooding are the major natural processes that drive this system. Soils are perennially wet, usually with high organic content.

Historically, many of the areas located in the lower brackish (mesohaline to oligohaline) and freshwater tidal zones of Oregon's estuaries were likely Sitka spruce and/or shrub tidal swamp. Tidal swamps were also found on the margins of the marine salinity zone where freshwater dilutes ocean water, such as along tributary streams, on high natural levees, and in hillslope seepage zones. On higher quality, least-disturbed remnant tidal Sitka spruce swamp sites, this community has scattered to abundant Sitka spruce, often growing on islands such as downed timber and natural levees along deep well-defined tidal channels, and a mixed herbaceous-woody understory. The vegetation between forested islands or along waters' edges consists of typical high marsh or tidal freshwater wetland species like tufted hairgrass, creeping bentgrass, Pacific silverweed, Baltic rush, slough sedge, and skunk cabbage as well as brackish-tolerant wetland shrubs such as red-osier dogwood, Nootka rose, dewberry, salmonberry, black twinberry, Pacific crabapple, and Hooker willow (Brophy 2002, NatureServe 2012). Non-wetland species such as salal and huckleberry can also be fairly abundant, growing on fallen logs or spruce root platforms elevated well over the hydric soil surface. Riparian red alder is also present and is important for its role in improvement of soil nutrient cycling and soil microbiology. Tree roots stabilize river banks and help prevent erosion. Alder also adds organic matter and nutrients to the river and keeps waters cool through shading. Cool water temperatures and cover are essential for fish spawning and survival (USFWS 1990b).

The wet-mesic forests and woodlands on Bandon Marsh NWR typically consist of mixed patches of forest that contain second growth red alder, Sitka spruce, western hemlock, and a small amount of Port Orford cedar. The understory is rich with shade-tolerant shrubs and ferns, including brackish-tolerant wetland shrubs such as black twinberry, cascara, Pacific crabapple, wax myrtle, Hooker willow, salal, evergreen huckleberry, sword fern, skunk cabbage, and deer fern, as well as a high diversity of mosses and lichens (Brophy 2005, Brophy and van de Wetering 2012). The disturbance regime is mostly small-scale windthrow or other gap mortality processes (though there are occasional widespread intense windstorms) and very few fires. Many of the snags in this community are Port Orford cedars that have been adversely affected from a root disease caused by cedar root fungus. Origin of the root disease is unknown, but the complete susceptibility of Port Orford cedar suggests that the fungus evolved outside the native cedar range, perhaps in Asia.

The desired attributes of wet-mesic Sitka spruce-western hemlock forest (i.e., forested wetland and stream-riparian habitats) are the following (based on Brophy 2009, Brophy et al. 2011, Brophy and van de Wetering 2012, NatureServe 2012):

- Periodic freshwater tidal and/or seasonal riparian flooding
- Flat topography with local microrelief caused by logs, stumps, and buttressed roots of spruce trees.
- High organic content of soils (>20% organic matter)
- Woody vegetation dominated by native trees and shrubs (e.g., Sitka spruce, red alder, Hooker willow, Sitka willow, twinberry, Pacific crabapple). Dominant herbaceous species include slough sedge and skunk cabbage with non-wetland species (e.g., salal, huckleberry) growing on fallen logs or spruce root platforms.
- <5% cover of invasive plants (e.g., blackberry, gorse, Scotch broom)

- No English ivy

4.4.2. Historic and Current Distribution

Sitka spruce is commonly referred to as "tideland spruce" in historical documents due to its prominence in tideland areas of Oregon and Washington (Franklin and Dyrness 1988). Sitka spruce forms the canopy of the only major type of tidal forest in Oregon, the spruce tidal swamp. Tidal swamps were historically located in a narrow elevation band at the upslope margin of emergent tidal marsh. Once extensive, spruce tidal swamp is now rare in Oregon. Estimates by Brophy (2011) using Scranton (2004) and Hawes et al. (2008) indicate a 90% loss of tidal swamp within Oregon's estuaries. It is likely that areas along the margins of the Coquille River estuary and the middle Coquille River were once spruce tidal swamp, but like most of Oregon's tidal forest lands, these areas have probably been filled, diked, or cleared of trees for agricultural fields and urban growth areas (Brophy 2005).

4.4.3 Refuge-specific Sites

Bandon Marsh NWR contains 79 acres of wet-mesic Sitka spruce-western hemlock forest along the fringes of the Coquille River, small tributaries of Fahys and Redd creeks, salt marsh and mudflats (Figure 2-1), with the majority of the acreage being located on the Ni-les'tun Unit. Additionally, the former cranberry bogs on the Smith Tract (11 acres) were recontoured and hydrologically restored to Fahys Creek and the area planted with a mixture of Sitka spruce and other riparian trees and shrubs (e.g., willows, vine maple, crabapple, twinberry, huckleberry) in 2010-2011. Historically, the Ni-les'tun Unit had an unknown greater percentage of this plant community. The current straight-line edges of the forest are indicative of logging, ditching and draining of this forest type for the development of pasture.

Recent logging activities within the Bandon Marsh Unit boundary occurred in 1991-1992 just prior to the acquisition of 17 acres of forested wetland by the Service. This habitat was re-forested with Sitka spruce seedlings by the Service and volunteers from Shoreline Education for Awareness (William Russell, personal communication).

4.4.4 Condition, Trends, and Threats

All of Bandon Marsh's wet-mesic Sitka spruce-western hemlock forest has been logged or converted to pasture. A few remaining large diameter (>36 inches DBH) Sitka spruce exist scattered in both the Bandon Marsh and Ni-les'tun Units. Most of the existing timber is second growth or in some cases third growth (<36 inches DBH). The understory has reestablished itself into a lush mixture of wet tolerant shrubs, ferns, and skunk cabbage, interspersed with remnant stumps of old growth trees. The stumps in many cases are becoming nursery logs for a variety of shrubs and in some cases new growth of Sitka spruce. In addition, much of the forest is littered with downed and decaying layers of small diameter (<12 inches) timber and shrubs that are being out-shaded by large stature timber.

For the past 100-150 years non-native invasive plants on Bandon Marsh NWR have been introduced inadvertently or intentionally as pasture grasses, soil stabilizers or as ornamentals. These invasive species are generally found along the edges of disturbed forest habitat due in large part their intolerance to the shaded conditions within the forested canopy. The non-native species include reed canarygrass, tall fescue, creeping bentgrass, Canada thistle, Himalayan blackberry, gorse, English ivy, and Scotch broom (Brophy 2005, Bilderback and Bilderback, personal communication). This list is not all inclusive and includes only the most problematic species; many other exotic plants have been introduced.

4.4.5 Key Species Supported

The riparian forest patches and the forested wetlands support large mammals such as black-tailed deer, and occasional Roosevelt elk, black bear and mountain lion. Small mammals including bobcat, gray fox, beaver, mink, river otter, striped skunk, raccoon, deer mouse, and vagrant shrews are common in the forest and along its edges. Amphibians and few reptiles are found in this wet-mesic habitat and include Pacific giant, northwestern, ensatina, and western red-backed salamanders, rough-skinned newt, chorus (Pacific tree) frog, southern alligator lizard, and garter snake (Mercer 2005, Kocourek 2006b, Wishnek 2011). The forest areas are also home to common Northwestern forest passerine species such as chestnut-backed chickadee, varied thrush, hermit thrush, and pileated woodpecker. Birds dependent on water and forest edges such as great blue herons, belted kingfisher, wood duck, Pacific wren, and yellow-rumped warbler can be found in this habitat (Hodder and Graybill 1984, Castelein and Lauten 2007, USFWS unpublished data).

4.5 Upland Forests

4.5.1 Description of Sitka Spruce–Western Hemlock Forest

Sitka spruce and western hemlock are the principal components of the Pacific Northwest coastal fog belt type or the *Picea sitchensis* zone found along the Oregon and Washington coasts. The tremendous potential for rapid growth and high yield of the Sitka spruce-western hemlock type ranks it among the most productive coniferous types in the world (Smith et al. 1984).

In this area of the southern Oregon coast, forest canopy is dominated by Sitka spruce, often with low to moderate cover of western hemlock, grand fir, western red cedar, or Port Orford cedar. The most prevalent broadleaf is the red alder. The understory is rich with shade-tolerant shrub, forb, and fern species including Pacific wax myrtle, salmonberry, thimbleberry, salal, evergreen huckleberry, red huckleberry, and Pacific sword fern. The composition of the moderately developed moss layer varies with the moisture regimes with more feather mosses on drier sites and more leafy mosses on wetter sites (NatureServe 2010). The desired attributes of this forested habitat include:

- 30-95% (73% average) canopy cover of Sitka spruce and western hemlock with DBH >24-36 inches with multiple distinct canopy layers also including grand fir, western red cedar, and/or Port Orford cedar.
- 25-95% (83% average) cover of a mosaic of native shrubs (e.g., salmonberry, huckleberry, salal, wax myrtle), ferns, and herbaceous species (e.g., sedges) in understory. Shrub height averages 3 meters (10 feet).
- 6/acre density of snags
- One tree per acre with significant structural defect or decadence (e.g., cavities, snapped top, mistletoe/fern infestation)
- 600+ square feet per acre density of downed logs/nurse logs of varying decay classes
- <5% cover of invasive plants (e.g., blackberry, gorse, Scotch broom)
- <1% English ivy

4.5.2. Historic and Current Distribution

Sitka spruce-western hemlock forests occur in the mountains of the Queen Charlotte Islands, the mountains and lowlands of western and northern Vancouver Island and along the outer coast and windward slopes of the Coast Mountains and Kitimat Ranges of British Columbia, at low elevations on the western Olympic Peninsula and western Willapa Hills of Washington, along a narrow outer coastal strip in Oregon, and just barely into the northwestern Cascade Range of Washington. It occurs on all slope positions on gentle to steep slopes on all aspects. At the south end of its range, it tends to occur more commonly on middle slopes (NatureServe 2010). Forests dominated by western hemlock and Sitka spruce hug the fog belt along the Oregon coast, seldom reaching more than a few miles inland or a few hundred feet above sea level. Both species are shade tolerant, but Sitka spruce is more resistant to salt spray. Sitka spruce sometimes grows in pure stands but is more commonly mixed with western hemlock, western red cedar, Douglas-fir, red alder, and lodgepole pine (commonly called shore pine along the coast).

4.5.3 Refuge-specific Sites

39 acres of Sitka spruce-western hemlock forest currently exist occurs on the Ni-les'tun Unit of Bandon Marsh NWR (Figure 2-1). Approximately 29 acres of former pasture will be restored to Sitka spruce-western hemlock forest. All of the forested areas of Bandon Marsh NWR are within the Sitka spruce zone (Franklin and Dyrness 1988), which often extends only a few kilometers inland along the Pacific coast. This zone transitions into and is a variant of the western hemlock zone, and is distinguished by the occurrence of Sitka spruce and frequent summer fog. The forested community on Bandon Marsh NWR is unique since it is located at the southern end of the range for Sitka spruce and the northern extent of the limited range of Port Orford cedar. The management goal is to assist the development of natural ecological processes that would produce late successional or old growth forests.

4.5.4 Condition, Trends, and Threats

Sitka spruce-western hemlock forests are among the most productive in the world and have been extensively managed for timber production. Harvest of old-growth and mature forests for commercial timber and paper production has resulted in loss of species diversity and forest complexity on most of the landscape due to planting of even-aged, monotypic stands, and short harvest rotations.

Threats facing this habitat type include climate change, invasive species, and insect or disease infestation. Response to climate change will vary according to regional and local topography, forest type, soil moisture, productivity rates, species distribution and competition, and disturbance regimes.

Natural disturbance is primarily windthrow resulting in small gaps and an all-aged stand structure. Forest regeneration is usually rapid and forest openings can quickly develop a dense canopy of young trees with sparse understory vegetation. Other small gaps may result from insect-caused mortality or root-rot. Historically fire was a very rare occurrence, occurring approximately every 4,000 years on average (Lertzman et al. 2002). Human-induced wildfire is a potential catastrophic threat to forested habitats as well as fire suppression. Conversion of habitat to residential and non-forest uses has accelerated forest fragmentation. Introduced invasive plants (e.g., English ivy and holly) pose a significant threat to forested habitats on the Refuge. Potential insects or diseases that could affect the Refuge's forests include aphids, scale and bark beetles, root rot, leaf cast, and other fungi.

The upland forests on Bandon Marsh NWR have not been actively managed for wood production since the mid 1970-80s, when the land was under private ownership. This discontinuation of timber removal, combined with the spread of the cedar root fungus that is decimating Port Orford cedar stands on the southern Oregon coast, results in the Refuge becoming an important remaining example of this forest type.

4.5.5 Key Species Supported

The current Sitka spruce forests within the Refuge provide foraging habitat for black-tailed deer, black bear, and bobcat, as well as habitat for band-tailed pigeon, northern flicker, pileated woodpecker, pacific-slope flycatcher, American robin, Swainson's thrush, varied thrush, cedar waxwing, and house finch. Forest regeneration on the Refuge is rapid, and forest openings can quickly develop a dense canopy of young trees with sparse understory vegetation. Many species of birds, such as great horned owl, western screech owl, hairy woodpecker, Steller's jay, American crow, chestnut-backed chickadee, red-breasted nuthatch, and Pacific wren use the conifer forest because of the presence of bark, wood-boring insects, and conifer seeds. Many species of amphibians occur because of the damp litter on the floor of mature forests, including northwestern salamander, western red-backed salamander, and Ensatina salamander. The Pacific giant salamander and southern torrent salamander both require cold mountain streams or seeps in old growth or undisturbed forests as breeding habitat, and damp litter on the forest floor to survive as metamorphosed adults.

4.6 Salmonids

The Coquille watershed is a productive fishery resource for the state of Oregon (Good et al. 2005) and the open water environments are critical to the important fisheries of the Coquille River system. The mixing of fresh and salt waters within the estuary permits anadromous fish to adjust to the change in salinity and temperatures as they pass to and from the ocean environment. Anadromous fish spawning and rearing in the Coquille system include spring (rare) and fall Chinook salmon, coho salmon, summer and winter steelhead, coastal cutthroat trout, and Pacific lamprey. Seasonal migrations of anadromous fish result in year round use of the Coquille watershed by adult salmon. In addition, resident coastal cutthroat trout are found throughout the watershed.

Conserving and restoring salmonid populations is an important goal, not only for their own sake, but also because of their cultural, historical, and ecological value. Salmonids are an important food source for numerous other wildlife species. Sixty-seven wildlife species of the Pacific Northwest, including many known to inhabit the Refuge, have been known to have a "strong" or "recurrent" relationship with salmon (Cederholm et al. 2000). Salmon play an important ecological role in the transport of energy and nutrients between the ocean, estuary, and freshwater streams, supporting overall ecosystem health. All life stages provide nutrients and energy needed for healthy stream ecosystems. Today, only three percent of the marine-derived biomass once delivered by anadromous fish is currently reaching those watersheds. Research on the consumption of salmon by vertebrate wildlife has documented 137 species of birds, mammals, amphibians, and reptiles are predators or scavengers of salmon. In coastal streams, marine derived nutrients from salmon carcasses increase the overall productivity of the system (Cederholm et al. 2000).

4.6.1 Description of Coho Salmon and Coastal Cutthroat Trout

The Oregon Coast coho salmon evolutionarily significant unit (ESU) found in the Coquille River system is listed as a threatened species under the Endangered Species Act (NOAA 2008). The size of an adult coho may measure more than 2 feet (61 centimeters) in length and can weigh up to 36 pounds (16 kg). However, the average weight of adult coho is 8 pounds (3.6 kg). Coho salmon have dark metallic blue or greenish backs with silver sides and a light belly and there are small black spots on the back and upper lobe of the tail while in the ocean. The gumline in the lower jaw is white while in Chinook salmon it is black. Spawning fish in inland rivers are dark with reddish-maroon coloration on the sides. Coho salmon adults migrate from a marine environment into freshwater streams and rivers of their birth in order to mate (called anadromy; i.e., anadromous). They spawn only once and then die. Adults return to their stream of origin to spawn and die, usually at around three years old. Some precocious males known as “jacks” return as two-year-old spawners. Spawning males develop a strongly hooked snout and large teeth. Females prepare several redds (nests) where the eggs remain for six to seven weeks until they hatch. As the time for migration to the sea approaches after spending a year in freshwater, juvenile coho salmon lose their parr marks, a pattern of vertical bars and spots useful for camouflage, and gain the dark back and light belly coloration used by fish living in open water. Their gills and kidneys also begin to change at this time so that they can process salt water. In their freshwater stages, coho feed on plankton and insects, and switch to a diet of small fishes as adults in the ocean (NOAA 2010). Parr have 8-12 narrow parr marks centered along the lateral line. The marks are narrow and widely spaced. The adipose fin is finely speckled, imparting to it a gray color, but the other fins lack spots and are tinted orange. They have 9-12 dorsal fin rays, 12-17 anal fin rays, and 9-11 pelvic fin rays. Lateral line scales number from 121-148 and the scales are pored. There are 11-15 branchiostegal rays on either side of the jaw. Gill rakers are rough and widely spaced, with 12-16 in the lower half of the first arch (Moyle 1976).

Throughout their native and introduced range, coastal cutthroat trout vary widely in size, coloration, and habitat selection. Though their coloration can range from golden to gray to green on the back, depending on subspecies strain and habitat, all populations universally feature distinctive red, pink, or orange marks on the underside of the lower jaw or below the gill plates; usually the easiest diagnostic of the species for the casual observer. These markings are responsible for the formation of the typical name “cutthroat.” At maturity, different populations and subspecies of cutthroat can range from 6 to 40 inches in length, depending on habitat and food availability, making size an ineffective indicator as to species identity. Anadromous cutthroat may reach weights of 20 pounds but those fish which remain permanently in fresh water may only reach a weight of 2 pounds (Eddy and Underhill 1978). Cutthroat will readily interbreed with the closely related rainbow trout, producing fertile hybrids commonly called “cutbow.” As this species generally bears similar coloration and overall appearance to the cutthroat, retaining the characteristic orange-red slash, these hybrids often pose a taxonomical difficulty (Connolly et al. 2008).

Coastal cutthroat trout exhibits anadromous, stream-dwelling, lake-dwelling, and headwater stream-resident life history forms. Anadromous fish spawn in small tributaries from late winter through spring, depending on the locality. Juveniles remain in streams for two or more years and congregate during their early months in habitats along stream edges. Later, they move to pools unless coho salmon are present, in which case they are driven to riffles. Most anadromous coastal cutthroat trout juveniles smolt are age 3 or 4 when they migrate to sheltered saltwater areas. Seaward migration peaks in May, and the fish remain close inshore while in salt water. The fish seldom overwinter at sea but return to rivers in the fall or winter of the year they go to sea. In some instances, these are overwintering migrations only, because anadromous female coastal cutthroat trout seldom spawn before age four. Stream-dwelling forms migrate to mainstem rivers or to lakes; otherwise, their life history characteristics are much like those of the anadromous form. Headwater stream-resident coastal cutthroat trout become sexually mature as early as age two, but seldom live beyond age four or five. These fish exhibit only limited instream movements and generally live out their lives within 200 meters (656 feet) of their birthplace (Trotter 1989).

4.6.2. Historic and Current Distribution

Coho salmon are a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from central California to Korea and northern Hokkaido, Japan. In the United States distribution is from Point Hope, Alaska to the San Lorenzo River in Santa Cruz County. The historic range of the coho in the lower 48 states included coastal streams of California, Oregon and Washington, plus the much larger Sacramento and Columbia river systems, reaching as far inland as Idaho. It also occurs in rivers throughout coastal British Columbia and western Alaska. Published investigations have reported that a number of local populations of coho salmon in Washington, Oregon, Idaho, and California have become extinct and that abundance and productivity of many others is depressed (Brown and Moyle 1991, Frissell 1993, Nehlsen et al. 1991, Good et al. 2005, NOAA 2008).

We have very limited direct information about the spatial structure of the Oregon Coast coho salmon populations. Previous analyses (Nickelson and Lawson 1998, Nickelson 2001) assumed that spawners from major river basins are largely isolated, and that each basin comprises at least one population. The Umpqua River is large and diverse enough to hold several populations, but for analysis purposes it was considered as one. Three coastal lakes, Siltcoos, Tahkenitch, and Tenmile, are considered to be a single population, but may actually be separate. Genetic analyses are being conducted to resolve these questions, but results were not available at the time of this review (Good et al. 2005). This is a change from the status review update in 1997 (Schiewe 1997), when the Oregon coast was considered to consist of four populations, called gene conservation groups. Three of these groups (north/mid coast, mid/south coast, and Umpqua) were in the Oregon Coast coho salmon ESU and the fourth (south coast) was in the Southern Oregon/Northern California Coast coho salmon ESU (Good et al. 2005).

The following ESUs are “likely to become endangered in the foreseeable future:” Snake River fall-run Chinook, Snake River spring/summer-run Chinook, Puget Sound Chinook, Lower Columbia River Chinook, Upper Willamette River Chinook, California Coastal Chinook, Central Valley spring-run Chinook, Snake River steelhead, Lower Columbia River steelhead, Upper Willamette River steelhead, Northern California steelhead, Central California Coast steelhead, South-Central California Coast steelhead, Oregon Coast coho, Southern Oregon/Northern California Coast coho, Ozette Lake sockeye, Hood Canal summer-run chum, and Lower Columbia River chum (Good et al. 2005).

Cutthroat trout are native to western North America. The species has evolved through geographic isolation into many subspecies, each native to a different major region or specific drainage basin. Native cutthroat species are found along the Pacific Northwest coast, in the Cascade Range, the Great Basin, and throughout the Rocky Mountains. For the coastal cutthroat trout subspecies, some populations have anadromous individuals, living for periods in the Pacific Ocean as adults and returning to freshwater from fall through early spring to feed on insects and spawn (Trotter 1989). Most populations, however, stay in fresh water throughout their lives and are known as non-migratory, stream-resident, or riverine populations.

The coastal cutthroat trout occurs over the broadest geographical range of any of the recognized cutthroat trout subspecies (Behnke 1979, Johnston 1981). The subspecies is distributed along the Pacific coast from the Humboldt Bay area of California to Prince William Sound, Alaska, a distance of about 3,025 kilometers (1,880 miles). It occurs inland to the crest of the Cascade Mountain Range in Oregon and Washington and to the Coast Range crest in British Columbia and southeast Alaska, an average distance of 160 kilometers (99 miles; Trotter 1989). Its native range coincides quite closely with the coastal rain forest belt defined by Waring and Franklin (1979).

4.6.3 Condition, Trends, and Threats

The status of most anadromous fish within the Oregon Coast coho ESU has been in decline for decades. Currently, coho salmon on the Oregon Coast (Oregon Coast ESU) are listed as “Threatened” on the federal Threatened and Endangered Species List. Oregon Coast coho ESU was originally listed threatened in 1998, set aside due to the Alsea case and commitment to conduct status review; proposed threatened in 2004, found not warranted in 2006, contested and listed in 2008 (73 FR 7816); contested and new status review conducted; threatened finding published in Federal Register in 2011 (superseded 2008 finding) and kept critical habitat and protective regulations from 2008 in place. The State of Oregon lists coho salmon as a Threatened species for the entire state. Oregon Coast steelhead was found not warranted for listing in 1998 and considered a “species of concern” by NOAA in 2004 due to specific risk factors. Oregon Coast Chinook ESU found not warranted for listing in 1998 because populations appear healthy and stable in some areas of the coast and are declining in others. There are very little data available for searun and native coastal cutthroat trout and their population status and needs are unclear.

In 2003 the Oregon Workgroup of the Oregon Northern California Coast Technical Recovery Team convened to review and analyze information that could shed light on historical populations of Oregon Coast coho salmon. Documentation of life history traits, distribution, or abundance of Oregon Coast coho salmon prior to 1940 is limited. Considerable biological information has been gathered during the past 30 years, and particularly the past 12 years; however, it is difficult to relate the biological characteristics of modern populations to those that existed historically in the same basin. Human activities over the past 200 years have altered every aspect of salmon habitat on the coast, harvest has changed abundance patterns, and hatcheries may have blurred the distinctions among stocks. Coho salmon have adapted their behavior to many of these changes and, as a result, present-day Oregon Coast coho salmon populations function differently than they did historically (Lawson et al. 2007).

The abundance and productivity of Oregon Coast coho since the status review completed in 1997 (NMFS 1997) represented some of the best and worst years on record (NOAA 2008). Yearly adult returns for the Oregon Coast coho ESU were in excess of 160,000 natural spawners in 2001 and 2002, far exceeding the abundance observed for the past several decades. These encouraging increases in spawner abundance in 2000–2002 were preceded, however, by three consecutive brood years (the 1994–1996 brood years returning in 1997–1999, respectively) exhibiting recruitment failure (recruitment failure is when a given year class of natural spawners fails to replace itself when its offspring return to the spawning grounds 3 years later). These 3 years of recruitment failure were the only such instances observed thus far in the entire 55+ year abundance time series for Oregon Coast coho salmon (although comprehensive population-level survey data have only been available since 1980). The encouraging 2000–2002 increases in natural spawner abundance occurred in many populations in the northern portion of the ESU, populations that were the most depressed at the time of the 1997 review (NMFS 1997). Although encouraged by the increase in spawner abundance in

2000–2002, the long-term trends in ESU productivity were still negative due to the low abundances observed during the 1990s (NOAA 2008).

The Oregon Coast coho salmon ESU total natural spawner abundance was estimated based on stratified random survey (SRS) techniques, broken down by ODFW's monitoring areas (MAs), for 11 major river basins and for the coastal lakes system. These data are for the return years 1990–2002 and are expressed in terms of naturally produced fish, rather than the standard of naturally spawning fish used in other status review updates. Total recent average (3-year geometric mean) spawner abundance for this ESU is estimated at about 140,600, up from the 5-year geometric mean of 52,000 in the 1997 update and higher than the estimate at the time of the most recent status review (Good et al. 2005). In 2001, the ocean run size was estimated to be about 178,000; this corresponds to one-tenth of ocean run sizes estimated in the late 1800s and early 1900s, and only about one third of those in the 1950s (ODFW 1995). In 2002, the ocean run size increased to 304,500, fourth highest since 1970 and perhaps 25% of historical abundance. Present abundance is more evenly distributed within the ESU than it was in 1997. Escapement in the relatively small mid/south coast monitoring area was the strongest in the ESU until 2001. In 2002, escapements in the mid/south were down about 25%, while the north and mid-coast monitoring areas showed strong gains. The Umpqua monitoring area is up by a factor of 4 since 1996 (Good et al. 2005).

The population of coho salmon in the Coquille River is one of the larger populations in southern Oregon. Population estimates ranged from 2,712 natural-origin spawning adults in 1990 to 8,488 spawning adults in 2002 (Good et al. 2005) and to more than 28,500 spawning adults in 2006. The number of adults returning to spawn is a direct result of the number of juveniles that migrate into the ocean. Estimates of juvenile production for three brood years in the late 1990s indicate that total juvenile production for the Coquille River was between about 120,000 and 300,000 individuals. Spawning adult population associated with these estimates was about 3,000 to 5,700 fish. Historical abundance of coho for the Oregon Coast coho ESU is estimated at approximately 2 to 3.3 million fish and within the Coquille River watershed 310,000 fish to 417,000 fish depending upon the methodology and data used to derive the estimate (Lawson et al. 2007).

Threats currently facing the Oregon Coast coho ESU include the present or threatened destruction, modification, or curtailment of its habitat or range. In many Oregon coastal streams, past human activities (e.g., logging, agriculture, gravel mining, urbanization) have resulted in impediments to fish passage, degradation of stream complexity, increased sedimentation, reduced water quality and quantity, loss and degradation of riparian habitats, and loss and degradation of lowland, estuarine, and wetland coho rearing habitats. The relevant issues are whether current habitat conditions are adequate to support the ESU's persistence and whether habitat conditions are likely to worsen in the future. There is uncertainty about the adequacy of current habitat conditions, and this uncertainty contributed to the finding that the ESU was likely to become an endangered species within the foreseeable future. Also, if the long-term decline in productivity of the Oregon Coast coho ESU reflects deteriorating conditions in freshwater habitat, this ESU could face very serious risks of local extinction during the next cycle of poor ocean conditions. With respect to population growth and urbanization, approximately 3.4 percent of "high intrinsic potential" habitat areas for coho (e.g., lowland stream reaches particularly important to juvenile coho rearing and overwintering survival) are within currently designated urban growth areas, suggesting that future human population growth may not represent a significant threat to the ESU (NOAA 2008). With respect to lowland and upland habitat areas under various types of land use and ownership, NOAA found that some areas are likely to improve, some are likely to decline, and others are likely to remain in their current condition. Overall, there is a high level of uncertainty associated with projections of future habitat conditions due to underlying economic and sociopolitical factors influencing forest harvest and restoration rates, urban conversion of agricultural and forest lands, and the enforcement and implementation of land-use plans and regulations. Based on their analysis, NMFS found that there is insufficient evidence to conclude that the Oregon Coast coho ESU was more likely than not to become an endangered species because of the "threatened destruction, modification, or curtailment of its habitat or range." It remains uncertain whether future freshwater habitat conditions will be adequate to support a viable coho ESU, particularly during periods of unfavorable ocean conditions and poor marine survival.

Another identified threat is overutilization for commercial, recreational, scientific, or educational purposes. Harvest rates on Oregon Coast coho populations ranged between 60 and 90 percent between the 1960s and 1980s (Good et al. 2005). Modest harvest restrictions were imposed in the late 1980s, but harvest rates remained high until most directed coho salmon harvest was prohibited in 1994. These restrictive harvest regulations, developed concurrently with the Oregon Plan and subsequently revised, have imposed conservative restrictions on direct and incidental fishery mortality, and appropriately consider marine survival conditions and the biological status of naturally produced coho populations. Under these revised regulations, harvest rates are stipulated to be between 0 and 8 percent during critically low spawner abundance, and may increase to a maximum exploitation rate of 45 percent under high survival and abundance conditions. Empirical data over the last 10 years show that harvest mortality for Oregon Coast coho has been maintained below 15 percent since the adoption of the revised regulations (NOAA 2008).

Diseases, predation, past species introductions, and habitat modifications have resulted in increased non-native predator populations, notably in coastal lake habitats. Predation by increased populations of marine mammals (principally sea lions) may influence salmon abundance in some local populations when other prey species are absent and where physical conditions lead to the concentration of adults and juveniles (Cooper and Johnson 1992). However, the extent to which marine mammal predation threatens the persistence of Oregon coast coho populations is unknown. Infectious disease is one of many factors that can influence adult and juvenile salmon survival. Salmonids are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment. Specific diseases such as bacterial kidney disease, ceratomyxosis, columnaris, furunculosis, infectious hematopoietic necrosis virus, redmouth and black spot disease, erythrocytic inclusion body syndrome, and whirling disease, among others, are present and known to affect West Coast salmonids (Rucker and Ordall 1953, Wood 1979, Leek 1987, Foott et al. 1994, Gould and Wedemeyer undated). In general, very little current or historical information exists to quantify trends over time in infection levels and disease mortality rates. However, studies have shown that naturally spawned fish tend to be less susceptible to pathogens than hatchery-reared fish (Buchanan et al. 1983, Sanders et al. 1992). Native salmon populations have co-evolved with specific communities of these organisms, but the widespread use of artificial propagation has introduced exotic organisms not historically present in a particular watershed. Habitat conditions such as low water flows and high temperatures can exacerbate susceptibility to infectious diseases. Aggressive hatchery reform efforts implemented by the State of Oregon have reduced the magnitude and distribution of hatchery fish releases in the ESU, and, consequently, the interactions between hatchery- and natural-origin fish and the potential transmission of infectious diseases. Additionally, regulations controlling hatchery effluent discharges into streams have reduced the potential of pathogens being released into coho habitats.

There are numerous introduced fish species that inhabit the Coquille River and adjacent aquatic habitats, many of which pose predation or competition impacts to juvenile salmonids. These include the following: striped bass, largemouth bass, yellow perch, bluegill, brown bullhead, mosquito fish, and American shad. The State introduced largemouth bass to the Tenmile Lakes and this species is now widely distributed within southwestern Oregon. This non-native bass has been documented in the Coquille River and within Fahys Creek of Bandon Marsh NWR (Christopher Claire, ODFW, unpublished data). Sportsmen have reported catching smallmouth bass in the Coquille River, but their presence is currently unconfirmed by ODFW. With the exception of striped bass and American shad, these introduced fish are adapted to a slow-moving, warm-water environment and have physiological mechanisms that enable them to tolerate higher pollution and lower levels of dissolved oxygen that can be found in the agriculturally impacted historic estuaries.

Natural or human-caused factors may affect the coho's continued existence. Natural variability in ocean and freshwater conditions has at different times exacerbated or mitigated the effects on Oregon Coast coho populations of habitat limiting factors. There is considerable uncertainty in predicting ocean-climate conditions into the foreseeable future and estimating their biological impacts on the Oregon Coast coho ESU. Variability in ocean-climate conditions is expected, and coho productivity and abundance are similarly expected to fluctuate in response to this natural environmental variability. It is unknown whether unfavorable ocean conditions will predominate in the foreseeable future.

During the twentieth century, the coho decreased to as little as 1% of its former abundance in its southern range (in California and Oregon). It is extirpated in more than half of its native rivers in that region. The decline of the coho stocks of California and Oregon has been caused by several interacting factors. Much of their freshwater habitat has been degraded by siltation and temperature increases caused by logging and other disturbances in the watersheds of their breeding and rearing habitats in headwater streams. Clear-cut logging in the riparian (or stream-side) zone results in large increases in the summertime water temperature, which can be lethal for these cool-water fish. In addition, the erosion of soil from destabilized stream-banks and at road crossings results in the deposition of silt into the gravel spawning and larval-rearing habitat of salmon, which smothers the eggs and larvae. Moreover, many rivers have had hydroelectric dams constructed on them, and this prevents or impedes the migration of coho to and from the sea. Other threats to coho include erosion associated with overgrazing of livestock, in-river mining of gravel or gold, urban and industrial pollution, agricultural diversions, and urbanization. These factors have affected coho salmon throughout their range on the Pacific coast, but the damages have been most intense for stocks breeding on coastal rivers in California and Oregon. Overall, the coho has become extirpated over about 56% percent of its historic range in the lower 48 states, endangered in about 13%, threatened in about 20%, and of special concern in 5%. The coastal rivers of Oregon produced about 1.4-million coho in 1900, but fewer than 20,000 in the 1990s. In Washington, the 1.2 million coho that once lived in the Columbia basin are virtually extinct (NOAA 2000).

NOAA Fisheries' 1999 review of West Coast coastal cutthroat trout populations identified six ESUs, including the Oregon Coast Coastal Cutthroat Trout ESU that includes the Coquille River watershed. The 1999 analysis by NOAA was evenly divided on whether the Oregon Coast cutthroat trout ESU is likely to become endangered in the foreseeable future. Currently, coastal cutthroat trout of the Oregon Coast ESU is not listed on the state or federal Threatened and Endangered Species List. Current or historical abundance information, especially for adult coastal cutthroat trout, is available for only a very small proportion of the known populations within any ESU. Biologists familiar with coastal cutthroat trout generally believe that, in some areas (e.g., Lower Columbia River Basin, Puget Sound, Northern California), anadromous coastal cutthroat trout populations have experienced significant recent declines relative to historical levels of abundance (NOAA 1999). Coastal cutthroat trout have a very plastic life history and are wide-spread in coastal areas; however, very little specific data have been collected to assess trends. Coastal cutthroat trout is subject to many of the same factors as coho and other salmon species, in addition to factors affecting isolated resident populations upstream of salmon distribution in watersheds.

The Oregon Coast coastal cutthroat trout Species Management Unit (SMU) includes 24 historical populations of coastal cutthroat trout inhabiting ocean tributary streams from the Necanicum River south to the Sixes River. All four life history types are present with the SMU, and several populations exhibit all four life history types. A status assessment of coastal cutthroat trout within the SMU determined all historical populations were found to be in existence and not at risk of extinction in the near future. An assessment for the Oregon Coast coastal cutthroat trout SMU found all populations passed all of the interim criteria and therefore, the conservation of the SMU was not at risk (Connolly et al. 2008).

4.6.4 Key Habitats Used

Coho salmon spawn in the headwaters of tributaries, rivers, or streams in beds with clean gravel. The freshwater habitat of the headwater is characterized by cool clean water, with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. These features are essential in the environment because without them the species cannot successfully spawn and produce offspring (NOAA 2008). After hatching from eggs, coho salmon fry spend one year in freshwater habitat, specifically in backwater pools and stream edges. As juveniles, coho salmon depend on deep water pools, off-channel alcoves, ponds, beaver dam pools, and complex cover for rearing and refuge during high winter runoff events (Barczak 1998, Pollock et al. 2004). Estuarine areas are also important to coho and in some cases smolts spend months in this transition zone, where the salt and fresh water meet. The estuaries need to be free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater. Submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels provide natural cover. Juveniles and adults forage on aquatic invertebrates and fishes which supports growth and maturation. These features are essential in the estuary because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to adult salmonids because they provide a final source of abundant forage that will provide the energy stores needed to make the physiological transition to fresh water, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas (NOAA 2008).

Coho migrate from the freshwater to the ocean, where they feed and grow for several years. During the marine phase of their life history, coho live in open-water (or pelagic), cool-temperate regions of the northeastern Pacific Ocean. When they reach sexual maturity, they return to the headwaters of their natal stream, where they breed, and die. Coho salmon migrate from the ocean to freshwater in September-January, and they spawn in October-January.

Resident coastal cutthroat trout grow, mature, and spawn often very close to the location from which they hatched. Fluvial and adfluvial cutthroats migrate to spawning streams in the spring, usually to the streams in which they hatched (natal streams), and spawn in spring or summer. For successful production, juvenile coastal cutthroat trout that live at the edges of streams or in backwater areas depend on the presence of streambank vegetation and abundant instream structure created by logs and root wads.

Anadromous coastal cutthroat trout migrate into freshwater in late summer to late fall, usually to their natal streams, and spawn from late winter to spring. The adults migrate back to the ocean shortly after spawning. Sea-run cutthroat fry migrate to lower reaches of streams after emerging from the gravel in spring or summer. As early as the following spring, but more often two to four springs later, juvenile coastal cutthroat trout migrate to estuaries and the ocean as seawater-adapted “smolts.” In the marine environment, coastal cutthroat trout tend to grow about an inch every month, feeding on a variety of small crustaceans and fish. Their residency in seawater is brief, usually lasting only a few months, and they tend to stay close to the freshwater streams and rivers from which they came. The fish return to freshwater later the same year in autumn to spawn or to spend another year growing and developing before undertaking another seaward migration (Fitzpatrick 1999).

4.6.5 Refuge-specific Sites

Critical habitat was designated for the Oregon Coast coho salmon ESU at the time they were federally listed as a threatened species (73 FR 7816). The definition of critical habitat is that area necessary for the survival and persistence of a species. Critical habitat is categorized by primary constituent elements (PCEs) that describe the habitats required by the species. The PCEs for coho salmon include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, and near shore marine habitats (73 FR 7816). The Coquille River and its tributaries are considered critical habitat; the PCEs within the Coquille are freshwater rearing areas, freshwater migration corridors, and estuarine areas. Most of the aquatic habitat within Bandon Marsh NWR or the lower Coquille River is considered estuarine habitat. The important elements within an estuary for rearing salmonids are salinity and water quality conditions that support both adult and juvenile life stages. These habitats support juvenile coho and Chinook salmon as they undergo the physiological transformation that allows them to survive in salt water.

Within the Bandon Marsh NWR, juvenile coho and Chinook salmon have been observed in the tributaries and estuary waters of the lower Coquille River. No known salmon spawning habitat is within creeks on the Refuge. Surveys from 2005-2011 of Spring, Redd, No Name, and Fahys Creeks documented the year-round presence of juvenile coho and Chinook salmon (Hudson et al. 2010, USFWS unpublished data).

Bandon Marsh NWR provides spawning and rearing habitat for coastal cutthroat trout. Surveys from 2005-2011 of Redd, No Name, and Fahys Creeks documented the year-round presence of adult and juvenile coastal cutthroat trout (Hudson et al. 2010, USFWS unpublished data). Cutthroat trout spawning habitat has been documented within the recently restored (2011) portion of Fahys Creek and is suspected on off-refuge lands within Fahys, Redd, Simpson, and Spring Creeks.

4.7 Shorebirds

Shorebirds spend the majority of their time near the water, though most species prefer mudflats, some use upland pastures, plowed fields, and even forest habitats (Long and Ralph 2001, O’Brien et al. 2006). Most shorebirds forage on a diversity of invertebrates, including mollusks, small crustaceans, worms, and insects (Skagen and Oman 1996). Recent studies have found that dunlin and western sandpipers feed on biofilm (sediment laden with a mixture of broken and unbroken diatoms plus organic detritus) (Tomohiro et al. 2008, Mathot et al. 2010). Bandon Marsh NWR plays an important role in the life cycle of migrating shorebirds by providing stop-over habitat rich in invertebrates and biofilm.

The migration of many shorebird species to their breeding grounds in the Arctic is constrained to a narrow band of time (Evans and Pienkowski 1984, Farmer and Parent 1997). If the birds arrive too early, there is the risk of dying due to extreme cold weather or lack of emerging insects and if they arrive too late, they run the risk of not acquiring a suitable territory (Evans and Pienkowski 1984). In addition, these migrations often include nonstop flights exceeding thousands of miles. To complete these long distance flights, shorebirds accumulate large fuel reserves. In many of the more common Pacific Northwest shorebird species, these fuel reserves are accumulated in the form of fat at food-rich stop-over areas. In some cases, large proportions (>50%) of entire migrating populations of shorebirds (e.g., western sandpiper at Yukon Delta, Alaska) use a single site, indicating that any loss of critical stop-over areas could reduce hemispheric shorebird numbers. Since many stop-over areas are relatively restricted along coasts or within estuaries they are particularly vulnerable to various forms of degradation, development, and industrialization.

4.7.1 Description of Shorebirds (Western Sandpiper)

Shorebirds include phalaropes, plovers, sandpipers, snipes, and turnstones. In general, they have long thin legs with little to no webbing on their feet. They are usually small bodied with long thin bills. The differences in their bill lengths and shape allow the different shorebird species to forage for food within their habitat either on dry soil, mud, or in shallow water.

The western sandpiper is one of the most common shorebirds in the Pacific Northwest and within the Western Hemisphere. This small shorebird (length 5.5- 6.5 inches, wingspan 14-15 inches, weight 22-35 grams) breeds in a restricted range of the arctic tundra and winters mainly along the western coast of North and South America. In migration, this species stages in huge, spectacular flocks, particularly along the Pacific Coast from San Francisco Bay to the Copper River Delta in Alaska. Estimates suggest that millions of individuals pass through the critical stop-over habitat of Copper River Delta during just a few weeks each spring. Most western sandpipers migrate along the Pacific Coast, although significant numbers move through interior North America. Relatively little is known of the biology of wintering birds, particularly those in the southeastern United States, the West Indies, Central America, and South America (Wilson 1994).

At the breeding site males build a nest scrape to hold the typical four-egg clutch. Both members of the pair incubate eggs and tend young until they fledge. This species eats a varied diet, although insect larvae comprise the majority of its food on the breeding grounds. Along coastal and estuary stop-over habitat during migration, biofilm, crustaceans and polychaete worms make up the bulk of this species diet.

4.7.2 Historic and Current Distribution

The Bandon Marsh estuary is located in the Pacific Flyway and is an important resting stop and wintering area for many migratory shorebirds. Shorebird migration spans great distances from the Arctic to South America. The migratory paths are influenced by geography, wind, and weather patterns. During the spring, summer, and fall migration, shorebirds rest and feed at stop-over locations including the coast of Oregon. The estuary is also important for other types of birds, including bald eagles and band-tailed pigeons.

In the Americas the breeding range of the western sandpiper is mainly in the tundra of Alaska, from the mouth of the Kuskokwim River north to the vicinity of Point Barrow and Camden Bay. The winter range of this small shorebird is primarily along the Pacific coast from California to Peru, with small numbers wintering as far north as Washington. This species is locally common along the Atlantic Coast from south New Jersey south to the Gulf Coast. Also, found locally inland at the Salton Sea, CA, to the interior of northern and central Mexico to elevations of 2,500 meters (8,202 feet). These birds are common locally along the Caribbean coast of Central America, Colombia, Venezuela, Surinam, and the West Indies. The species is rare in Canada except for where abundant during migration in coastal British Columbia. Outside of the Americas a small breeding population is located in eastern Siberia on the Chukotski Peninsula. Accidental observations of the species have been documented in Ireland, Britain, France, Spain, Denmark, Sweden, and the Azores, with one specimen collected at Kultuk, Russia on the southwestern shore of Lake Baikal (Wilson 1994). The combination of a restricted breeding range and a broad non-breeding distribution means that some western sandpipers migrate much farther than others. Western sandpipers are differential migrants; males spend the winter farther north than females, and juveniles are disproportionately represented on the northern and southern edges of the distribution. There is also a life history difference as a function of migratory distance. Western sandpipers spending their juvenile non-breeding season in northern Mexico migrate northward in their first spring, but many juveniles in Panama remain on the non-breeding grounds until their second spring.

Although no races or discrete breeding populations of the species are recognized, genetic differences based on random amplified polymorphic DNA analyses were found between wintering grounds in Humboldt Bay, California, and South Island, South Carolina (Haig et al. 1997). Interestingly, the rather limited breeding distribution of western sandpipers does not suggest that this should occur. The extent of genetic differentiation between the small population on the Chukotski Peninsula of Siberia and the North America population is currently unknown.

The estimated total population of western sandpipers is 3.5 million birds (range = 2.8–4.3 million) (Bishop et al. 2000, Morrison et al. 2001). The data used to derive the population estimate were collected in 1992–1995. Although it is possible that a population decline is occurring (Brown et al. 2001), the magnitude of any change in population size is unknown. During spring migration, high concentrations of western sandpipers have been observed in the San Pablo-San Francisco Bay area of California when 473,963 western sandpipers were counted between 16 and 18 Apr, 1988 (Stenzel and Page 1988). During spring migration, nearly 75,000 - 100,000 western sandpipers were estimated to have stopped over at Bandon Marsh NWR on a single day in mid-May, 2006 (USFWS unpublished data). It has been estimated that nearly 2.4 million western sandpipers pass through British Columbia annually on fall migration (Butler et al. 1987).

4.7.3 Condition, Trends, and Threats

The Pacific Northwest region extends from Cook Inlet on the south coast of Alaska through coastal Alaska, British Columbia, Washington, and Oregon to northern California. The important shorebird habitats tend to be similar estuarine, riverine, and forested wetland landforms throughout the region. However, the intensity of land use and future threats to shorebird conservation are extremely different between, for example, the wilderness of Alaska and the urbanized Fraser River delta. Strategic plans for this region have been prepared in three sections: Alaska, British Columbia, and the Pacific Northwest of the United States.

Threats to shorebirds and associated habitat include: (1) wetland loss due to urban sprawl and human expansion, (2) contamination of the estuarine habitat by industry, (3) aquatic beds' destruction or reduction because of shellfish mariculture, (4) wetland drainage and water quality problems, and (5) sea level rise, which may reduce the amount of suitable shallow water habitat.

Pacific coast wetlands have been degraded by urban sprawl and human expansion. Large-scale timber harvest and development of agricultural lands have resulted in direct wetland loss, sedimentation of bays and degradation of water quality and submergent plant beds. Extensive urbanization and industrialization has eliminated entire wetlands and reduced the value of other coastal wetlands to waterbirds. Many of the estuaries along the Pacific coast have been diked and drained, primarily for agricultural development. Losses of 80-95% of intertidal marsh habitat in Oregon’s estuaries have resulted from diking for farmland conversion (Thomas 1983, Brophy 2010, USFWS unpublished data).

Western sandpipers appear to be declining across their range, and it has been suggested that threats at stop-over areas and on the wintering grounds play a significant role in this decline. Anthropogenic impacts may prevent birds from engaging in normal feeding and roosting activities. Marine, estuarine, and upland habitats in western Washington and Oregon provide essential conditions for hundreds of thousands of wintering and migratory western sandpipers and other shorebird species along the Pacific Flyway. The loss of habitat important to shorebirds has been particularly dramatic in the last 100 years (Page and Gill 1994, Dahl 1990). Wetland loss in Oregon has been severe with an 80-95% reduction of intertidal marsh habitats (Brophy 2010, USFWS unpublished data). Other potential threats to shorebirds in the Oregon include disease, non-point oil spills, contamination of habitat or food resources caused by agricultural and industrial chemicals, invasion of non-native vegetation and invertebrates in migratory habitat, and direct human disturbance (Buchanan 2005). Catastrophic impact events such as an oil spill (e.g., Exxon Valdez in Prince William Sound, Alaska) would potentially affect the viability of the species, as virtually the entire population of western sandpipers stops in at one migratory location (e.g., Copper River Delta, Alaska) on its way north to breeding grounds.

Potential effects of global warming are serious concerns in many areas and in all seasons. Of concern in the subarctic and Arctic breeding grounds of the western sandpiper is the unknown effect of global warming on breeding success. It is well documented that major breeding areas in Alaska are being affected by reduced snow cover and warmer days. It is not well understood how this warming may affect the reproduction or survival of western sandpipers. An increase in sea level has the potential to reduce available tidal flat foraging areas for shorebirds on their breeding grounds and during migration. The effects of rapid climate change, including potential consequences such as an increase in sea level and increased severe weather events, may affect conditions on breeding, migration, and wintering grounds of the western sandpiper in a manner far beyond present comprehension (Fernández et al. 2010).

4.7.4 Key Habitats Used

The breeding range for the western sandpiper includes subarctic and low-arctic from coast to uplands, occasionally on lower mountain slopes where well-drained, elevated ground occurs amid wet areas (Bent 1927, Holmes 1971). Favored nesting habitat is dominated by dwarf birch, dwarf willow, crowberry, various ericaceous shrubs, tussock grasses, and bryophytes. Proximity of elevated areas for nesting and wetland areas for feeding is a requisite. On arrival in the spring, birds are found in snow-free areas waiting for snow to melt to expose potential nesting sites. During spring and fall migration, from the center of the breeding range east of the Yukon-Kuskokwim Delta, Alaska, post-breeding birds and juveniles stage along the coastal flats of the Delta (Gill and Handel 1990). At coastal stop-over areas (e.g., Bandon Marsh NWR), birds frequent intertidal mudflats and river edges. At interior stop-over sites, the margins of lakes and ponds are preferred habitat. Winter range habitat generally is within coastal areas with fine sand to muddy substrates (e.g., intertidal mudflats) where the birds generally follow receding and rising tide line for foraging. In the interior of Mexico, western sandpipers are uncommon to common locally along lakeshores, up to 2,500 meters (8,202 feet) in elevation (Wilson 1994).

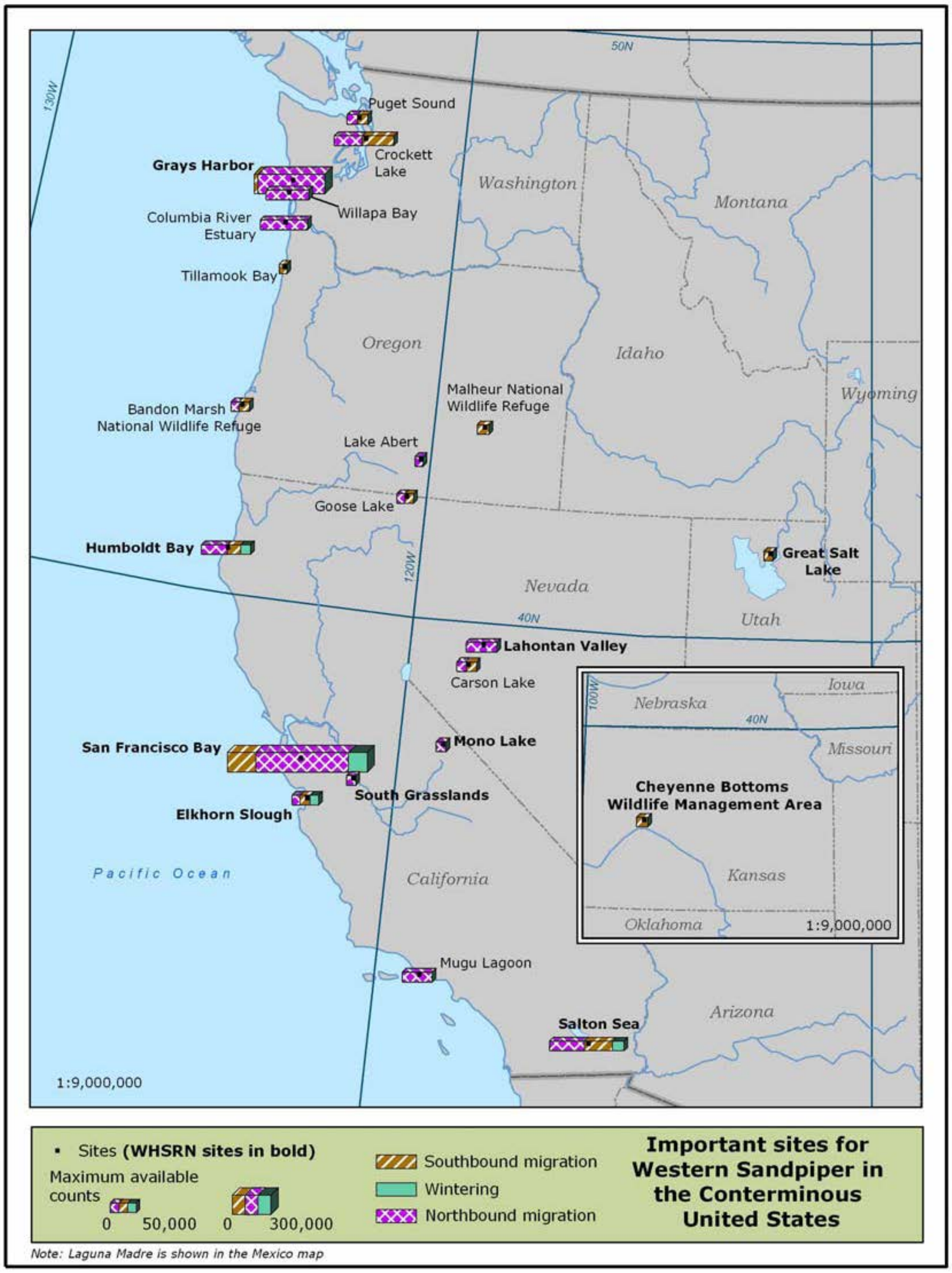
4.7.5 Refuge-specific Sites

The wetlands and intertidal mudflats within Bandon Marsh NWR are protected and allowed to function naturally since they receive intensive use by shorebird species throughout the year. Shorebirds by the thousands utilize the area as a stop-over site to feed and rest during spring and fall migration.

Western sandpipers migrate north through temperate latitudes (Bandon Marsh NWR) generally between mid-April and mid-May, and males mostly migrate ahead of females (Butler et al. 1987). Once the spring migration has begun the birds move quickly north with length of stay at migratory stop-over sites typically ranging between 1 and 5 days (Bishop and Warnock 1998; Bishop et al. 2004). In comparison to the northward migration, the southbound movement from the breeding grounds is more prolonged. Western sandpipers migrate south from mid-June to November, arriving at Bandon Marsh generally early to mid-July. The length-of-stay during southward migration is about 1–5 days at temperate coastal sites (Butler et al. 1987). At Bandon Marsh NWR western sandpipers have been observed in all months of the year, with peak numbers during April/May and August/September during migration (Hodder and Graybill 1984, Castelein and Lauten 2007, USFWS unpublished data).

Stop-over habitat use by western sandpipers at Bandon Marsh NWR is generally restricted to tidal mudflats, edges of the tidally influenced salt marsh channels and the banks of the lower Coquille River estuary. During stop-over migration western sandpipers feed on a variety of mudflat mollusks, polychaete or marine worms, small invertebrates, and biofilm in mixed shorebird flocks with dunlin, least sandpiper, semi-palmated and black-bellied plovers, long and short-billed dowitchers, and greater and lesser yellowlegs. Spring migration of western sandpipers initiates at Bandon Marsh NWR with small groups of 15-35 individuals arriving early to mid-April followed by large groups of 5,000 to 30,000 individuals in late April (Nehls 1994, Hodder and Graybill 1984, Castelein and Lauten 2007). Peak counts of western sandpipers at Bandon Marsh were recorded in May 2006 with an estimated 400,000 individuals migrating north along the Bandon coast on May 2 and approximately 75,000 individuals observed foraging and resting on the refuge tidal wetlands on May 3 (Castelein and Lauten 2007, USFWS unpublished data). Fall migration starts in July and peaks in early to mid-September with the largest flocks ranging from 1,500 to 7,000 birds. The number of individuals observed is variable year-to-year and season-to-season as flight patterns of migrating western sandpipers and other species of shorebirds is highly influenced by the strength of northwest winds in the spring. During periods of high winds birds are driven off the near-shore waters and coastal mountain ridgelines to gather along the coastal strand.

Figure 4-2. Important sites for western sandpipers in the conterminous United States. (Fernández et al. 2010).



Bandon Marsh NWR is recognized within the Western Hemisphere Shorebird Reserve Network's Conservation Plan for the Western Sandpiper as one of twenty-five most important migratory stop-over habitats for the species. These 25 sites, 23 of which are on the west coast of the United States, support a large proportion of the western sandpiper global population. Bandon Marsh is documented in the Plan due to its importance as stop-over habitat for the species during both migration periods (north and south migrations). In addition, this Plan supports the restoration of historic estuary and mudflat habitat, for western sandpipers, that has been degraded through the development of water-use systems, including the construction of channels and dikes (e.g., diked pastures within the Coquille estuary).

4.8 Waterfowl (Ducks)

Waterfowl include ducks, geese, and swans and are part of the worldwide family Anatidae. These are aquatic, web-footed, gregarious birds that mostly feed on water but some also graze on land. Ducks are classified in the tribe Anatini which contains three genera and 40 species throughout the world. In North America there is but one genus, *Anas*, embracing 10 species of "dabbling or puddle ducks" (Bellrose 1986). Dabbling ducks or puddle ducks are surface-feeders that occur in freshwater shallows or salt marshes. Some of the more commonly found dabbling ducks in the Coquille River estuary include mallard, gadwall, northern pintail, American wigeon, northern shoveler, and green-winged teal. Although a dabbling duck in general appearance, the wood duck belongs to the tribe Cairinini. This species belongs to a group called "perching ducks" which are surface feeding woodland ducks that nest in tree cavities or nest boxes. There are nine genera representing 13 species worldwide. Only one species, the wood duck, inhabits North America north of Mexico (Bellrose 1986).

The remaining ducks are placed in three tribes embracing 12 extant genera around the world and are generally referred to as "diving ducks." The tribe Aythyini is represented by the "pochards or bay ducks" (Bellrose 1986). In North America all belong to one genus, *Aythya*, composed of the canvasback, the redhead, the ring-necked duck, and the scaups (greater and lesser). Members of the tribe Mergini are termed "sea ducks" and although most of them frequent the ocean during the winter, many also inhabit freshwater areas. These species breeds in the far north and migrate in large compact flocks to and from their coastal wintering grounds. Common sea ducks include the scoters (surf, and white-winged), common goldeneye, bufflehead, and mergansers (common, red-breasted, and hooded). Lastly, the tribe Oxyurini make up the "stiff-tailed duck" group, which consists of one genus and two species that frequent North America (Bellrose 1986). The most common species of this group is the ruddy duck.

4.8.1 Description of Waterfowl

Surface-feeding members of the genus *Anas* are termed "dabbling or puddle ducks." Dabblers feed by tipping tail-up to reach aquatic plants, seeds, and snails. They require no running start to take off but spring directly into flight. Members of this group have their feet set forward underneath their body and their hind toes are smooth without a lobe of skin. Most species show a distinguishing swatch of bright color, or speculum, on the secondary feathers. Many are known to hybridize. "Perching ducks" (wood duck) are equipped with sharp claws for perching in trees, well-developed hind toes, and broad wings.

The "diving ducks" consist of "pochards or bay ducks, sea ducks, and stiff-tailed ducks." These diving ducks have legs set far back and far apart (a location that facilitates diving), which makes walking awkward. These heavy-bodied birds require a running start on water for takeoff. This group also has a lobe of skin on their hind toes. Sea ducks are stocky and have short necks. Mergansers have long, thin, serrated bills which help to catch fish, crustaceans, and aquatic insects. The ruddy duck is the most distinct species among all ducks and is termed "stiff-tailed duck." Their feathers are long, stiff, and pointed and their legs are farther back on their bodies than other ducks. Their necks are short and thick. They lay the largest eggs among waterfowl, considering their size. They perform a bizarre courtship display, unique among waterfowl.

4.8.2 Historic and Current Distribution

Migratory waterfowl use four major migratory routes (Pacific, Central, Mississippi, and Atlantic flyways) in North America. The Pacific Flyway includes Alaska, Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, and those portions of Colorado, Montana, New Mexico, and Wyoming west of the Continental Divide. Because of the unique biological characteristics and relative number of hunters in these regions, state and federal wildlife agencies adopted the flyway structure for administering migratory bird resources within the United States. Each flyway has its own council that is an administrative body that forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory birds in western North America. Flyway councils have responsibilities in the annual process of setting migratory bird policy and regulations within the United States and they conduct and contribute to migratory bird research and management throughout the United States, Canada, and Mexico.

4.8.3 Conditions, Trends, and Threats

Ducks are plentiful in late fall through the winter months, utilizing refuge wetlands and flooded lowland pastures. Waterfowl numbers vary greatly depending on habitat conditions and yearly variables such as weather and breeding production. Using mid-winter waterfowl survey numbers as an index, the number of wintering ducks in Bandon Marsh is highly variable and no trends can be inferred. However, tidal salt marsh restoration at the Ni-les'tun Unit has provided over 400 acres of additional good quality wetland habitat within the Refuge and can support large numbers of waterfowl. The most abundant duck species identified at Bandon Marsh/Coquille River estuary during the 2010-11 mid-winter waterfowl survey are bufflehead, green-wing teal, and mallard (USFWS unpublished data). Some of the duck species that can be found wintering in the Bandon Marsh area have been documented as breeders on refuge lands.

Waterfowl hunting occurs on the Refuge and on adjacent lands which may influence bird distribution and behavior. Hunting, by its nature, results in the intentional take of individual animals, as well as wounding and disturbance (DeLong 2002). Indirect impacts such as displacement of animals by hunters or disturbance from gunfire also occurs in and adjacent to, areas opened for hunting. It can also alter behavior (e.g., foraging time), population structure (young birds are generally more susceptible), and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartlett 1987, Madsen 1985, and Cole and Knight 1990). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1985).

Every year, the U.S. Fish and Wildlife Service conducts surveys that are used to estimate waterfowl hunting activity, success, and harvest by species. Results are used by the Service and State wildlife agencies, in part, to establish season lengths and bag limits designed to maintain healthy, sustainable waterfowl populations. During 2010-11 season, waterfowl hunters in Oregon harvested an estimated 419,100±18% (Raftovich et al. 2011) ducks. On the Bandon Marsh Unit of Bandon Marsh NWR during 2010-11, hunters harvested very few ducks and the harvest numbers are considered to be below reportable levels (B. Reishus, ODFW, personal observation). Waterfowl harvest data are unavailable because only a small number of hunters pursue waterfowl in the Bandon Marsh area and no hunters were surveyed in 2010-11. At any given time there are only 1-3 hunting parties in the marsh because of space and hunting quality is best at only a few spots (e.g., the mouth of the sloughs). Waterfowl hunters tend to self-limit their numbers. Most hunting occurs in October and November and tides influence hunting times. After November the birds disperse further inland and there is almost no hunting occurring in the marsh.

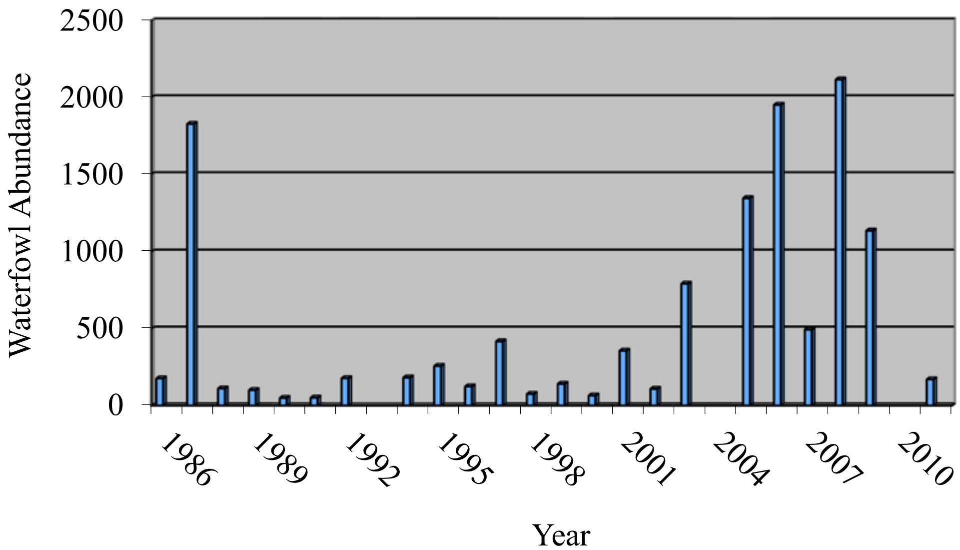
The most heavily harvested duck species in Oregon are mallard, American wigeon, northern pintail, green-winged teal, and northern shoveler (Raftovich et al. 2011). In 2011, continental populations of northern shoveler, green-wing teal, and mallard were all above their long-term averages (USFWS 2011b). American wigeon were 20% below their long-term average and northern pintails were similar to the long-term average. Hunters are permitted to harvest coots, but this species is not common on the Refuge and are not popular with hunters. Given the low harvest rates of these species relative to the State harvest, the refuge hunt program will not significantly contribute to the population changes of these species and the refuge will continue to conform to State bag limits for ducks.

4.8.4 Waterfowl Population Trends

The Waterfowl Breeding Population and Habitat Survey is the most extensive and most important of North America's waterfowl population surveys. This survey is a cooperative effort of the U. S. Fish and Wildlife Service, the Canadian Wildlife Service, and state, provincial, and tribal agencies. It currently covers more than 2.1 million square miles of the northern United States and Canada, and includes most of the primary duck nesting areas in North America. Each year, air crews (a pilot biologist and an observer) fly fixed-wing aircraft at low altitude (150 feet) over transect lines through waterfowl habitat areas. Over 55,000 miles of transects are flown every year. Estimates of breeding populations for all waterfowl species observed are derived by taking the aerial counts, adjusting them based on the visibility correction factors, and expanding them over the survey area. Final results from the 2011 Waterfowl Breeding Population and Habitat Survey indicate a total duck population estimate of 45.6 million birds in the traditional survey area, which is an 11% increase over last year's tally of 40.9 million and 35 percent above the long-term average. Continental populations of northern shoveler, green-wing teal, and mallard were all above their long-term averages. American wigeon were 20% below their long-term average and northern pintails were similar to the long-term average (USFWS 2011b).

Biologists from state and federal agencies annually conduct the Midwinter Waterfowl Survey to provide a measure of the relative numbers or trends of duck populations. The survey identifies winter waterfowl distribution and habitat use throughout the United States. The survey also provides estimates of the size of goose and swan populations and tracks population trends of duck species that nest outside of breeding survey areas. Midwinter Waterfowl Surveys are conducted during the first two weeks in January along the Oregon coast. Observers count divers, dabblers, geese, swans, and American coots from a fixed-wing aircraft and an overall abundance is estimated (USFWS unpublished data). Data were compiled for all waterfowl observed at Bandon Marsh NWR and Coquille River Estuary Bay during the midwinter waterfowl surveys from 1986 to 2011 and are displayed in Figure 4-3. The overall mean count was 531 individuals and the lowest count was 49 individual birds recorded in 1990 and the largest was 2,116 in 2008. These data are collected from a fixed-wing aircraft at an altitude of 200-300 feet and traveling 80-120 mph, which limits ability to survey all areas and all habitats and count every individual present. However, general abundance and population trends can be inferred and obviously Bandon Marsh and the Coquille River estuary are important use areas for waterfowl. Waterfowl abundance is usually lower during the January mid-winter survey compared to fall months, when birds are concentrated on the bay prior to dispersing throughout the area due to field and seasonal wetland flooding. (R. Lowe, personal obs.). It should be noted that the mid-winter waterfowl survey serves as an index for comparative purposes and is not necessarily representative of the number of ducks that may be present within the entire geographic area. Refuge counts for ducks have generally ranged from 500 to 2,100 over the past several winters, with the exception of the 2011 count.

Figure 4-3. Waterfowl abundance at Bandon Marsh NWR and Coquille River Estuary, Oregon from 1986 to 2011 (USFWS unpublished data).



4.8.5 Key Habitats Used

Surveys have indicated waterfowl make significant use of the open bay, mud flats, and tidal marsh with heaviest use occurring from September through January and again during spring migration. Dabbling ducks use freshwater shallows and the edge of salt marshes. Waterfowl utilize both private and refuge lands.

4.8.6 Refuge-specific Sites

Waterfowl are observed on the Bandon Marsh Unit, the Ni-les'tun Unit and Coquille River estuary. In 2011 over 400 acres of tidal salt marsh was restored on the Ni-les'tun Unit and already waterfowl use of the area is increasing and it is anticipated large numbers of waterfowl will utilize this area in the near future.

4.9 Threatened, Endangered, and Candidate Species

4.9.1 State or Federally Listed Species Known to Occur on the Refuge

One goal of the Refuge System is "To conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered." In the policy clarifying the mission of the Refuge System, it is stated, "We protect and manage candidate and proposed species to enhance their status and help preclude the need for listing.” In accordance with this policy, the CCP planning team considered all species with Federal or State status. Tables 4-1 and 4-2 list state or federal endangered and threatened species that are known to occur on the Refuge. Other listed species may occur but have not been documented. Discussion follows the tables in Section 4.9.2.

Table 4-1. Federal or State Listed Bird Species Known to Occur on the Refuge

Common Name	Federal Status	State Status	Current Occurrence on Refuge
Marbled murrelet	Threatened	Threatened	Potential Flyover

Table 4-2. Federal or State Listed Fish Species Occurring on the Refuge or in Surrounding Waters

Common Name	Federal Status	State Status	Current Occurrence on Refuge
Coho salmon	Threatened		Bandon Marsh and Ni-les’tun Units/Coquille River/coastal streams
Pacific smelt (eulachon)	Threatened		Coquille River
Green sturgeon	Threatened		Coquille River

4.9.2 Description and Status of Listed Species Known to Occur on the Refuge

Marbled Murrelet

The marbled murrelet is a small, robin-sized, diving seabird that feeds primarily on fish and invertebrates in near-shore marine waters. It spends the majority of its time on the ocean, roosting and feeding, but comes inland up to 80 kilometers (50 miles) to nest in forest stands with old growth forest characteristics. These dense shady forests are generally characterized by large trees with large branches or deformities for use as nest platforms. Murrelets nest in stands varying in size from several acres to thousands of acres. However, larger, unfragmented stands of old growth appear to be the highest quality habitat for marbled murrelet nesting. Nesting stands are dominated by Douglas-fir in Oregon and Washington and by old-growth redwoods in California (USFWS 2012d).

Salmonids

See Salmonid Section 4.6.

Pacific Smelt (eulachon)

Eulachon (commonly called smelt, candlefish, or hooligan) are a small, anadromous fish from the eastern Pacific Ocean. They are distinguished by the large canine teeth on the “vomer” and 18 to 23 rays in the anal fin. Like Pacific salmon they have an “adipose fin”; it is sickle-shaped. The paired fins are longer in males than in females. All fins have well-developed breeding tubercles (raised tissue “bumps”) in ripe males, but these are poorly developed or absent in females. Adult coloration is brown to blue on the back and top of the head, lighter to silvery white on the sides, and white on the ventral surface; speckling is fine, sparse, and restricted to the back. They feed on plankton but only while at sea.

Eulachon typically spend 3 to 5 years in saltwater before returning to freshwater to spawn from late winter through mid-spring. During spawning, males have a distinctly raised ridge along the middle of their bodies. Eggs are fertilized in the water column. After fertilization, the eggs sink and adhere to the river bottom, typically in areas of gravel and coarse sand. Most eulachon adults die after spawning. Eulachon eggs hatch in 20 to 40 days. The larvae are then carried downstream and are dispersed by estuarine and ocean currents shortly after hatching. Juvenile eulachon move from shallow nearshore areas to mid-depth areas. Within the Columbia River Basin, the major and most consistent spawning runs occur in the mainstem of the Columbia River as far upstream as the Bonneville Dam, and in the Cowlitz River.

Eulachon occur in nearshore ocean waters and to 1,000 feet (300 meters) in depth, except for the brief spawning runs into their natal (birth) streams. Spawning grounds are typically in the lower reaches of larger snowmelt-fed rivers with water temperatures ranging from 39 to 50° F (4-10° C). Spawning occurs over sand or coarse gravel substrates (NOAA 2012a).

Green Sturgeon

Green sturgeon are long-lived, slow-growing fish and the most marine-oriented of the sturgeon species. Mature males range from 4.5-6.5 feet (1.4-2 meters) in “fork length” and do not mature until they are at least 15 years old, while mature females range from 5-7 feet (1.6-2.2 meters) fork length and do not mature until they are at least 17 years old. Maximum ages of adult green sturgeon are likely to range from 60-70 years. This species is found along the west coast of Mexico, the United States, and Canada.

Green sturgeon are believed to spend the majority of their lives in nearshore oceanic waters, bays, and estuaries. Early life-history stages reside in freshwater, with adults returning to freshwater to spawn when they are more than 15 years of age and more than 4 feet (1.3 meters) in size. Spawning is believed to occur every 2-5 years. Adults typically migrate into fresh water beginning in late February; spawning occurs from March-July, with peak activity from April-June (Moyle et al. 1995). Females produce 60,000-140,000 eggs. Juvenile green sturgeon spend 1-4 years in fresh and estuarine waters before dispersal to saltwater. They disperse widely in the ocean after their out-migration from freshwater (NOAA 2012b).

4.10 Invasive and Exotic Plant Species

One of the largest threats to wildlife and habitat of the Refuge is exotic or invasive plants. Invasive plant species displace native vegetation, altering the composition and structure of vegetation communities, affecting food webs, and modifying ecosystem processes (Olson 1999). Ultimately, invasive plant species can result in considerable impact to native wildlife and the habitat they are dependent upon.

Several non-native invasive plants found on Bandon Marsh National Wildlife Refuge include reed canarygrass, Himalayan blackberry, English ivy, Scotch broom, and gorse. *Spartina* spp. are not currently found on the Refuge; however, monitoring for this species is conducted to detect outbreaks or infestation and control efforts would be implemented immediately upon the species’ detection. Many exotic and invasive plants have been introduced to the Refuge; therefore, this list is not all inclusive and includes only the most problematic species.

Invasive marine plants such as Japanese eelgrass and smooth cordgrass, have been recorded within the southern Oregon estuaries (Dudoit 2006, Bilderback and Bilderback, personal communication, Davidson et al. 2007).

4.10.1 Description and Status of Reed Canarygrass

A highly variable species, reed canarygrass is a rhizomatous perennial grass that can reach three to six feet in height. The sturdy, often hollow stems can be up to ½ inch in diameter, with some reddish coloration near the top. The leaf blades are flat and hairless, ¼ to ¾ of an inch wide. The flowers are borne in panicles on culms high above the leaves. The panicles are generally three to six inches in length. The species flowers in June and July (Weinmann et al. 1984, Hitchcock et al. 1969).

Reed canarygrass is extremely aggressive and often forms dense, highly productive single species stands that pose a major threat to many wetland ecosystems. The species grows so vigorously that it is able to inhibit and eliminate competing native species. In addition, areas that have existed as reed canarygrass monocultures for extended periods may have seed banks that are devoid of native species (Apfelbaum and Sams 1987). Unlike native wetland vegetation, dense stands of reed canarygrass have little value for wildlife. Few species eat the grass, and the stems grow too densely to provide adequate cover for small mammals and waterfowl (Maia 1994). The species is considered a serious weed along irrigation banks and ditches because infestations can increase siltation (Marten and Heath 1973). When in flower, the species produces abundant pollen and chaff, which aggravate hay fever and allergies (Weinmann et al. 1984). Once established, reed canarygrass is difficult to control because it spreads rapidly by rhizomes.

4.10.2 Description and Status of Himalayan Blackberry

Himalayan blackberry is a robust, perennial, sprawling, more or less evergreen, shrub of the Rose family. Leaves are large, round to oblong and toothed, and typically come in sets of three (side shoots) or five (main stems). The most characteristic feature is probably the robust stems supporting large stiff prickles. The shrubs first appear as individual canes, then groups of canes, gradually increasing to become great mounds or banks with individual canes reaching up to 3 meters (10 feet). Trailing canes spread up to 20-40 feet, frequently taking root at the tips. The white flowers and then the roundish black and shiny 2 centimeters (less than 1 inch) fruit forms on second year (secondary) canes that grow off of first year canes. The fruit ripens from midsummer to autumn; late when compared with native blackberries.

Himalayan blackberry readily invades riparian areas, forest edges, oak woodlands, meadows, roadsides, clear-cuts, and any other relatively open area, including all open forest types. Once it becomes well established, it out competes low stature native vegetation and can prevent establishment of shade intolerant trees (e.g., Douglas-fir), leading to the formation of blackberry thickets with little other vegetation present. The resulting dense thickets can limit movement of large animals from meadow to forest and vice versa, reducing the utility of small openings and meadows as foraging areas. Although the fruit is widely consumed by native animals, it is a poor functional replacement for a diverse native forest understory, meadow, or riparian floodplain. Seeds from the fruit are spread widely by birds via their feces.

4.10.3 Description and Status of English Ivy

English ivy is an evergreen climbing vine that attaches to the bark of trees, buildings, and other surfaces by way of small root-like structures which exude a sticky substance that helps the vines adhere to various surfaces. Older vines have been reported to reach 1 foot in diameter. Leaves are dark green with white veins, waxy to somewhat leathery, and arranged alternately along the stem.

Leaf forms include a 3 to 5-lobed leaf (the most common) and an unlobed rounded leaf often found on mature plants in full sun that are ready to flower. Vines may grow for up to ten years before producing flowers. Under sufficient light conditions, terminal clusters of small, pale yellow-green flowers are produced in the fall. The flowers are attractive to flies and bees in search of late season nectar sources. The black-purple fruits have a thin fleshy outer covering, contain one to three hard stone-like seeds, and may persist through the winter if not eaten first. The leaves and berries of English ivy contain the glycoside hederin which could cause toxicosis if ingested. Symptoms include gastrointestinal upset, diarrhea, hyperactivity, breathing difficulty, coma, fever, polydipsia, dilated pupils, muscular weakness, and lack of coordination. This feature also helps ensure effective seed dispersal by birds (NPS 2011).

English ivy is a vigorous growing vine that impacts all levels of disturbed and undisturbed forested areas, growing both as a ground cover and a climbing vine. As the ivy climbs in search of increased light, it engulfs and kills branches by blocking light from reaching the host tree's leaves. Branch dieback proceeds from the lower to upper branches, often leaving the tree with just a small green "broccoli head." The host tree eventually succumbs entirely from this insidious and steady weakening. In addition, the added weight of the vines makes infested trees much more susceptible to blow-over during high rain and wind events and heavy snowfalls. Trees heavily draped with ivy can be hazardous if near roads, walkways, homes, and other peopled areas. On the ground, English ivy forms dense and extensive monocultures that exclude native plants (NPS 2011). Ivy will only flower and set fruit on climbing vines therefore, as a first defense it is advisable to prevent the plants from climbing or removing climbing vines first to prevent fruit production. English ivy fruit is eaten by birds and spread widely in their feces.

4.10.4 Description and Status of Scotch Broom

Scotch broom is a perennial evergreen shrub in the legume family. It reaches heights up to 10 feet and has stiff, angled, more or less erect, dark green, broom-like branches. Many branches are leafless or have few leaves. Upper leaves are simple, but lower leaves are trifoliate (three-parted). The bright yellow flowers are about ¾ inch long, shaped like pea flowers, and bloom from April to June. The brown or black pods are flat with hairs on the margins only. Each contains several seeds. Seeds are oval, about ⅛ inch long, dark greenish-brown, and have a shiny surface. Seeds can last for 60 years in the soil (Hulting et al. 2008).

Scotch broom was introduced as a garden ornamental by early settlers of the Pacific Coast. It has spread far beyond the bounds of cultivation and now covers many acres west of the Cascades from British Columbia to California. Scotch broom is moving rapidly into forest lands of western Oregon and Washington, where it is interfering increasingly with re-establishment of conifer seedlings on harvested lands. Scotch broom also is being found more frequently in areas east of the Cascades. Wherever it grows, this aggressive plant spreads to form pure stands at the expense of desirable forbs, grasses, and young trees. Because it is a threat to native plant species and indirectly to animals that feed on the displaced plants, Scotch broom is a Class B noxious weed in Washington and Oregon (Hulting et al. 2008).

4.10.5 Description and Status of Gorse

Gorse is native to western and central Europe where it was cultivated as hedgerows and as a reserve for livestock forage. In southern coastal Oregon, gorse was introduced by early European emigrants and planted as an ornamental shrub. This invasive non-native plant grew in monotypic stands and became an established exotic shrub in most coastal habitats. This species is extremely competitive, displaces native plants, and impoverishes the soil. In addition, it creates an extreme fire hazard due to oily, highly flammable foliage and seeds, and abundant woody material in the plant's center. The city of Bandon was almost completely destroyed by a fire fueled in part by gorse in 1936. All but 16 buildings out of 500 were completely burned to the ground.

4.10.6 Description and Status of Spartina

Smooth cordgrass or saltmarsh cordgrass is a perennial deciduous grass, which is found naturally in intertidal wetlands, especially salt marshes on the East Coast. However on the West Coast, smooth cordgrass is viewed as an aggressive exotic that alters estuarine structure and function, excludes native salt marsh and mudflat vegetation, and eliminates native habitat for shorebirds, waterfowl, and certain shellfish and finfish (USFWS 1997).

This long-lived, warm season perennial typically grows from 1-2.3 meters tall (3.3-7.5 feet), and has smooth, hollow stems which bear leaves up to 20-60 centimeters long and 1.5 centimeters wide at their base, which are sharply tapered and bend down at their tips. The flowers are a yellowish-green, turning brown in the winter, and are wind pollinated. Like its relative saltmeadow cordgrass it produces flowers and seeds on only one side of the stalk and spreads extensively by long hollow rhizomes. Soft, spongy stems up to ½ inch in diameter emerge from the rhizomes. The rhizoidal roots, when broken off, can result in vegetative asexual growth. In September and October seedheads, which are 10 to 12 inches long, emerge at the end of the stem. Each spike holds from twelve to fifteen 2 or 3 inch long spikelets (USDA 2008). Smooth cordgrass can become an invasive species either by itself or by hybridizing with native species and preventing propagation of the pure native strain.

Smooth cordgrass dynamically alters West Coast physical, hydrological, chemical, and biological estuarine functions and is noted for its capacity to act as an environmental engineer. It grows out into the water at the seaward edge of a salt marsh and can appear on mudflats far from nearby marshes. Sediment accumulates in the cordgrass infested area and enables other habitat-engineering species to settle. This accumulation of sediment and other substrate-building species gradually builds up the level of the mudflats and tidal channels are deepened. This in turn eliminates the gently sloping bare intertidal zone that lies between the salt marsh and the tidal channels (USFWS 1997). As the marsh accretes, smooth cordgrass moves still further out to form a new edge. Smooth cordgrass grows in tallest forms at the outermost edge of a given marsh, displaying shorter morphologies up onto the landward side of the cordgrass belt.

Cordgrass may affect habitat structure for native wetland animals, benthic invertebrate populations, and shorebird and wading bird foraging areas. As a result of smooth cordgrass growth, benthic invertebrate species composition and abundance in the intertidal zone changes substantially as their habitat is overgrown. In turn, food sources shrink for birds who feed on those invertebrates. Smooth cordgrass also displaces eelgrass on mudflats and native vegetation in salt marshes (USFWS 1997).

Smooth cordgrass was introduced into Willapa Bay, Washington in 1894 as packing material for oyster shipments from the East Coast. From 1945 to 1988, the plant spread rapidly throughout Willapa Bay. In 1999 it covered 6,000-10,000 hectares (15,000-25,000 acres) of land. Currently, approximately 10 acres are considered to be infested at Willapa Bay according to a 2012 estimate. It is also making inroads into Puget Sound and Grays Harbor in Washington.

4.10.7 Description and Status of Japanese Eelgrass

The non-native Japanese eelgrass was first introduced to the Pacific Northwest in the 1950s as a packing material for non-native Japanese oysters (Harrison and Bigley 1982). This invasive species was first established in estuaries in the state of Washington and subsequently became established from British Columbia, Canada south to Humboldt Bay in northwestern California. Colonization of habitat occurs on bare, unvegetated tidal flats with elevations between 0.3 and 2.4 meters (1.0 and 7.9 feet) above mean lower low water. The rhizomes of this eelgrass stabilize soft substrate (e.g., mudflats) while the vegetative blades trap suspended sediment that facilitates succession of estuary habitat to higher elevation terrestrial habitats. The altering of habitat elevation and structure by colonization affects the availability of clams, worms, and biofilm to migrating shorebirds (Baldwin and Lovvom 1994, PIBC 2004).

4.10.8 Refuge-specific Sites

Reed canarygrass is found throughout the Bandon Marsh NWR, with major infestations at restored salt marsh on the Ni-les'tun Unit, along the fringe of the Bandon Marsh Unit near Riverside Drive and Highway 101, and within the converted upland forest that is currently grassland. However, a decrease in extent and decline in condition of the reed canarygrass infestations at the Ni-les'tun Unit restoration site has been observed since tidal function was restored in 2011 (USFWS unpublished data). A mix of salt tolerant native species typical southern Oregon tidal marshes is replacing reed canarygrass within the newly restored salt marsh.

Invasive species treatment has been concentrated on the Himalayan blackberry that infests much of the refuge uplands, roadsides, and trail edges. The blackberry was primarily hand-cut by volunteers at various locations on the Refuge.

Intensive efforts to remove English ivy have been completed at the Refuge. Volunteers and school groups spent many hours each year since 2007 cutting, chopping, and removing ivy that had infested wooded areas of the Refuge.

Scotch broom has formed dense thickets along U.S. Highway 101 near the refuge boundaries, ditch banks and fences, and forested borders. Efforts to control Scotch broom have been erratic and only partially successful. Plants re-sprout if root systems are not removed or killed and will quickly reoccupy the sites.

Gorse is currently found in two locations on the Refuge. One small patch is currently under control on the Bandon Marsh Unit through the use of volunteer labor performing mechanical removal. This infestation is being supported by a larger infestation on adjacent private lands to the south. Recent efforts to assist the neighbor with controlling this invasive plant are underway. The other more pervasive infestation of gorse is located on the northern boundary of the Ni-les'tun Unit in an area historically used by the previous landowners as a borrow pit that supplied material for the exterior fringing dikes and pasture road system. This degraded forest habitat is devoid of top soil and is in need of reclamation. The gorse in the area is mixed with Scotch broom and a variety of early native successional plants (e.g., red alder, Pacific madrone, and Sitka spruce). Control efforts in this area have included mechanical removal by hand and limited chemical spraying efforts to reduce and control the spread of the invasive non-native plants.

Invasive Japanese eelgrass was first observed and documented in the Coquille River estuary in 1992. It is currently rare at Bandon Marsh but can be found in small isolated patches along the edge of the Coquille River within both refuge units and may have an effect on native benthic communities and migrating shorebirds (Dudoit 2006, Crombie 1993, Posey and Rudy 1987). The Coquille River estuary is the only major estuary in Oregon where Japanese eelgrass does not form contiguous meadows (Dudoit et al. 2006). In 2006, the limited and sparsely distributed beds of Japanese eelgrass at Bandon Marsh were the site of a research study to determine the feasibility of manually controlling colonization to adjacent habitat. Results of the study indicated that the vegetative growth of the plants can be controlled but the remaining seed source may reestablish the infestation. In addition, the study area was a site of hydraulic harvesting of mud shrimp used as fishing bait. The action of turning over the substrate with pumps creates pits and mounds of sediment. If done regularly and repeated over the years, it was theorized that the eelgrass would be prevented from establishing large contiguous beds (Dudoit et al. 2006).

4.11 Invasive and Exotic Animal Species

One of the largest threats to wildlife and habitat of the Refuge is pest animals. Introduced native and non-native animal species are usually in direct competition with native wildlife species for food, shelter, and breeding areas and often cause existing native species populations to decline or become extirpated. Ultimately, animal invasive species can result in considerable impact to native wildlife and the habitat they are dependent upon. For example, introductions of Arctic and red foxes for fur farming purposes resulted in widespread extirpation of breeding of the Aleutian Canada goose in the Aleutian Islands, Alaska due to predation (USFWS 1993, Bailey and Trapp 1984). The fox decimated goose populations by preying upon vulnerable nesting adults, chicks, and eggs. The Aleutian Canada goose inhabits refuge lands in Alaska during the summer and Oregon during the winter - spring. Because of cooperative recovery efforts that included removing invasive foxes from the breeding islands, the USFWS officially delisted this species from threatened status in 2001 (USFWS 2001). The following list is not all-inclusive and includes only the most problematic species; many other exotic animals have been introduced.

4.11.1 Description and Status of Nutria

The nutria is a large, dark-colored, semiaquatic rodent that is native to southern South America. At first glance, a casual observer may misidentify nutria as either a beaver or a muskrat, especially when it is swimming. This superficial resemblance ends when a more detailed study of the animal is made. Other names used for the nutria include coypu, nutria-rat, South American beaver, Argentine beaver, and swamp beaver.

Nutria are members of the family Myocastoridae. They have short legs and a robust, highly arched body that is approximately 24 inches (61 centimeters) long. Their round tail is from 13 to 16 inches (33 to 41 centimeters) long and scantily haired. Males are slightly larger than females; the average weight for each is about 12 pounds (5.4 kg). Males and females may grow to 20 pounds (9.1 kg) and 18 pounds (8.2 kg), respectively. The dense grayish underfur is overlaid by long, glossy guard hairs that vary in color from dark brown to yellowish brown. The forepaws have four well-developed and clawed toes and one vestigial toe. Four of the five clawed toes on the hind foot are interconnected by webbing; the fifth outer toe is free. The hind legs are much larger than the forelegs. When moving on land, nutria may drag its chest and appear to hunch its back. Like beavers, nutria have large incisors that are yellow-orange to orange-red on their outer surfaces. In addition to having webbed hind feet, nutria have several other adaptations to a semiaquatic life. The eyes, ears, and nostrils of nutria are set high on their heads. Additionally, the nostrils and mouth have valves that seal out water while swimming, diving, or feeding underwater. The mammae or teats of the female are located high on the sides, which allows the young to suckle while in the water. When pursued, nutria can swim long distances under water and see well enough to evade capture (ICWDM 2011).

Nutria construct burrows in banks of rivers, sloughs, and ponds, sometimes causing considerable erosion. Burrowing is a commonly reported damage caused by nutria. Burrows can weaken roadbeds, stream banks, dams, and dikes, which may collapse when the soil is saturated by rain or high water. Rain action can wash out and enlarge collapsed burrows and compound the damage. Nutria depredation on crops is also well documented. Crops that have been damaged include corn, sugar and table beets, alfalfa, wheat, barley, oats, various melons, and a variety of vegetables from home gardens and truck farms. Nutria girdle fruit, nut, deciduous and coniferous forest trees, and ornamental shrubs. They dig up lawns when feeding on the tender roots and shoots of sod grasses. At high densities and under certain adverse environmental conditions, foraging nutria can also significantly impact natural plant communities. Overutilization of emergent marsh plants can damage stands of desirable vegetation used by other wildlife. Nutria are aggressive competitors with the native muskrat which is smaller. Muskrats have been largely eliminated or greatly reduced where nutria have become established (ODFW 2011a).

Nutria is a semi-aquatic South American mammal, tolerant of mild coastal winters, and is known to be expanding its range in southern coastal Oregon wetlands and within the Coquille River system (Sheffels and Sytsma 2007, Stuart Love, ODFW, personal communication). This rodent is capable of extensive damage as a result of its foraging and burrowing behaviors which adversely impacts the root mass of wetland plants that hold the wetland together. In addition to direct habitat damage to salt marshes and competition with native species (e.g., muskrat, beaver), this large rodent is capable of transporting parasites, and pathogens communicable to wildlife, domestic animals and humans (reviewed in Sheffels and Sytsma 2007). The high reproductive rate of the animal is a concern, as one breeding pair can result in a population of more than 16,000 after only 3 years. If left unchecked, numbers are capable of increasing to tens of thousands within a 30 year period (Sheffels and Sytsma 2007, CBNWG 2003).

In 2010, non-native nutria was documented at the Ni-les'tun Unit of Bandon Marsh NWR with the sighting of a few individuals (USFWS unpublished observations). The habitat damage associated with this expanding nutria population on the Refuge is not currently assessed. Future control efforts will involve working with the ODFW to control, and if possible, eliminate this threat within the lower Coquille River estuary.

4.11.2 Description and Status of Invasive Aquatic Species

Historic use of the Coquille River and southern Oregon estuaries for the maritime industries and aquaculture has introduced and been a vector for the transport of marine invasive species (Carlton and Geller 1993) which threatens the biological diversity of Bandon Marsh (Bax et al. 2003). These are some of the newest and least understood threats to Bandon Marsh NWR due to difficulties in monitoring and jurisdictional controls.

Invasive marine invertebrates such as Asian tunicate, lacy crust bryozoan, Japanese orange-striped anemone, Harris mud crab, European green crab, European saltmarsh snail, Chinese mitten crab, New Zealand burrowing isopod, New Zealand mud snail, Griffen's isopod, and a variety of Asian and eastern United States clams, have been recorded within the southern Oregon estuaries and within the lower Coquille watershed (Dudoit et al. 2006, Bilderback and Bilderback, personal communication, Davidson et al. 2007, USGS 2009).

Chapter 5
Human Environment

Dave Ledig/USFWS

Chapter 5. Human Environment

5.1 Cultural Resources

5.1.1 Native American Cultural Landscape

For thousands of years, people living on the Oregon coast relied upon resources obtained from estuaries (Minor and Toepel 1983, Draper 1988, Ross 1990, Lyman 1991 as cited in Byram 2002). Fish, shellfish, terrestrial and marine mammals, avian species, and edible plants all provided the means for sustenance. With its dense food value and predictable runs, salmon in particular were of high value. This is reflected in the ethnographic accounts and archaeological evidence. Major river drainages are known to have been well populated and have many major archaeological sites. However, smaller estuaries without a major stream to support a strong salmon run had smaller populations and fewer major archaeological sites.

The concentration of preferred resources in the productive interface of ocean and land led to numerous stable and distinct groups of Native people on the Oregon coast. These are recorded in early written records and later ethnographic studies. Each estuary and bay was associated with a unique group that broadly shared the same cultural habits, beliefs, and sometimes language with other coastal groups.

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The Coquille River native people (the Nasomah) hunted, fished, and created river shoreline settlements for thousands of years (Byram and Shindruk 2010, Tveskov and Cohen 2007). The Coquille River provided Native people a convenient transportation route to inland resources and access to the sea. Tributary streams and river side marshes were ideal locations for the use of fish traps or weirs (Byram 2002). Marsh and estuarine habitats have abundant waterfowl; dry uplands were suitable for constructing living quarters, hunting of land mammals and gathering of roots and berries.

The lower reaches of the Coquille River traverses the traditional territory of two Native American tribes. Broadly speaking they are separated by two language phylums. The Miluk, or Lower Coquille, were speakers of the Coosan language family of the Penutian phylum. To the east were the Upper Coquille who spoke Tututuni out of the Athapaskan phylum. The separate languages and numerous dialects belie the intermingled cultures that shared many traits. Bilingualism and intermarriage were common. Trade between groups was wide and extensive largely due to river and oceangoing canoe travel.

Maximizing the depth and breadth of available resources, these early inhabitants developed collection strategies in sync with the seasonal availability of prized food. In spring, various plants and marine fish, including herring, became abundant, and the tides were low on the shore for shellfish harvests. Spring and fall runs of salmon were harvested. Much of the harvest was dried and stored for use throughout the year. Lamprey, sturgeon, flounder, and many other fish were also caught. Spring and summer, being seasons of vigorous vegetative growth, were times to gather roots, tender greens, berries, and nuts. As with most of the Northwest, the bulb of the camas plant provided a staple starch. Harvested in great quantities, camas was baked in rock-lined earth ovens and processed into dried cakes for future use.

Ocean resources tend to be available throughout the year. Seaweed, flounder, crab, seals, sea lions, sea otters, and the occasional drift whale were procured. Clams and mussels were also common food items. Many of these would be cooked in rock-lined earth ovens or boiled in baskets using hot rocks to heat water. Both techniques fracture the rock with use.

Permanent housing was built of cedar logs and split planks. These cedar plank houses could house several families and several fire pits. The roof pattern, style of entry and internal layout may vary but remained within the typical Northwest coast pattern. Center posts held a ridge beam, which supported rafters that lead to the sides. The roof and siding were of split planks.

Evidence of the above activities and items has been found along the coast. Shell middens, or layers of shell, bone, charcoal and fire-cracked rocks that accumulate at occupation sites, are common on the coast. Large quantities of fire-cracked rock with charcoal indicate a roasting pit location. A plank house may be identified by a large rectangular depression with indications of post holes and fire pits. The banks of the lower Coquille River provided prime locations for prehistoric Native American villages and food procurement locations.

5.1.2 Post-settlement Overview

The earliest Euro-American inhabitants of the Coquille watershed were believed to be fur trappers, traders, and explorers. The first settlers established the present town site of Bandon in 1853. As the Euro-American population increased, it moved away from fur trading and diversified into fishing, forestry, and agriculture. In the early 1880s, the first cranberry bogs were planted in the area. Riparian timber was logged and the lowland areas were diked, drained, and then cleared for pasture and crop production. Upland forested areas were harvested and logs were transported by splash damming and on roads. The hydrology of the riverine and tidally influence portion of the Coquille River was altered by dredging and maintenance for commerce and travel. Historic commerce activities in the lower Coquille River, in the proximity of the town of Prosper, south of Bandon Marsh NWR's Ni-les'tun Unit, consisted of shipyards, lumber mills, salmon canneries, schools, and residential buildings (Byram and Shindruk 2010, Reid and Stroud 2003).

5.1.3 Archaeological Sites, Surveys, and Research

Within the approved boundary of the Bandon Marsh National Wildlife Refuge there are thirteen recorded archaeological sites (Tables 5-1 and 5-2). Two of the sites are documented long-term occupation locations. Three sites have major midden components that may indicate occupation or food processing locations. The rest are single fish weirs or a complex of weirs in a discrete location. This pattern and density of sites extends both up and down river from the Refuge.

Archeological Research

Research is currently underway building on Dr. Scott Byram's PhD dissertation and the work of others describing human responses to major tsunami events and the slow, but inexorable, physical changes of sea level rise and anthropogenic effects. Portions of Bandon Marsh NWR have proved rich with data showing human adaptation to dramatic estuary changes. The same work may provide insight to the effects of human actions on the marsh itself.

Table 5-1. Known Archaeological Sites within Bandon Marsh National Wildlife Refuge

Trinomial	Common Name	Attributes
CS1	Philpott Site	Midden & Fish Weirs
CS61	Blue Barn	Occupation site
CS108	Culvert Site	Fish Weir
CS115		Midden
CS116		Midden &Fish Weirs
CS118	Fish Traps	Fish Weirs
CS130	Osprey Weir	Fish Weirs
CS147	Bandon Marsh Weirs	Fish Weirs
CS158	Bussmann	Occupation site
CS159	Rip Rap	Fish Weir
CS160	Philpot Jr.	Fish Weir
FWS-09-1		Fish Weir
FWS-09-2		Fish Weir

Table 5-2. Archaeological Surveys and Excavations within Bandon Marsh National Wildlife Refuge

SHPO Number	Survey Title	Author
18188	Coquille Cultural Heritage	Ivy & Byram
8507	Ocean Disposal Site	M. Martin
2425	Geo-Pacific/Bullards Beach	S. Snyder
	Osprey Site Project	Byram & Erlandson
	Coquille River Archaeological Mapping Project	Coquille Indian Tribe
#07-2209	Pedestrian Survey of North Bank Lane	N. Norris
	The Blue Barn Site	M. Tveskov
	The Bussmann Site	M. Tveskov, Z. Rodriques, D. Ivy & S. Byram
	Ni-les'tun Archaeology, Bussmann, Blue Barn and Old Town Bandon Sites	M. Tveskov & A. Cohen
In progress	Ni-les'tun Restoration	S. Byram
FWS-PA FY2000	Riverside Drive Interpretive Facility	A. Bourdeau
FWS-PA FY2001	Ni-lae-tun – Barns & Silos Removal	A. Bourdeau
FWS-PA FY2001	Philpott Ranch	L. Speulda
FWS-PA FY2005	Replace Refuge Residence #2	L. Speulda
FWS-PA FY2005	Ni-lae-tun – Building Removal	A. Bourdeau

5.1.4 Threats to Cultural Resources

A variety of natural and human-caused activities can threaten cultural resources, including:

- Fire, both naturally-occurring and prescribed for habitat restoration, can cause significant damage to historic structures and archaeological sites as can the activities to suppress and manage fire (such as creating fuel breaks, etc.)
- Erosion, whether the byproduct of fire, wind, waves or another natural or manmade agent
- Habitat restoration and other land management activities.
- Vandalism or “pot hunting”

Any activity identified in the CCP (see Chapter 2), including construction of new facilities or changes in public use, could have a potential impact to cultural resources. The greatest threats may be posed by earthmoving, removal of structures, or alteration of the current erosion patterns occurring during habitat restoration, construction, or other land management activities.

The Service is committed to protecting valuable evidence of plant, animal, and human interactions with each other and the landscape over time. These may include previously recorded or yet undocumented historic, cultural, archaeological, and paleontological resources as well as traditional cultural properties and the historic built environment. Protection of cultural resources is legally mandated under numerous Federal laws and regulations. Foremost among these are the National Historic Preservation Act (NHPA) as amended, the Antiquities Act, the Historic Sites Act, the Archaeological Resources Protection Act (ARPA) as amended, and the Native American Graves Protection and Repatriation Act (NAGPRA). The Service’s Native American Policy (USFWS 1994) articulates the general principles guiding the Service’s relationships with Tribal governments in the conservation of fish and wildlife resources. Additionally, the Refuge seeks to maintain a working relationship and consult on a regular basis with the Tribes that are or were traditionally tied to lands and waters within the Refuge.

5.2 Refuge Facilities

The infrastructure and facilities discussed in this section include boundary signs, public entrances, roads, trails, and administrative buildings. Facilities associated with specific public use programs are discussed in Section 5.5. All public and administrative facilities, with the exception of boundary signs, are depicted on the map located in Chapter 2.

5.2.1 Boundary Signs

Approximately 50% of the Refuge is posted with official refuge boundary signs. Boundary signs are located primarily where refuge lands are adjacent to roads. The majority of the Bandon Marsh Unit was posted in the mid-1980s and the perimeter boundary signs are gradually being replaced. Additional signage denoting the south boundary of the hunting area is being updated as well. The Niles’tun Unit boundary along Highway 101, Fahys Road, North Bank Lane, and the Coquille River is posted. There is posting on the north boundary of the Smith Tract.

5.2.2 Public Entrances, Roads, Launches, Access Points, and Parking

Bandon Marsh Unit

There is one official public entrance to the Bandon Marsh Unit and it is located on the west side of Riverside Drive within the city limits of Bandon. There are no additional official entrances to this unit. The Bandon Marsh Unit is marked with a standard National Wildlife Refuge entrance sign at the Riverside Drive entrance and near the northern end of the unit within the high salt marsh. There is a paved parking lot associated with this unit and it is located on the west side of Riverside Drive. The parking lot runs parallel with the road and contains spaces for 10 vehicles. It includes one accessible parking space for people with disabilities. An elevated boardwalk and deck runs from the parking lot west to the edge of the marsh. These public use facilities were completed in February 2002.

The public may also access the Bandon Marsh Unit by boat during higher tides from the Coquille River. There are two boat launches nearby that waterfowl hunters occasionally use to launch their watercraft. One launch is at Bullards Beach State Park directly across the river and another one is located further south at the Port of Bandon. Boating provides access to the high marsh area in the northwest portion of this unit where hunters set up temporary hunting blinds.

Ni-les'tun Unit

There is one official public entrance for visitors to the Ni-les'tun Unit and it is located on the south side of North Bank Lane adjacent to the South Coast Refuge office, bunkhouse, and shop facilities. The Unit is marked with a standard refuge entrance sign and provides visitors with access to a parking lot and viewing deck. There is an automatic gate located at the public entrance to the Ni-les'tun Unit's visitor parking lot, which closes daily at sunset and opens at sunrise. The paved parking lot has 22 spaces for passenger vehicles, room for bus/RV parking and two accessible passenger vehicle spaces. As part of the North Bank Lane Improvement project, completed 2011, a trail and pedestrian underpass was constructed that leads visitors from the parking lot at the viewing deck to the refuge office.

There is an additional entrance to the Refuge on the north side of North Bank Lane, which leads to the refuge office and storage garage that is marked with a U.S. Fish and Wildlife emblem sign. The entrance road to the office was relocated as part of the North Bank Lane Improvement project and moved a little further to the east while former entrance road was incorporated into the trail from the viewing deck parking lot. A non-striped parking area at the office is open to the public but is used primarily by refuge staff, volunteers, and researchers. Finally, there is an additional administrative use only refuge access point and associated gravel parking area at the Smith Tract used by refuge staff, friends group members, and volunteers.

5.2.3 Trails

Bandon Marsh Unit

There are no official trails on the Bandon Marsh Unit. However, there is a short elevated boardwalk that leads to a set of stairs that allows the public to gain access from the observation deck into the marsh. From the stairs, there is an unofficial 50-foot long foot trail that leads through the high salt marsh to the low tidal mudflats. Once visitors reach the open mudflats they are able to hike anywhere on the refuge unit.

Ni-les'tun Unit

There is one official trail off of the Ni-les'tun Unit overlook deck leading west along a concrete/gravel path into the restored salt marsh. This 300-foot long trail allows the public to get to the level of the highest tides and small meandering tidal channels. In addition, a trail from the parking lot/overlook deck to the office was completed in 2011.

5.2.4 Administrative Buildings and Other Infrastructure

The south coast administrative facility is located on the Ni-les'tun Unit of Bandon Marsh NWR approximately five miles north of the city of Bandon. Specifically, the South Coast Refuge Office is located on the north side of the Coquille River and North Bank Lane. The administrative facilities consist of an office, a three bay garage, a maintenance shop, and a volunteer bunkhouse with an associated detached two bay garage. The bunkhouse has five bedrooms and serves refuge staff, volunteers, biologists, and/or researchers. On the Smith Tract there is a double-wide manufactured home that is used as office space by the Friends of Southern Oregon Coastal Refuges/Shoreline Education for Awareness and a three bay maintenance shop. The Smith Tract also has two full hook-up Recreational Vehicle (RV) sites and two small outbuildings used for storage and laundry facilities for refuge volunteers.

5.3 Wildlife-dependent Public Uses

The National Wildlife Refuge System Improvement Act of 1997 defined six wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) and required that they receive priority consideration in refuge planning when they are compatible with the refuge mission.

The Bandon Marsh Unit of Bandon Marsh NWR currently offers all six wildlife-dependent public uses. The purpose of this CCP and public involvement is to determine if public uses on the Bandon Marsh Unit are in need of updating and to address compatible public use opportunities on the Ni-les'tun Unit of the Refuge. Currently, refuge visitation is relatively low though it has increased in recent years with the installation of visitor use facilities (e.g., wildlife viewing decks and parking lots) at Riverside Drive and at the Ni-les'tun Unit. Visitors from outside of the area usually visit the Refuge as a destination either to observe birds and other wildlife or to clam or hunt. Their visits are often seasonal as birders time their trips to coincide with the seasonal migration of shorebirds in late April/early May and again in late August/early September and waterfowl hunters time their trips with the arrival of migratory waterfowl within the early portion of the ODFW regulated waterfowl hunting season. Local residents tend to visit the Refuge year-round with most visitations occurring during the height of shorebird migration in the spring and again in the fall.

5.3.1 Waterfowl Hunting

Bandon Marsh Unit

The northern-most section of the Refuge, outside of the city of Bandon limits, is open to waterfowl hunting during State of Oregon waterfowl hunting seasons and follows Oregon Department of Fish and Wildlife regulations; the remaining southern section falls within city limits and is closed to all hunting. The hunt program allows the take of waterfowl species such as geese, ducks, and coot. The site is used by small number of regular and visiting hunters and the waterfowl hunt program has been in place since acquisition occurred in 1983. Access for hunting parties is either via boat or walk-in through the southern closed hunting area from the Riverside Drive parking lot. There are no blinds or designated hunting spots. Only portable blinds or blinds constructed of on-site dead vegetation or driftwood may be used and they must either be removed or disassembled at the end of each day.

Ni-les'tun Unit

This unit is currently closed to hunting.

5.3.2 Fishing and Clamming

Fishing is allowed on the Bandon Marsh Unit, but consists primarily of clamming. The state of Oregon regulates the take of clams and this activity currently takes place just downstream from the U.S. Highway 101 Bridge and on the mudflats southwest of the Riverside Drive viewing deck.

5.3.3 Wildlife Observation and Photography

These two wildlife-dependent public use activities are popular with birders and wildlife enthusiasts on the Refuge. Participation in both of these occurs year-round and the number of public participants peaks during the bi-annual migration of shorebirds, waterfowl, and raptors. Local and out of town wildlife observers and birders travel to Bandon Marsh in April/May and again in August/September to witness and/or photograph the abundance of coastal and shorebirds using the marsh as a migration stop-over site. The Refuge is a co-sponsor of the annual Oregon Shorebird Festival, usually held in late August, which attracts between 70 to 130 birders. This festival is one of the longest running bird festivals in Oregon and has repeat attendees accounting for approximately 50% of the participants. The festival is a collaborative effort between the Service, the Cape Arago Audubon Society, South Slough National Estuarine Research Reserve, Oregon Institute for Marine Biology, Friends of Southern Oregon Coastal Refuges/Shoreline Education for Awareness, and Oregon Field Ornithologists.

Wildlife observation facilities include two viewing decks, one at the Bandon Marsh Unit and the other at the Ni-les'tun Unit. There are no photography blinds on the Refuge.

5.3.4 Environmental Education

The Refuge offers environmental education (EE) programs both on and off-site to help promote an understanding of fish and wildlife, their habitats, and the mission of the U.S. Fish and Wildlife Service. Current refuge EE programs have been developed with the State of Oregon's educational requirements and benchmark standards. The largest and most requested EE program for the Refuge Complex is the Shorebird Sister Schools Program (SSSP). Since 2002, the Refuge Complex has expanded and delivered this shorebird ecology program to students in grades 4-6. The SSSP has grown to be one of the largest within the National Wildlife Refuge System. Annually, the program's teachers, interns, and volunteers reach approximately 700 students from schools in three participating school districts that span half of the Oregon coast. Through the assistance and dedication of the schools' teachers, interns, community, and Friends Group volunteers, the program offers lessons that are fun, interactive, and educational from January to June. Using activities and lessons from the USFWS endorsed SSSP curriculum, individual lessons teach about the need for quality shorebird and wildlife habitat and the role the USFWS plays in managing it. The field component of the five-week program brings students to Bandon Marsh NWR or other estuaries where they spend two hours rotating through three field experience stations. It is during this trip that all of the hands-on lessons from the classroom become real when the students are able to use binoculars and field guides to identify the birds they have been learning about as they walk the perimeter of the marsh. In another field activity, students are immersed in the diet of shorebirds as they dig on the edge of the tidal mudflat for invertebrates and view shorebird prey items in magnified boxes. Finally they participate in helping maintain the marsh during an estuary debris cleanup hike within the high tide wrack line.

Since 2008, interns and volunteers with the Free Flight Bird and Wildlife Education and Rehabilitation group have developed an EE program for wildlife conservation using live non-releasable birds of prey. The pilot program in 2008 was developed using State of Oregon educational benchmarks and curriculum standards (e.g., bio-accumulation, biodiversity). This highly desired classroom or field program involves various ages of student (K-12) with hands-on activities and up close and personal experiences with wildlife.

5.3.5 Interpretation

Bandon Marsh NWR is represented in an Oregon Coast National Wildlife Refuges brochure that is stocked at the Refuge Complex headquarters in Newport, the South Coast Refuge Office in Bandon, and at multiple visitor centers along the Oregon coast. The Refuge Complex maintains a website (www.fws.gov/oregoncoast) where current information regarding the Refuge can be obtained at any time. The Refuge further involves the public through social media and maintains a Facebook account and a Flickr site.

Bandon Marsh Unit

All lands within the Bandon Marsh Unit are open to public use. The Unit contains a viewing deck with stairs leading to the marsh, a bench, and two interpretive panels. The interpretive panels were installed in the spring of 2010 and tell visitors the story of wildlife ecology of the salt marsh and the role this estuary plays as critical migratory stop-over habitat for tens of thousands of migrating shorebirds.

Ni-les'tun Unit

A small portion of the Ni-les'tun Unit is open to public use. The open area contains a parking lot, a short marsh trail, and a viewing deck with a series of five interpretive panels about the National Wildlife Refuge System, marsh restoration, local history and culture, wildlife management, and the role natural forces play in shaping land. All other lands on this unit are currently closed to public use.

5.4 Other Refuge Uses

5.4.1 Non-recreational Public Uses

Right-of-ways on record relate to Coos County maintained road and utilities (phone/electric/cable) on the Refuge to serve refuge and public facilities.

5.4.2 Illegal/Unauthorized Uses

The Oregon Coast NWR Complex has one full-time Wildlife Law Enforcement (LE) Officer. LE assistance is also provided to the Refuge Complex by the Zone LE officer, along with the Coos County Sheriff, officers from the Bureau of Land Management and the U.S. Forest Service, and Bandon Police Department on an as needed basis. Refuge law enforcement deals with issues that include enforcement of the waterfowl hunt program, litter, vandalism, archaeological theft and damage, illegal harvest of plants or animals, and trespass. The Riverside Drive access area is located away from the refuge office area and within the city limits of Bandon which creates an infrequent number of law enforcement issues associated with vandalism, drug use, disorderly conduct, and litter.

5.5 Surrounding Area Outdoor Recreational Opportunities and Trends

5.5.1 Nearby Recreational Opportunities

Bandon Marsh NWR is located within and adjacent to the small coastal city of Bandon, which has a population of approximately 3,250. Local, state, and federal governments have all developed recreational opportunities for both residents and visitors within 25 miles of the Refuge. The City of Bandon manages one park, while Coos County manages three day-use parks and three boat ramps. Oregon Parks and Recreation Department (OPRD) manages five day-use parks, and two additional parks with campgrounds and they provide and maintain multiple locations for beach access. Both the state and federal government manage the South Slough National Estuarine Research Reserve (Reserve), a 5,000-acre natural research and public use area located in the Coos estuary and a short drive from Bandon Marsh NWR. The Reserve is comprised of a network of estuarine habitats protected and managed for the purposes of long-term research, education, and coastal stewardship. The Reserve manages a series of hiking trails, a non-motorized boat launch, and a visitor center that offers year-round environmental education and interpretation programs.

The Port of Bandon has developed the city waterfront near the mouth of the Coquille River for public use. It includes marina facilities for boat launching and sport fishing, a crab dock, a boat ramp and roofed fish cleaning station, an interpretive riverwalk, public restrooms, and a glassed-in picnic shelter and amphitheater.

The Bureau of Land Management manages the New River Area of Critical Environmental Concern. The New River runs parallel to the Pacific Ocean for nine miles and is separated from the ocean by a thin foredune of sand. Many rare birds, animals, and plants depend on the New River's estuarine, forest, meadow, wetland, and shrub habitats for survival. The site is dedicated almost exclusively to Watchable Wildlife providing nature enthusiasts with short, rustic, self-guided loop trails to view wildlife.

Coquille Point, a mainland unit of Oregon Islands NWR, is located in Bandon and provides visitors with a spectacular place to observe seabirds and harbor seals as well as explore the tidepools and the beach with its rocks, islands, and reefs. A paved trail winds over the headland and features interpretive panels that share stories about the area's wildlife and its rich Native American history. Stairways to the beach are located on opposite sides of the headland and allow visitors to make a loop on the beach.

Waterfowl hunting occurs on many privately-owned lands within Coos County. In addition, there are a few public opportunities for waterfowl hunting including a large portion of Coos Bay, even though it is within the City Limits of Coos Bay. Also portions of the South Slough National Estuarine Research Reserve are open to hunting (ODFW 2011b).

5.5.2 Outdoor Recreation Trends

OPRD is responsible for providing guidance, information and recommendations to federal, state, and local units of government, as well as the private sector, in making policy and planning decisions regarding outdoor recreation in Oregon. They do this in the Statewide Comprehensive Outdoor Recreation Plan or SCORP (OPRD 2008). The latest SCORP is a five-year plan covering outdoor recreation in Oregon from 2008 through 2012.

The OPRD began the SCORP planning process in September 2005. The agency took a more proactive approach in addressing a limited number of previously identified and defined issues. Key findings from the 2003-2007 SCORP and the 2005-2014 statewide trails planning efforts identified a number of important demographic and social changes facing outdoor recreation providers in the coming years including: (1) a rapidly aging Oregon population, (2) fewer Oregon youth learning outdoor skills, and (3) an increasingly diverse Oregon population. Key findings for each of these issues are:

Aging Oregon Population

- On average across all activities, respondents expect to spend 28% more days recreating 10 years from now than they currently do.
- The most popular outdoor recreation activities for Oregonians between the ages of 42 and 80 included walking, picnicking, sightseeing, visiting historic sites, and ocean beach activities. A comparison across age categories for top five activities by participation intensity leads to the following conclusions: Walking is the top activity across all age categories (40- 79); jogging is a top activity between the ages of 40-59, but is also popular for those in their 70s; bicycling is a top activity between the ages of 40-64; sightseeing is a top activity between the ages of 45-74; bird watching is a top activity between the ages of 55-79; and RV/trailer camping is a top activity between the ages of 55-74.
- The top five activities in terms of future participation intensity 10 years from now included walking, bicycling, jogging, bird watching, and day hiking.
- Over one-third of Oregon Boomers and Pre-Boomers volunteered in their community, with an average time commitment of 5.3 hours per week. Of those who volunteered, 43% expect future changes in their volunteer activities, with most of the changes involving greater volunteerism: more time, more projects at current volunteer opportunities, and new volunteer opportunities.

Youth Learning Outdoor Skills

- The most popular outdoor activities for parents were walking, viewing natural features, and relaxing/hanging out. For children, the most popular were walking, followed by outdoor sports/games, relaxing/hanging out, and general play at neighborhood parks/playgrounds.
- The more a parent engages in an outdoor recreation activity, the more their child does. Participation varies across child age, with both the number of activities and the number of activity-days peaking amongst 12-14 year olds and decreasing for 15-17 year olds.

- Rural children spend more days, on average, in outdoor activities relative to urban and suburban children.
- Outdoor sports programs and day camps were the most popular types of outdoor recreation programs with respect to past participation. Many parents indicated that it would be very likely for their children to participate in outdoor sports programs (62%), multi-day camps (49%), outdoor adventure trips (45%), and day camps (45%) in the future.

An Increasingly Diverse Oregon Population

- Walking for pleasure was the most common favorite activity for both Hispanics and Asians, with fishing and soccer being the next most common for Hispanics and hiking and fishing the next most common for Asians.
- Both Hispanic and Asian respondents most commonly did their favorite activity with members of their immediate family. Asians were more likely than Hispanics to do activities alone, as were older respondents relative to younger respondents.
- The most common location for Hispanic and Asian respondents to do their favorite activity was in a park or other area outside one's town or city. Males were more likely than females to engage in their favorite activity further from home.
- Walking for pleasure was also the activity respondents spent the most days engaged in during the past year. Hispanics engage more intensely than Asians in jogging/running, day hiking, picnicking, fishing, viewing natural features, visiting nature centers, and visiting historic sites.
- The most common activities respondents would like to do more often, or start doing were walking for Asians and walking and camping for Hispanics. The factor that would most help make this happen is availability of partners, followed by more time.
- For the Hispanic population, being in the outdoors, relaxing and having fun were the most important motivators or reasons for participating in outdoor activities. For the Asian population, relaxing, fitness, and having fun were the top motivators.

A summary of management recommendations, that are relevant to the types of outdoor recreation that the Service is engaged in, resulting from the SCORP are as follows:

- Develop a statewide youth outdoor programming framework and funding source to focus youth programming efforts across Oregon to address a specific set of key measurable objectives.
- Create a new Outdoor Recreation Section within OPRD addressing the areas of outdoor recreation and environmental education.
- Develop a strategy to strengthen the role of park and recreation agencies in the state's Safe Routes to Schools grant program.
- Plan and develop regional trail systems in areas having highest relocation intensity in the 40 to 79 age range (Coastal, Southern and Central Oregon communities).
- Provide design assistance for innovative park designs connecting kids with nature.
- Encourage organizational cultural change within public recreation agencies/organizations to effectively address the diversity issue.
- Develop recommendations for addressing language barriers to encourage underrepresented population use of outdoor recreation facilities and programs
- Create a customer service training module related to serving the outdoor recreation needs of an increasingly diverse population.

5.6 Socioeconomics

5.6.1 Population and Area Economy

Oregon's population of approximately 3,825,700 ranks 27th in the nation. State land area covers 95,997 square miles compared to 3,537,438 square miles in the United States with a population density of 40 persons per square mile compared to 87 nationwide.

The two units of the Bandon Marsh NWR, Bandon Marsh Unit and Ni-les'tun Unit, are located along the southern Oregon coast in Coos County. The Refuge is situated along the lower Coquille River and just north of the city of Bandon. Coos Bay is the largest city in the county with a population of approximately 16,670.

Table 5-3 provides a summary of area population and economy. The county population remained constant from 1999 to 2009, compared with an 11 percent increase for the state of Oregon and a 10 percent increase for the U.S. as a whole. County employment increased by 2 percent from 1999 to 2009 but was outpaced by the state of Oregon showing an 8 percent increase and the U.S. an 8 percent increase. Per capita income in Coos County increased by 13 percent over the 1999-2009 period, while the state of Oregon and the U.S. increased by 4 and 9 percent respectively.

Table 5-3. Bandon Marsh NWR: Summary of Area Economy, 2009 (population & employment in thousands; per capita income in 2010 dollars)

	Population		Employment		Per Capita Income	
	2009	Percent Change 1999-2009	2009	Percent Change 1999-2009	2009	Percent Change 1999-2009
Coos County, OR	62.8	-0.3%	31.2	2%	$32,133	13%
Oregon	3,825.7	11%	2,202.7	8%	$36,785	4%
United States	307,006.6	10%	173,809.2	8%	$40,285	9%

Source: U.S. Department of Commerce 2011.

The largest industry sectors of Coos County include Local Government, Health Care and Social Assistance, and Retail Trade. The Coos County economy is also dependent on forestry products, fishing, agriculture, and tourism. As the economy shifts away from manufacturing forestry products, it is moving toward the service industry in support of its tourism industry.

The largest industry sectors for Coos County are ranked below by employment (Table 5-4). The largest employer is the State and local government. Natural resource-based industries (logging, sawmills, and support activities for agriculture and logging) totaled 1,890 jobs. Food services, retail stores, and hotels, which are impacted by refuge visitation, are also important contributors to the economy (3,899 jobs).

Table 5-4. Industry Summary for Coos County (dollars in thousands)

Industry	Employment	Output	Employment Income
State and Local Government	5,005	286,196	252,681
Health Care	1,957	143,914	58,779
Food Services	1,757	92,280	28,909
Retail Stores	1,609	100,470	41,396
Employment Services	881	30,963	21,092
Commercial Logging	830	208,710	29,035
Individual and Family Services	746	24,463	10,761
Private Household Operations	725	4,238	3,698
Religious Organizations	576	82,356	10,846
Sawmills and Wood Preservation	539	132,943	27,826
Hotels and Motels	533	44,487	14,017
Support Activities for Agriculture and Forestry	521	15,591	16,990

Source: Minnesota IMPLAN Group, Inc. 2008.

5.6.2 Economic Benefits of Refuge Visitation to Local Communities

From an economic perspective, Bandon Marsh National Wildlife Refuge provides a variety of environmental and natural resource goods and services used by people either directly or indirectly. The use of these goods and services may result in economic impacts to both local and state economies. The various services the Refuge provides can be grouped into five broad categories: (1) maintenance and conservation of environmental resources, services and ecological processes; (2) production and protection of natural resources such as fish and wildlife; (3) protection of cultural and historical sites and objects; (4) provision of educational and research opportunities; and (5) outdoor and wildlife-related recreation. People who use these services benefit in the sense that their individual welfare or satisfaction level increases with the use of a particular good or service. One measure of the magnitude of the change in welfare or satisfaction associated with using a particular good or service is economic value. Aside from the effect on the individual, use of the good or service usually entails spending money in some fashion. These expenditures, in turn, create a variety of economic effects collectively known as economic impacts.

A comprehensive economic profile (baseline) of the Refuge would address all applicable economic effects associated with the use of refuge-produced goods and services. However, for those goods and services having nebulous or non-existent links to the market place, economic effects are more difficult or perhaps even impossible to estimate. Some of the major contributions of the Refuge to the natural environment, such as watershed protection, maintenance and stabilization of ecological processes, and the enhancement of biodiversity would require extensive on-site knowledge of biological, ecological, and physical processes and interrelationships even to begin to formulate economic benefit estimates. This is beyond the scope of this section. Consequently, this section focuses on economic effects which can be estimated using currently available information. As a result, benefits represent conservative estimates of total social impacts.

The following section focuses on a limited subset of refuge goods and services, primarily those directly linked in some fashion to the marketplace, such as recreation use and refuge budget expenditures. It should be kept in mind that the emphasis on these particular market-oriented goods and services should not be interpreted to imply that these types of goods and services are somehow more important or of greater value (economic or otherwise) than the non-market goods and services previously discussed. To estimate the total economic activity, employment, employment income and federal and state taxes generated by refuge activities, this report uses IMPLAN, a regional input-output model and software system (Minnesota IMPLAN Group, Inc. 2004).

Regional Economic Impacts of Recreational Activities

Two types of information are needed to estimate the economic impacts of recreational visits to the Refuge: (1) the amount of recreational use on the Refuge by activity; and (2) expenditures associated with recreational visits to the Refuge. Recreational use is estimated by refuge staff. Expenditure patterns used were obtained from the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USFWS 2007). With this information, total expenditures for each activity can be estimated. These expenditures, in turn, can be used in conjunction with regional economic models to estimate industrial output, employment, employment income and tax impacts associated with these expenditures.

Bandon Marsh NWR currently offers a variety of wildlife-dependent public uses. Refuge visitation is relatively low though it has increased in recent years with the installation of visitor use facilities. Refuge visitors are a blend of both local residents and visitors. Visitors from outside of the area usually visit the Refuge as a destination either to observe birds and other wildlife or to hunt. Local residents tend to visit the Refuge year-round with peak visits around shorebird migrations.

Table 5-5 shows the recreation visits for Bandon Marsh NWR. The Refuge had an estimated 4,772 recreation visits in 2010. In addition to recreation visits, the Refuge also had 2,900 environmental education visits for the Shorebird Sister Schools Program and the Free Flight Bird Programs. The environmental education program provides education opportunities to the community. However, these types of opportunities do not contribute to the local economic impacts because the events do not bring visitors who are spending money toward travel-related goods and services. Therefore, only visits associated with recreational activities are used to estimate economic effects.

Table 5-5. Bandon Marsh NWR: FY2010 Recreation Visits

Activity	Residents	Non-Residents	Total
Non-consumptive:			
Pedestrian	1,760	1,760	3,520
Photography	225	75	300
Other recreation	752	0	752
Hunting:			
Waterfowl	150	50	200
Total Recreation Visitation	**2,887**	**1,885**	**4,772**

Regional Economic Analysis

Visitor recreation expenditures for 2010 are shown in Table 5-6. Total expenditures were $73,600 with non-residents accounting for $46,900 or 64 percent of total expenditures. Expenditures on non-consumptive activities accounted for 85 percent of all expenditures, followed by hunting at 15 percent.

Table 5-6. Bandon Marsh NWR: Visitor Recreation Expenditures (2010 dollars in thousands)

Activity	Residents	Non-residents	Total
Non-Consumptive:			
Pedestrian	$10.7	$38.9	$49.6
Photography	$1.8	$2.2	$4.0
Other recreation	$9.1	$0.0	$9.1
Total Non-Consumptive	**$21.6**	**$41.1**	**$62.7**
Hunting:			
Waterfowl	$5.1	$5.8	$10.9
Total Hunting	**$5.1**	**$5.8**	**$10.9**
Total Expenditures	**$26.7**	**$46.9**	**$73.6**

Input-output models (Minnesota IMPLAN Group, Inc. 2004 and Miller and Blair 1985) were used to determine the economic impact of expenditures on the Refuge's local economy. The estimated economic impacts are expected to occur in the local area of Coos County, Oregon. It is assumed that visitor expenditures occur primarily within this county. Table 5-7 summarizes the local economic effects associated with recreation visits. Final demand totaled $99,400 with associated employment of 1 job, $29,100 in employment income and $13,800 in total tax revenue.

Table 5-7. Bandon Marsh NWR: Local Economic Effects Associated with Recreation Visits (2010 dollars in thousands)

	Residents	Non-residents	Total
Final Demand	36.6	62.8	99.4
Jobs	0.4	0.6	1.0
Job Income	10.8	18.3	29.1
Total Tax Revenue	5.0	8.7	13.8

The economic impacts from recreation expenditures estimated in this report are gross area-wide impacts. Information on where expenditures may occur locally and the magnitude and location of resident and non-resident expenditures (resident and non-resident relative to the geographical area of interest) is not currently available. Generally speaking, non-resident expenditures bring outside money into the area and thus generate increases in real income or wealth. Spending by residents is simply a transfer of expenditures on one set of goods and services to a different set within the same area. In order to calculate net economic impacts within a given area derived from resident expenditures, much more detailed information would be necessary on expenditure patterns and visitor characteristics. Since this information is not currently available, the gross area-wide estimates are used as an upper-bound for the net economic impacts of total resident and non-resident spending in the two and six county areas. The economic impacts of non-resident spending in Table 5-7 represent a real increase in wealth and income for the area (for additional information, see Loomis 1993 p. 191).

Regional Economic Impacts of the Refuge Budget

In addition to impacts from recreational visitors, there are also economic effects related to the refuge expenditures that contribute to local and regional economies. In 2010, the refuge budget totaled about $367,000. Approximately $296,000 (81 percent) is allocated to salaries while the remaining $71,400 is allocated to goods and services supporting the Refuge. Table 5-8 summarizes the Refuge's expenditures in 2010.

Table 5-8. Bandon Marsh National Wildlife Refuge Annual Expenditures, 2010 (2010 dollars in thousands)

Expenditure	Annual Expenditures
Salary – Permanent Employees	$295.5
Non-Salary	$71.4
Total	**$366.9**

Table 5-9 shows the jobs, job income, and tax revenues generated by refuge expenditures. The Refuge's annual budget generates approximately 4 jobs and $165,100 in job income. Overall, refuge expenditures result in about $459,200 in final demand.

Table 5-9. Local Annual Economic Effects Associated with 2010 Refuge Budget (2010 dollars in thousands)

	Salary	Non-salary	Total
Final Demand	$340.3	$118.9	$459.2
Jobs	3	1	4
Job Income	$97.1	$68.0	$165.1
Total Tax Revenue	$44.3	$18.6	$62.8

5.6.3 Refuge Revenue Sharing

National wildlife refuges, like other Federal, State, and County-owned lands are not subject to property taxes. However, under provisions of the Refuge Revenue Sharing Act, the Service annually reimburses counties for revenue lost as a result of acquisition of fee title. Payments to the county are based on the highest value as determined by one of the following three equations: three-fourths of 1 percent of the fair market value of the land; 25 percent of net receipts; or $.75 per acre, whichever is greater. Refuge lands are re-appraised every 5 years to ensure that payments are based on current land values. The revenue sharing fund consists of net income from the sale of products or privileges such as timber sales, grazing fees, permit fees, mineral royalties, etc. If this fund has insufficient funds to cover payments to local counties, Congress is authorized to appropriate money to make up the deficit. Should Congress fail to appropriate such funds, payments to counties will be reduced accordingly.

Table 5-10 summarizes Refuge Revenue Sharing payments made to Coos County from 2006 to 2010.

Table 5-10. Refuge Revenue Sharing Payments to Coos County for Bandon Marsh National Wildlife Refuge

Year	Fee Acres	Total Payment
2006	889	$5,667
2007	889	$5,480
2008	889	$5,503
2009	889	$5,171
2010	889	$3,643

5.7 Special Designation Areas

The Bandon Marsh Unit of Bandon Marsh NWR has been designated as an Important Bird Area (IBA) by the National Audubon Society. Oregon's IBA program recognizes sites of outstanding importance to birds in the state (Audubon Society of Portland 2011). Sites with IBA designation are extremely important to Oregon's birds, though the IBA program by itself does not ensure the continued productivity of selected sites and certainly cannot guarantee continued avian diversity throughout the state. Most species of birds within IBAs are at least partially migratory, and most of the waterfowl, shorebirds, and seabirds of Oregon's IBAs are highly migratory or at least make extensive flights between the recognized IBAs and other areas. In Oregon, this non-regulatory global program is coordinated by The Audubon Society of Portland (2011) with a mission to identify places in Oregon that are important for birds and to promote the restoration and conservation of important bird values at these sites through partnerships, education, observation, and hands-on efforts.

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Dave Ledig/USFWS

Appendices A-J

Chapter 1 Introduction and Background

Chapter 2 Management Direction

Chapter 3 Physical Environment

Chapter 4 Biological Environment

Chapter 5 Human Environment

Appendices

Appendix A. Appropriate Use Findings

A.1 Introduction

The Appropriate Refuge Uses Policy (603 FW 1 (2006)) 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 provides refuge managers with a consistent procedure to first screen and then document decisions concerning a non-priority 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. For purposes of this CCP an "appropriate use" must meet at least one of the following three conditions.

- The use is a wildlife-dependent recreational use as identified in the Refuge Improvement Act.
- The use involves the take of fish and wildlife under state regulations.
- The use has been found to be appropriate as specified in Section 1.11 of the policy and documented on FWS Form 3-2319.

The policy also requires review of existing non-priority public uses. During the CCP process, the refuge manager evaluated all existing and proposed non-priority refuge uses at Bandon Marsh National Wildlife Refuge 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 time 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, 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 refuge use was appropriate, and directed that a compatibility determination be completed for the use: Research.

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Finding of Appropriateness of a Refuge Use

Refuge Name: Bandon Marsh National Wildlife Refuge

Use: Research, Scientific Collecting, and Survey Activities

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?	X	
(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use, or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(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?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	X	

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 _X_

When the refuge manager finds the use **appropriate** based on sound professional judgment, the ApA_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 _X_

Refuge Manager: Rebecca G. Chuck Acting Date: 12/18/12

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: 12/18/12

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

Research, Scientific Collecting, and Surveys

Further Explanation of Answers Provided for the Decision Criteria:

Project: Conducting research on refuge lands and waters

Summary: The Refuge receives requests to conduct scientific research on refuge lands and waters.

Research applicants must submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on refuge wildlife and/or habitat, including disturbance (short- and long-term), injury, or mortality; (5) personnel required; (6) costs to the Refuge, if any; and (7) end products expected (i.e., reports, publications). Research proposals will be reviewed by refuge staff, the Regional Office Branch of Refuge Biology, and others as appropriate prior to the Refuge issuing a special use permit (SUP). Projects will not be open-ended, and at a minimum, will be reviewed annually.

For each of the findings listed on FWS Form 3-2319, a justification has been provided below:

(a) Do we have jurisdiction over the use?

Some or all of the proposed activities would take place within refuge boundaries. The Refuge has jurisdiction over those research projects that are sited within refuge boundaries.

(b) Does the use comply with applicable laws and regulations (federal, state, tribal, and local)?

Any proposed research activities will comply with all applicable laws and regulations and any restrictions or qualifications that are required to comply with laws and regulations will be specified in the SUP.

(c) Is the use consistent with applicable executive orders and Department and Service policies?

Through the review of individual projects, the Refuge will ensure that they are consistent with applicable policies, especially the Research on Service Lands Policy (803 FW 1).

(d) Is the use consistent with public safety?

Through individual project review, the Refuge will ensure that each project is consistent with public safety. If necessary, stipulations to ensure public safety will be included in the project's SUP.

(e) Is the use consistent with goals and objectives in an approved management plan or other document?

The Refuge Administration Act directs the Service to "ensure that the biological integrity, diversity, and environmental health of the National Wildlife Refuge System are maintained for the benefit of present and future generations of Americans." The Service's Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3) provides for the consideration and protection of a broad spectrum of native fish, wildlife, and habitat resources found on refuges and associated ecosystems. When evaluating the appropriate management direction for refuges (e.g., in compatibility determinations), refuge managers are to use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, knowledge of refuge resources, an understanding of the refuge's role within an ecosystem, applicable laws, and best available science, including consultation with others both inside and outside the Service. Therefore, research is consistent with Service policy.

In addition, one of the refuge goals listed in the 1985 Refuge Management Plan is "to cooperate with other agencies, institutions of higher education, private organizations, and individuals in providing technical assistance and research opportunities." The Complex believes that appropriate, compatible research activities will contribute to, and are essential to accomplishing, the enhancement, protection, conservation, and adaptive management of native wildlife populations and their habitats on the Refuge.

(f) Is the use manageable within available budget and staff?

The Refuge receives few requests per year for this activity, and it is manageable with available budget and staff.

(g) Will this be manageable in the future within existing resources?

The use at current levels will be manageable in the future with the existing resources.

(h) 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?

The use is beneficial to the Refuge's natural and cultural resources because the types of research projects approved are those that have the distinct likelihood of helping achieve refuge purposes by providing information useful for the management of trust resources and contributing to the public's understanding and appreciation of natural and/or cultural resources.

(i) 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?

The Service believes that wildlife and habitat conservation and management on the Refuge should be based upon statistically viable scientific research combined with long-term monitoring. The information gained through appropriate, compatible research on refuge lands will be beneficial to the Refuge's natural and cultural resources through application of this information into adaptive management strategies. The Refuge Complex will also distribute any information gained to the public, which will allow them to better understand and appreciate the refuge resources and the need for protecting them.

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Appendix B. Compatibility Determinations

B.1 Introduction

The compatibility determinations (CDs) developed during the comprehensive conservation plan (CCP) planning process evaluate uses projected to occur under Alternative C, the preferred alternative, in the Draft CCP/Environmental Assessment (EA) for the Bandon Marsh National Wildlife Refuge (NWR or Refuge) (USFWS 2012a), which was carried forward as the management direction for the Refuge in this CCP. The evaluation of funds needed for management and implementation of each use is described in Appendix C, Implementation. Chapter 6 of the Draft CCP/EA also contained an analysis of the impacts of refuge uses to wildlife and habitats. That document is incorporated through reference into this set of CDs.

B.1.1 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, compatibility determinations are to be completed for all uses proposed under a CCP that have been determined to be appropriate. Existing wildlife-dependent recreational uses must also be reevaluated and new CDs prepared during development of a CCP. According to the Service's compatibility policy, 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 Compatibility Determinations

Refuge Use	Compatible	Page
Wildlife Observation, Photography, Interpretation and Environmental Education	Yes	B-5
Waterfowl Hunting	Yes	B-21
Fishing and Clamming	Yes	B-31
Research, Scientific Collecting, and Surveys	Yes	B-45

B.1.2 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 national wildlife 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, national wildlife 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, 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 overflights, emergency actions, some activities on navigable waters, and activities by other Federal agencies on “overlay refuges” are exempt from the compatibility review process.

New compatibility regulations, required by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), were adopted by the Service in October, 2000 (http://refuges.fws.gov/policymakers/nwrpolicies.html). The regulations require that a use must be compatible with both the mission of the System and the purposes of the individual refuge. This standard helps to ensure consistency in application across the Refuge System. The 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 the Bandon Marsh National Wildlife Refuge are based on the professional judgment of refuge and planning personnel including observations of refuge uses and reviews of appropriate scientific literature.

In July 2006, the Service published its Appropriate Refuge Uses Policy (603 FW 1). Under this policy, most proposed uses must also undergo a review prior to compatibility. Uses excepted from the policy include priority wildlife-dependent recreational uses, and uses under reserved rights – see policy for more detail. Appropriate use findings for Bandon Marsh NWR are included in Appendix A.

B.1.3 References

Defenders of Wildlife v. Andrus (Ruby Lake Refuge I). Case 2098 (D.D.C. 1978). Environmental Reporter 11:873.

House of Representatives. 1997. Report 105-106 on National Wildlife Refuge System Improvement Act. Available at: http://www.fws.gov/Refuges/policiesandbudget/HR1420_part1.html.

USFWS. 2000b. Compatibility regulations. Available at: http://www.fws.gov/Refuges/policymakers/nwrpolicies.html.

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B.2 Compatibility Determination

Use: Wildlife Observation, Photography, Interpretation, and Environmental Education

Refuge Name: Bandon Marsh National Wildlife Refuge

County and State: Coos County, Oregon

Establishing and Acquisition Authorities:

Bandon Marsh National Wildlife Refuge (NWR) was authorized by Public Law 97-137, of December 29, 1981 and established by the authority of the Fish and Wildlife Act of 1956, as amended [16 U.S.C. 742a-742j] to protect migratory bird habitat. Additional lands were added to the Refuge in the 1990s through the Refuge Recreation Act of 1962, as amended [16 U.S.C. 460k-4]. Public Law 105-321 (95 Stat. 1709; Oregon Public Lands Transfer and Protection Act of 1998) amended P.L. 97-137 to authorize boundary expansion of Bandon Marsh NWR from 300 to 1,000 acres. Legal authorities used for establishment of the Refuge include the Endangered Species Act of 1973, as amended [16 U.S.C. 1531-1544] and the Migratory Bird Conservation Act of 1929, as amended [16 U.S.C. 715-715d, 715e, 715f-715r].

Refuge Purpose(s):

- “For the preservation and enhancement of the highly significant wildlife habitat … for the protection of migratory waterfowl, numerous species of shorebirds and fish … and to provide opportunity for wildlife-oriented recreation and nature study on the marsh” [95 Stat. 1709, dated Dec. 29, 1981] and Public Law 97-137 – Dec. 29, 1981 and H.R. 2241 March 2, 1981.
- “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)].
- “particular value in carrying out the national migratory bird management program” [16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife)].

National Wildlife Refuge System Mission:

“The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use:

Wildlife observation, photography, interpretation, and environmental education are defined as priority public uses under the Refuge Improvement Act of 1997 and can enhance the users’ appreciation of the Refuge, the National Wildlife Refuge System, wildlife, their habitats, and the human environment. Because there is often substantial overlap between activities associated with wildlife observation, wildlife photography, interpretation and environmental education at Bandon Marsh NWR, these uses are evaluated together in this compatibility determination.

Under the management direction described in the CCP for Bandon Marsh NWR, the U.S. Fish and Wildlife Service (Service) will continue to allow wildlife observation, photography, interpretation, and environmental education to occur on the Bandon Marsh Unit. In addition, the Service will open portions of the Ni-les'tun Unit to the same wildlife-dependent uses.

At the Bandon Marsh Unit, infrastructure is already in place for wildlife observation, photography, interpretation, and environmental education. The Refuge maintains a paved parking lot that can accommodate 10 passenger vehicles or two RVs/buses. The parking lot is located on the west side of Riverside Drive. An elevated boardwalk and deck extend from the parking lot west to the edge of the marsh. There are two interpretive panels on the viewing deck. Across the Coquille River to the north, a boat launch is located at Bullards Beach State Park. This launch can be used by visitors to launch both motorized and non-motorized boats to access the refuge unit during high tides. All refuge lands on this unit are open to observation and photography year-round; thus visitors can walk or boat, unrestricted, throughout the Unit to access the best views of wildlife. Wildlife observation and photography on this unit peaks during the bi-annual migration of shorebirds from mid-April through early May and again from early August through September. During this time, the Unit receives approximately 10-20 visitors daily, with most visitors remaining on the viewing deck. The highest daily public use of the Bandon Marsh Unit occurs annually during the Oregon Shorebird Festival, usually held in late August, which attracts between 70 and 130 birders.

The Refuge offers an environmental education (EE) program onsite at the Bandon Marsh Unit to promote an understanding of the importance of shorebirds, the need for quality wetland habitat, and the role the Service plays in managing and protecting their habitat. The program, called the Shorebird Sister Schools Program, targets students in grades 4-6. Annually, the program's teachers, interns, and volunteers reach approximately 700 students from schools in three coastal counties. The field component of the five-week program brings students to Bandon Marsh NWR or other estuaries, where the students (~ 75) spend two hours rotating through three field experience stations. Under the CCP's management direction, the Refuge will continue the Shorebird Sister Schools Program, including bringing students to the Bandon Marsh Unit to view shorebirds. The Refuge will also develop citizen science projects for high school students in Coos County and when possible work with students in other grades to promote hands-on learning and an understanding and appreciation for the Refuge's natural resources. The Service will require advance reservations for all groups participating in environmental education and all groups will be instructed on refuge etiquette and ways to reduce wildlife and habitat disturbance.

At the Ni-les'tun Unit of the Refuge, some infrastructure is in place for visitors to engage in wildlife observation, photography, interpretation, and environmental education. However, the Service will add additional public use facilities to increase and/or enhance these uses. Current facilities include a public parking lot, a short graveled trail that leads out into the marsh and a viewing deck with a series of five interpretive panels. The Service will construct a loop trail that connects the Ni-les'tun parking lot with Fahys Creek and the uplands north of the refuge office. The loop trail will be open to observation, photography, and interpretation year-round during daylight hours. These recreational activities will be largely self-guided; visitors will be required to remain on the designated trail. At times, users engaged in these activities will be accompanied by refuge staff and/or trained volunteers (i.e., tours conducted during special events, school groups). Interpretive materials will be available to visitors including interpretive panels along the trail, refuge brochures, and through the internet via a refuge website and/or social media site. These interpretive materials will help educate the public on minimizing wildlife and habitat disturbance.

The Service will also open that portion of the Ni-les'tun Unit south of North Bank Lane to unrestricted walking to allow visitors to engage in wildlife observation and photography during daylight hours from February 1 through September 30. To avoid conflicts between visitors participating in waterfowl hunting and those engaged in wildlife observation or photography, the Ni-les'tun Unit south of North Bank Lane will be closed to unrestricted walking from October 1 through January 31 annually, which coincides with the waterfowl hunting season. However, the viewing deck and marsh trail will remain open to these uses daily throughout the year. Due to the difficulty of walking throughout the marsh because of the presence of multiple tidal channels and downed large woody debris, the Service anticipates very little participation in wildlife observation and photography within the Ni-les'tun tidal marsh area.

Availability of Resources:

Under the CCP's management direction, Bandon Marsh NWR will be open for wildlife observation, photography, interpretation, and environmental education. The Refuge Complex has one full-time employee dedicated to the Visitor Services program for all six refuges within the Complex, including Bandon Marsh NWR. Additional refuge staff assists in trail and parking area maintenance, facility and road maintenance, sign posting, construction projects, interacting with the public, and developing and implementing refuge management programs.

Costs to Administer and Manage Public Use Programs on Bandon Marsh NWR under the CCP's Management Direction

Activity or Project	One-time Expense	Recurring Expense
Construct a loop trail that connects the Ni-les'tun parking lot with Fahys Creek and the uplands behind the refuge office. Includes elevated boardwalk/viewing blind at Ni-les'tun Unit.	$700,000	
Develop welcoming kiosk	$2,800	
Develop five interpretive panels	$12,000	
Brochures		$500
Environmental Education Specialist		$50,000
Law enforcement patrols		$17,000
Recruit and train volunteers to help manage the program		$16,500 (Vol. coordinator. Salary, volunteer expenses, intern cost)
Maintain viewing decks and trails		$10,000 (Maint. Worker + equipment)
Staff		$10,000(Portion of South Coast mgr., Volunteer coordinator, Visitor Services Manager salaries)

Anticipated Impacts of the Use(s):

The Service is committed to providing quality opportunities for wildlife oriented recreation at Bandon Marsh NWR. As part of the Service mission and refuge goals for Bandon Marsh, all of the six Refuge System priority wildlife-dependent uses will be offered including: hunting, fishing, wildlife observation and photography, interpretation, and environmental education. Offering wildlife observation, photography, interpretation, and environmental education will help fulfill refuge purposes and goals and does not conflict with the mission of the Refuge System.

General Impacts:
A general assessment of impacts resulting from wildlife observation, photography, and interpretation has been compiled from the literature and is briefly summarized below.

Effect of disturbance intensity: Some researchers have attempted to correlate disturbance events in wildlife to the intensity, proximity, or loudness of human disturbance. While studying shorebirds on an eastern coastal refuge, Burger (1986) found that the level of disturbance in the shorebirds increased (fewer remained, more flew) as the total number of disturbances and the number of children, joggers, people walking, dogs, aircraft, and boats increased, and the duration of the disturbance and distance from the disturbance decreased.

Effect of human proximity: Other researchers have looked at the question of proximity. At what distance do humans on foot elicit a disturbance response? From an examination of the available studies, it appears that the distance varies dramatically from species to species. Burger and Gochfeld (1991) found that sanderlings foraged less during the day and more during the night as the number of people within 100 meters (328 feet) increased. Elk in Yellowstone National Park were disturbed when people were at average distances of 573 meters (1,880 feet; Cassirer 1990). These elk temporarily left the drainage and their home range core areas and moved to higher elevations, steeper slopes, and closer to forested areas. Average return time to the drainage was two days. Erwin (1989) studied colonial wading and seabirds in Virginia and North Carolina. Mixed colonies of common terns and black skimmers responded at the greatest distances, with respective means of 142 meters and 130 meters (466 feet and 427 feet); mixed wading bird species were more reluctant to flush (30-50 meters, or 98-164 feet average). There were few statistically significant relationships between flushing distance and colony size. Similarly, there were few differences between responses during incubation compared to post-hatching periods.

Miller et al. (2001) defined an “area of influence” as the area that parallels a trail or line of human movement within which wildlife would flush from a particular activity with a certain probability. In a study analyzing response distance from hiking and mountain biking in sagebrush-grassland habitat in Utah, Taylor and Knight (2003) found that at 100 meters (328 feet) from the line of movement of an off-trail trial, mule deer showed a 96 percent probability of flushing. That probability did not drop to 70 percent until the perpendicular distance increased to 390 meters (1,280 feet).

Taylor and Knight (2003) also found that the area of influence around a recreationist on a trail did not differ between mountain biking and hiking. This may mean that wildlife do not differentiate between hikers and bikers, but are instead reacting to the presence of a moving human on a trail, regardless of the person’s activity. However, the area of influence differed considerably between on-trail and off-trail trials.

An analysis of over 4,000 human activity events near bald eagle nests in Central Arizona (Grubb and King 1991) found distance to disturbance to be the most important classifier of bald eagle response, followed in decreasing order of discriminatory value by duration of disturbance, visibility, number of units per event, position relative to affected eagle, and sound.

Breeding bald eagles in north-central Minnesota (Fraser et al. 1985) flushed at an average distance of 476 meters (1,562 feet) at the approach of a pedestrian. Skagen (1980), also studying bald eagles in northwest Washington, found a decrease in the proportion of eagles feeding when human activity was present within 200 meters (656 feet) of the feeding area in the previous 30 minutes. A between-season variation occurred in the use of feeding areas relative to human presence, which correlated with food availability. Eagles appeared more tolerant of human activity in the season of low food availability. In a review of several studies of the reaction of waterfowl and other wetland birds to people on foot, distances greater than 100 meters (328 feet) in general did not result in a behavioral response (DeLong 2002).

Effects from pedestrian access: Wildlife is frequently more sensitive to disturbance from people on foot than in vehicles (Skagen 1980, Grubb and King 1991, MacArthur et al. 1982). Numerous studies have confirmed that people on foot can cause a variety of disturbance reactions in wildlife, including flushing or displacement (Erwin 1989, Fraser et al. 1985, Freddy 1986), heart rate increases (MacArthur et al. 1982), altered foraging patterns (Burger and Gochfeld 1991), and even, in some cases, diminished reproductive success (Boyle and Samson 1985). These studies and others have shown that the severity of the effects depends upon the distance to the disturbance and its duration, frequency, predictability, and visibility to wildlife (Knight and Cole 1995). Taylor and Knight (2003), analyzing mule deer, pronghorn antelope, and bison response to mountain biking and hiking on- and off-trail found that the variables best explaining wildlife response included wildlife species, perpendicular distance of animals to trail (closest distance of animal to trail, regardless of recreationist position), trail position (on-trail or off-trail), and degree of vegetation cover.

Effects on migrant birds versus resident birds: Klein (1989) studied the effect of visitation on migrant and resident waterbirds at Ding Darling National Wildlife Refuge, finding that resident birds were less sensitive to human disturbance than migrants. Migrant ducks were particularly sensitive when they first arrived on-site in the fall. They usually remained more than 80 meters (262 feet) from a visitor footpath on a dike, even at very low visitor levels. Herons, egrets, brown pelicans, and anhingas were most likely to habituate to humans, thus exposing them to direct disturbance as they fed on or near the dike. Shorebirds showed intermediate sensitivity. Strauss (1990) observed piping plover chicks spent less time feeding (50 percent versus 91 percent) and spent more time running (33 percent versus 2 percent), fighting with other chicks (4 percent versus 0.1 percent), and standing alert (9 percent versus 0.1 percent) when pedestrians or moving vehicles were closer than 100 meters (328 feet) than when they were undisturbed. In addition, plover chicks spent less time out on the feeding flats (8 percent versus 97 percent) and more time up in the grass (66 percent versus 0.1 percent) during periods of human disturbance.

Wildlife photography: Wildlife photography is likely more disturbing, per instance, than wildlife observation. Klein (1993) observed at Ding Darling National Wildlife Refuge that wildlife photographers were the most likely to attempt close contact with birds. He also concluded that even slow approach by photographers was disruptive to waterbirds. Wildlife photographers tend to have larger disturbance impacts than those viewing wildlife since they tend to approach animals more closely (Morton 1995, Dobb 1998).

Predictability of disturbance (habituation): Dwyer and Tanner (1992) noted that wildlife habituate best to disturbance that is somewhat predictable or "background." Investigating 111 nests of sandhill cranes in Florida, Dwyer and Tanner found that nesting cranes seemed to habituate to certain forms of human disturbance and nested within 400 meters (1,312 feet) of highways, railroads, and mines; cranes also were tolerant of helicopter flyovers. Visits to nests and development-induced alterations of surface water drainage were implicated in 24 percent of the nest failures. Taylor and Knight (2003) found that for mule deer, the area of influence around off-trail trials was much greater than that for on-trail trials, suggesting habituation to trails. However, the time it takes for wildlife to habituate and what wildlife use is like compared to pre-disturbance. A study by Fairbanks and Tullous (2002) measured the distance of pronghorn from recreational trails on Antelope Island State Park in Utah. The study gathered data the year before the trails were opened for public use, and compared these to data gathered in three consecutive years after recreational use began. Groups of pronghorn were observed significantly farther from trails in years with recreational use than in the year before recreational areas were opened.

Effects from boat proximity: Boating, both motorized and non-motorized, can alter the distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). More sensitive species may find it difficult to secure adequate food or loafing sites as their preferred habitat becomes fragmented and recreation related disturbance increase (Skagen et al. 1991, Pfister et al. 1992). However, disturbance to birds in general was reduced when boats traveled at or below five mph speed limit. Motorized boats can generally have more impact on wildlife than non-motorized boats because motorboats produce a combination of movement and noise (Tuite et al. 1983, Knight and Cole 1995). Motorized boats can also cover a larger area in a relatively short time, in comparison to non-motorized boats.

Motorized boats introduce noise and pollution, in the form of gas and oil, and particulates in the air, in estuarine and riverine habitats of the Refuge. Hydrocarbon pollution has been found to bio accumulate with the complex food web, posing a serious threat to the marine environment (Tjarnlund et al. 1993). Hydrocarbons can also be transferred to eggs from the plumage of incubation birds. Extremely small amounts of petroleum hydrocarbons can be toxic to eggs and birds that ingest these contaminants (Hoffman 1989).

Canoes and kayaks can cause significant disturbance effects based on their ability to penetrate into shallower marsh areas (Speight 1973, Knight and Cole 1995). In the Ozark National Scenic Riverway, green heron activity declined on survey routes when canoes and boat use increased on the main river channel (Kaiser and Fritzell 1984). Canoes or slow moving boats have also been observed to disturb nesting great blue herons (Vos et al. 1985). Huffman (1999) found that non-motorized boats within 30 meters (98 feet) of the shoreline in south San Diego Bay caused all wintering waterfowl to flush between the craft and shore. However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (Jahn and Hunt 1964, Huffman 1999, DeLong 2002).

The total number of boats and people can be an inappropriate measure of recreational intensity because the presence of a single boat might be just as disturbing as that of many (Tuite et al. 1983, Knight and Knight 1984). Even a low level of boating activity affects the duration and pattern of use by wildlife (Bratton 1990).

<u>Refuge-specific Impacts:</u>
People engaging in wildlife observation, photography, interpretation and environmental education generally access the Refuge by motorized vehicles, travelling on public roads, and using pullouts and parking lots. Pullouts, parking lots, and public roads have minimal direct impacts because they occupy a relatively small acreage. A limited group of individuals access the Refuge via boat from the Coquille River.

One designated trail will be added to support wildlife observation, photography, interpretation, and environmental education, and the remaining areas open to these uses will allow free roaming of the area. The trail will be located on the Ni-les'tun Unit in upland forest or riparian habitats (associated with the trail north of the office). In forest or riparian habitats, trail construction may require the removal of some trees, snags, or logs. It may also result in a minor amount of habitat degradation (vegetation removal or modification and soil compaction) from trail use and trail maintenance (e.g., mowing, tree trimming). The trail construction through the secondary Sitka spruce and western hemlock forest and associated riparian habitat will have a minor negative impact that will be offset by allowing the public into these habitats. Providing this opportunity to the public will help promote a greater understanding of the importance of forest management to fish and wildlife. This appreciation of wildlife and its associated habitat may lead to increased public stewardship of wildlife and their habitats. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System.

Bicycle access: A few people access the refuge wildlife viewing decks or areas along its boundaries (county roads) by bicycle. Although bicycles on county roads may create additional disturbance, county roads are not under refuge jurisdiction, therefore effects from activities occurring on these roads are not considered in this compatibility determination.

Pedestrian access: Pedestrian access to the Refuge creates the highest potential for disturbance or damage to natural resources. Foot travel associated with wildlife observation or photography could potentially result in temporary and minor vegetation trampling. Foot travel may also potentially create disturbance in or near any habitat.

During the late fall and winter season, pedestrian access outside of the designated trails and viewing deck will be prohibited in the Ni-les'tun Unit in conjunction with the waterfowl hunting season from October 1 through January 31. This translates to a closure of the majority of the refuge unit to wildlife observation and photography access during the fall/winter migratory bird season. This sanctuary area limits pedestrian human disturbance during the season of highest waterfowl and shorebird activity and allows wildlife to habituate in the Bandon Marsh Unit where humans and wildlife may both be regularly present. The only areas on the Ni-les'tun Unit that people will be permitted to access by foot for wildlife observation and photography during the waterfowl hunting season are at the designated short gravel estuary trail adjacent to the overlook interpretive deck and the loop trail north of the office. Since migrant ducks are particularly sensitive when they first arrive on-site in the fall, the closure of the remainder of the Unit during waterfowl hunting season will provide sanctuary area and should result in negligible impacts to migrant waterfowl from wildlife observation and photography from the observation deck and marsh trail on the Ni-les'tun Unit.

The Bandon Marsh Unit will be open year-round; however, this area is infrequently visited away from the observation deck during the winter months due to the large mudflats and daily tides. Any visitor access into the marsh during the winter is likely to cause some disturbance to birds using the mudflats; however, this disturbance is temporary and the mudflat area is large enough that birds should be able to move to an undisturbed area to continue feeding or loafing activities. Wildlife observation, photography, and interpretation are not expected to negatively impact wildlife in this unit during the winter.

From February 1 through September 30 visitors may access all of the Ni-les'tun marsh south of North Bank Lane on foot or by boat and may walk with no restrictions anywhere within the marsh. North of North Bank Lane, the only area open to public use will be the loop trail and the refuge office. Since most wildlife observers and hikers actually remain on the observation decks or on designated trails, direct effects from trampling and disturbance effects will likely be minor. Once this trail use becomes regular, resident wildlife are expected to habituate to human presence, and negative impacts to their daily activities should be minor to negligible. Some minor negative impacts may be detected in marsh-nesting birds such as marsh wrens, which may be flushed from nests if visitors frequently venture off-trail.

Some interpretive and environmental education programs are moderately large organized events (<35 visitors) that differ in character from the more informal day-to-day observation and interpretive activities. These types of programs create more disturbances and can overfill parking facilities to the point where people park on the sides of county roads where normally there is no parking. To minimize impacts by large groups, the Service will require advance reservations and will instruct all groups on refuge etiquette and ways to reduce wildlife and habitat disturbance.

To minimize disturbance impacts related to roads the Refuge is working directly with the Coos County Road Department to establish a safe speed limit and to post wildlife warning signs and road side delineators to assist in preventing vehicles from driving off-road.

Boat access: Boat access to the refuge units creates a potential for disturbance to migratory and resident waterfowl and wading birds. Boat use associated with wildlife observation or photography could potentially create disturbance in or near any habitat adjacent to navigable waters. This may cause birds that use the waters of the bay and the forested edges of the island habitat to flush. The disturbance to wildlife is localized and of short duration. Nearby resting and feeding areas will be available for use by any displaced wildlife.

The Bandon Marsh Unit is currently open year-round for wildlife observation and photography by boat. This unit can be accessed from the Coquille River. Access to this unit and the Ni-les'tun Unit are limited and challenging due to the availability of correct weather conditions (e.g., winds < 15 mph) and high tide waters to fill tidal channels or cover the mudflats. The Ni-les'tun Unit's access by boat is additionally limited by a seasonal late fall/winter closure and limited access to tidal channels unrestricted by large woody debris. Boats parking on the Coquille River Bank during the open period will be restricted to a designated location.

Both refuge visitation and the number of facilities and emphasis devoted to wildlife observation, photography, interpretation, and environmental education are projected to increase under the CCP. Most studies cited above have demonstrated immediate, rather than long-term responses to disturbance. Long-term responses are inherently more difficult and expensive to determine. Given that wildlife observation, photography, interpretation, and environmental education efforts are not typically loud or intense kinds of activities, the area of habitat within a known distance of human activity centers (trails, decks, interpretation panels, etc.) is considered a reasonable indicator to evaluate the disturbance effects of public uses on refuge wildlife. In a review of several studies of the reaction of waterfowl and other wetland birds to people on foot, distances greater than 328 feet (100 meters) generally did not result in a behavioral response (DeLong 2002). Although disturbance to wildlife from these activities will be higher than at present, the overall effect to refuge wildlife is expected to be minor.

Impacts to listed species: The listed species using Bandon Marsh NWR is the threatened coho salmon, Pacific smelt (eulachon), and green sturgeon. As designed and implemented, wildlife observation and photography activities, and their associated facilities, are not expected to have an impact on coho salmon, eulachon, and green sturgeon. Designated trails to be constructed will not create stream obstructions, or significantly alter marsh topography. Unrestricted walking through the Ni-les'tun Unit is not expected to impact these species because visitors will not be traversing the deep tidal channels used by the fish. Since the species uses the estuary as an underwater nursery, no disturbance is expected. Because wildlife observation, photography, and interpretation will be allowed only from designated trails and from boats on waters within and outside refuge lands, impacts on coho, green sturgeon, and eulachon are expected to be a negligible negative effect. Impacts to these fish species will be minimized or eliminated through locating public use facilities (e.g., designated trails) away from tidal and freshwater creeks that host these fish.

Impacts to other priority public uses: People engaged in wildlife observation, photography, interpretation and environmental education generally result in little disturbance, unless they are using the same space at exactly the same time, to other users including anglers and waterfowl hunters. It is possible that wildlife observers or photographers may inadvertently flush waterfowl being pursued by hunters on the Bandon Marsh Unit. This conflict is expected to be minimal because waterfowl hunting will continue to occur only during late fall and winter, a time of year when visitors engaged in wildlife observation and photography are fewer in number due to inclement weather and the absence of shorebirds which is one of the main groups of birds that draw the attention of birders and photographers. Waterfowl hunting has occurred on the Bandon Marsh Unit since acquisition in 1983 along with other recreational uses, specifically wildlife observation, photography, and clamming. During that time, very few conflicts among users of the Refuge have been documented. This is likely related to the weather along the Oregon coast during the winter months which is often cold and rainy and thus not particularly popular with wildlife viewers or photographers. In addition, these uses are separated in time and location by the primary wildlife species being observed or pursued (spring and early fall for shorebird observation; winter for waterfowl hunting), and the fact that there have been no reported conflicts to date. The lack of conflicts between the uses and the low potential for development of these conflicts in the future will allow these uses to continue to occur simultaneously. Impacts to continuing these uses concurrently on the Bandon Marsh Unit are expected to be negligible.

Very little clamming occurs on the Bandon Marsh Unit and there have been no complaints registered between waterfowl hunters, wildlife observers, and recreational clammers. The impact to clammers from wildlife observation and photography is expected to be negligible since clammers are accessing one small location on the marsh at low tide and wildlife observers and photographers are usually moving around or remaining on the observation deck. The movements of visitors engaged in wildlife observation and photography will have no impact on the location of clams and therefore is expected to have no direct impact to clammers.

On the Ni-les'tun Unit, little to no impact is anticipated to occur between wildlife observers and photographers on hunters because the uses will be separated by season. To minimize safety conflicts and, help prevent inadvertent flushing of waterfowl, unrestricted walking within the Unit's tidal marsh will be closed to wildlife observation, photography, and interpretation from October 1 through January 31.

<u>Other Impacts:</u>
No significant effects to roads, trails, or other existing refuge infrastructure from the wildlife observation, photography, interpretation, and environmental programs are expected. Normal road, trail, and facility maintenance will continue to be necessary. There will be a minor to medium impact on some members of the refuge staff through the increase in staff time required for overseeing the

construction of the new loop trail, maintaining the trail, monitoring use by visitors and any impacts to wildlife, and increased law enforcement patrols to help educate the public as to the regulations covering the new uses on the Ni-les'tun Unit. Residents of North Bank Lane may experience a slight negative impact due to the inconvenience of added traffic on this county road.

Public Review and Comment:

Wildlife observation, photography, interpretation, and environmental education were discussed at two public meetings held in conjunction with the Comprehensive Conservation Plan process. To initiate the CCP process, a Notice of Intent was published in the Federal Register on November 29, 2010 (Volume 75, Number 228). Written comments were solicited from the public about proposed wildlife-dependent recreational uses. Three CCP planning updates were prepared to summarize the progress of the CCP and to discuss issues related the planning process. This compatibility determination was submitted for public review and comment as an appendix to the Draft Comprehensive Conservation Plan and Environmental Assessment for Bandon Marsh NWR. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination:

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Motorized vehicles and bicycles will be limited to designated public roads and parking lots.
- To minimize safety conflicts with waterfowl hunting on the Ni-les'tun Unit, the area south of North Bank Lane will be closed to unrestricted walking from October 1 through January 31. The observation deck and marsh trail will remain open during this time.
- Advanced reservations will be required for all groups participating in environmental education. Limits will be established for the total number of environmental education groups permitted per day.
- All groups participating in environmental education programs will be instructed on refuge etiquette and ways to reduce wildlife and habitat disturbance.
- Monitoring and evaluation will be conducted to ensure that high-quality habitat for wildlife feeding, resting, breeding is maintained.
- Pets and dogs are allowed outside vehicles only in parking areas (not on trails) and must be kept on-leash any time they are outside vehicles.
- Refuge lands associated with these uses are available only during daylight hours.
- Camping, overnight use, and fires are prohibited.
- The Refuge will provide signs and brochures to promote appropriate use of trails, observation decks and other refuge lands to minimize wildlife and habitat disturbance, including boating practices such as no-wake and slower speeds. These materials will clearly state pertinent refuge-specific regulations.
- The loop trail on the Ni-les'tun Unit, once developed, will be open year-round for the purpose of wildlife observation, photography, interpretation, and environmental education. Visitors will be required to remain on the trail to reduce the impacts of wildlife disturbance.

- The Service will periodically monitor and evaluate the area and programs to determine if objectives are being met and to ensure the resource is not being degraded.
- Law enforcement patrols will be conducted on a regular basis to ensure compliance with refuge regulations.

Justification:

As wildlife-dependent recreational uses, wildlife observation, photography, interpretation, and environmental education receive enhanced consideration in the Comprehensive Conservation Planning process. Given the location of seasonal sanctuary, closed areas, and the locations of wildlife viewing, photography, and interpretation facilities, these uses will be expected to have a minor direct impact on refuge resources. The associated disturbance to wildlife from these activities, though larger than at present, is also expected to be minor. 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 these activities to occur. The relatively limited number of individual animals and plants expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of refuge 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 wildlife photography, observation, interpretation, and environmental education programs under the stipulations described above will not materially detract or interfere with the purposes for which the Refuge was established or the refuge mission. Wildlife observation, photography, interpretation, and environmental education provide visitors with the joy of experiencing wildlife on their public lands, and as such, help fulfill the mission of the National Wildlife Refuge System.

Mandatory Re-Evaluation Date:

____X____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

__________ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________ Categorical Exclusion without Environmental Action Statement

__________ Categorical Exclusion and Environmental Action Statement

____X_____Environmental Assessment and Finding of No Significant Impact

__________ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	Bob J. West (Signature)	12-19-12 (Date)

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B.3 Compatibility Determination

Use: Waterfowl Hunting

Refuge Name: Bandon Marsh National Wildlife Refuge

County and State: Coos County, Oregon

Establishing and Acquisition Authorities:

Bandon Marsh National Wildlife Refuge (NWR) was authorized by Public Law 97-137, of December 29, 1981 and established by the authority of the Fish and Wildlife Act of 1956, as amended [16 U.S.C. 742a-742j] to protect migratory bird habitat. Additional lands were added to the Refuge in the 1990s through the Refuge Recreation Act of 1962, as amended [16 U.S.C. 460k-4]. Public Law 105-321 (95 Stat. 1709; Oregon Public Lands Transfer and Protection Act of 1998) amended P.L. 97-137 to authorize boundary expansion of Bandon Marsh NWR from 300 to 1,000 acres. Legal authorities used for establishment of the Refuge include the Endangered Species Act of 1973, as amended [16 U.S.C. 1531-1544] and the Migratory Bird Conservation Act of 1929, as amended [16 U.S.C. 715-715d, 715e, 715f-715r].

Refuge Purpose(s):

- "For the preservation and enhancement of the highly significant wildlife habitat … for the protection of migratory waterfowl, numerous species of shorebirds and fish … and to provide opportunity for wildlife-oriented recreation and nature study on the marsh" [95 Stat. 1709, dated Dec. 29, 1981] and Public Law 97-137 – Dec. 29, 1981 and H.R. 2241 March 2, 1981.
- "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)].
- "particular value in carrying out the national migratory bird management program" [16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife)].

National Wildlife Refuge System Mission:

> "The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use(s):

Under the CCP's management direction, the U.S. Fish and Wildlife Service (Service) will continue to allow the hunting of waterfowl, defined here as geese, ducks, and coots. Waterfowl hunting will be permitted from October through January in accordance with State and Federal regulations and seasons.

Waterfowl hunting will continue to be allowed seven days per week on 256 acres of the Bandon Marsh Unit on refuge lands that fall outside of Bandon city limits. In addition, the Service will expand waterfowl hunting, with specific conditions, on Bandon Marsh NWR to include the Ni-les'tun Unit. Hunters will be allowed to hunt geese, ducks, and coot in 299 acres of the 582-acre Ni-les'tun Unit three days per week. The established days for hunting on the Ni-les'tun Unit will be Wednesday, Saturday, and Sunday.

For the Bandon Marsh Unit, hunters will access the area by using the paved public parking lot associated with this unit located on the west side of Riverside Drive. The public may also access the Bandon Marsh Unit by boat during higher tides from the Coquille River. There are two boat launches nearby that hunters occasionally use to launch their watercraft. One launch is at Bullards Beach State Park and another one is located further south at the Port of Bandon. Boating provides access to the high marsh area in the northwest portion of this unit where hunters set up temporary hunting blinds.

For the Ni-les'tun Unit, hunters can either use the two boat launches mentioned previously, the boat launch at Rocky Point or they can walk-in by using the refuge parking lot located on North Bank Lane across from the refuge office. In addition a small graveled parking area will be developed to accommodate three to four vehicles to allow hunters to walk into the Unit. The parking area will be located on refuge-owned lands adjacent to North Bank Lane near the northeast corner of the Coquille River RV Park. Boats parking on the riverbank of the Coquille River within the Unit will be required to park within a designated location. Public waterfowl hunting opportunities in the area surrounding Bandon Marsh NWR and in the Coquille River Watershed are extremely limited, with the Bandon Marsh Unit representing the only public land open to hunting. Private lands offer waterfowl hunting opportunities in the area but only to those who are granted permission and/or the ones willing and able to purchase hunting rights or leases. There is a demand for public hunting in the Coquille River Watershed and Estuary, especially in areas that have walk-in access and do not require the use of a boat.

For both areas, hunter access to refuge lands will be allowed from one hour before sunrise to one hour after sunset. Permanent blinds will not be allowed to be established; however, hunters will be allowed to use portable blinds or blinds constructed of onsite dead vegetation or driftwood under the condition that they either be removed or disassembled at the end of each day.

Although dogs are prohibited on the Refuge away from parking lots, they are a vital part of the waterfowl hunting tradition and can reduce the loss of waterfowl to the hunter's bag and hence prevent waste and reduce the overall impact to the resource. Because of their role, both as part of the waterfowl hunting tradition and their contribution to increasing the likelihood of retrieval of birds that have been shot, properly trained dogs used in the act of hunting will be allowed on Bandon Marsh NWR per Service Policy in 50 CFR 32.26.21.

Hunters must comply with all State and Federal regulations regarding waterfowl hunting including provisions outlined in the Code of Federal Regulation 50 CFR 32.2 which states:

- Each person shall secure and possess the required State license and waterfowl validation.
- Each person 16 years of age and older shall secure and possess a Federal Migratory Bird Hunting Stamp while hunting migratory waterfowl.
- Each person shall comply with the terms and conditions authorizing access or use of wildlife refuges.
- The distribution of bait and the hunting over bait is prohibited on wildlife refuges.

- The use or possession of alcoholic beverages while hunting is prohibited.
- Hunters may possess only approved nontoxic shot while in the field or on certain other areas of the National Wildlife Refuge System.

Availability of Resources

The following funding/annual costs will be required to administer and manage hunting activities as described above:

Costs to Administer Waterfowl Hunting at Bandon Marsh NWR under the CCP's Management Direction

Activity or Project	One-time Expense	Recurring Expense
Develop hunt opening package	$10,000	
Build and maintain a small gravel parking lot	$93,000	$2,000
Law Enforcement patrols		$5,000
Brochures, signs, posters	$4,000	$500
Maintenance		$4,000
Staff		$2,000
Develop and post a boat parking area along the Coquille River Bank	$5,000	

Anticipated Impacts of the Use(s):

The Service is committed to providing quality opportunities for fish and wildlife-oriented recreation at Bandon Marsh NWR. As part of the Service mission and refuge goals for Bandon Marsh, all six of the Refuge System's priority wildlife-dependent uses will be offered at Bandon Marsh including fishing, hunting, wildlife observation, photography, environmental education and interpretation. Offering these public uses will help fulfill refuge purposes and goals and does not conflict with the mission of the Refuge System.

<u>Harvest of Waterfowl:</u>
Hunting, by its nature, results in the intentional take of individual animals, as well as wounding and disturbance (DeLong 2002). Indirect impacts such as displacement of animals by hunters or disturbance from gunfire also occurs in and adjacent to, areas opened for hunting. It can also alter behavior (e.g., foraging time), population structure (young birds are generally more susceptible), and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartlett 1987, Madsen 1985, and Cole and Knight 1990). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1985).

The Refuge seeks to reduce the magnitude of these impacts by only allowing hunting a limited number of days per week to some areas of the Refuge. The Ni-les'tun Unit will be limited to hunting three days per week and thus providing sanctuary the remainder of the week. In addition, the portion of the Bandon Marsh Unit within the Bandon city limits and portions of the Ni-les'tun Unit will remain closed to waterfowl hunting providing permanent sanctuary.

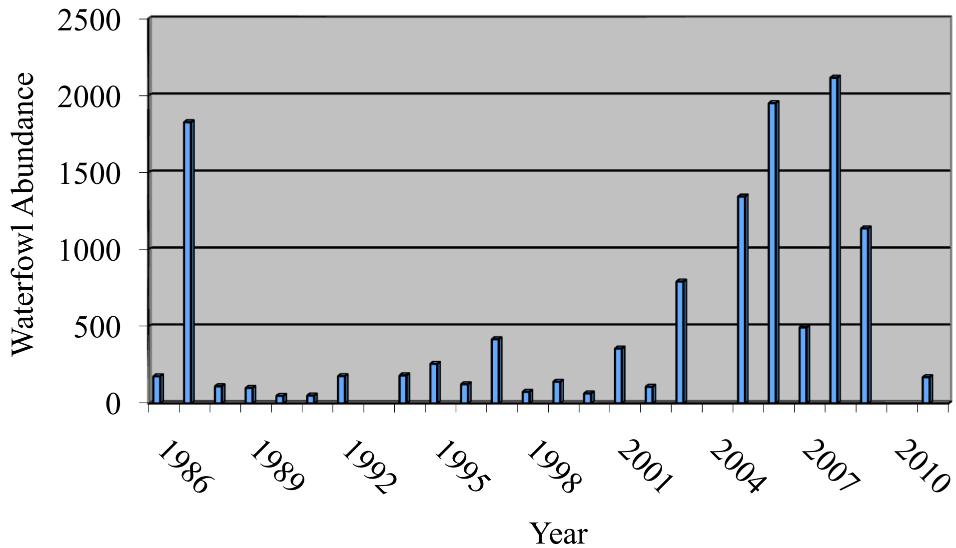
The U.S. Fish and Wildlife Service conducts annual surveys that are used to estimate waterfowl hunting activity, success, and harvest by species. Results are used by the Service and State wildlife agencies, in part, to establish season lengths and bag limits designed to maintain healthy, sustainable waterfowl populations. During 2010-11 season, waterfowl hunters in Oregon harvested an estimated 419,100±18% ducks (Raftovich et al. 2011). On the Bandon Marsh Unit of Bandon Marsh NWR during 2010-11, hunters harvested very few ducks and the harvest numbers are considered to be below reportable levels (B. Reishus, ODFW, personal observation). Waterfowl harvest data are unavailable because only a small number of hunters pursue waterfowl in the Bandon Marsh area and no hunters were surveyed in 2010-11. At any given time there are 1-3 hunting parties in the marsh because of limited space (i.e., 256 acres) and hunting quality is best at only a few spots (e.g., the mouth of the sloughs). Waterfowl hunters tend to self-limit their numbers. Most hunting occurs in October and November and tides influence hunting times. In late November when rain increases and causes prolonged flooding and development of seasonal wetland habitat further inland, waterfowl disperse to newly flooded areas. Thus there is limited hunting occurring on Bandon Marsh after mid-December due to the lower abundance of birds.

The most heavily harvested duck species in Oregon are mallard, American wigeon, northern pintail, green-winged teal, and northern shoveler (Raftovich et al. 2011). In 2011, continental populations of northern shoveler, green-wing teal, and mallard were all above their long-term averages (USFWS 2011). American wigeon were 20% below their long-term average and northern pintails were similar to the long-term average. Hunters are also permitted to harvest coots, but while this species is common on the Refuge, coots are not popular with hunters. Given the low harvest rates of these species relative to the State harvest, the refuge hunt program will not significantly contribute to the population changes of these species and the Refuge will conform to State bag limits for ducks.

Biologists from state and federal agencies annually conduct the Midwinter Waterfowl Survey to provide a measure of the relative numbers or trends of duck populations. The survey identifies winter waterfowl distribution and habitat use throughout the United States. The survey also provides estimates of the size of goose and swan populations and tracks population trends of duck species that nest outside of breeding survey areas. Waterfowl make significant use of the Coquille River, mud flats, and tidal marsh with heaviest use occurring from September through December and again during spring migration. Common dabbling ducks include mallard, northern pintail, American wigeon, and green-winged teal and diving ducks include bufflehead, scaup, red-breasted merganser, and surf scoter.

Midwinter Waterfowl Surveys are conducted during the first two weeks in January along the Oregon coast. Observers count divers, dabblers, sea ducks, geese, swans, and American coots from a fixed-wing aircraft and an overall abundance is estimated (USFWS unpublished data). Data were compiled for all waterfowl observed at Bandon Marsh NWR and Coquille River estuary during the midwinter waterfowl surveys from 1986 to 2011 and are displayed in Figure B-1. The overall average count was 531 individuals and the lowest count was 49 individual birds recorded in 1990 and the largest was 2,116 in 2008. These data are collected from a fixed-wing aircraft at an altitude of 200-300 feet and traveling 80-120 mph, which limits ability to survey all areas and all habitats and count every individual present. However, general abundance and population trends can be inferred and Bandon Marsh/Coquille River Estuary is an important use area for waterfowl. Waterfowl abundance is usually lower during the January mid-winter survey compared to fall months, when birds are concentrated on the Coquille River and estuary prior to dispersing throughout the area due to field and seasonal wetland flooding (R. Lowe, personal obs.). Given the low waterfowl harvest rates relative to the large wintering duck population, the refuge hunt program will not significantly contribute to waterfowl population changes and the area should support a sustainable harvest. A program will be implemented to monitor waterfowl population numbers and habitat use.

Figure B-1. Waterfowl abundance at Bandon Marsh NWR and Coquille River Estuary, Oregon from 1986 to 2011 (USFWS unpublished data).



Impacts to Non-Target Species:
The refuge hunt program indirectly impacts species other than those targeted by hunters. The presence of hunters and dogs, sounds of gunfire, and the sight of hunters traveling to and from hunt areas can disturb other wildlife species such as great blue heron, bald eagle, great egret, and northern harrier which forage in refuge wetlands and waterbodies. This disturbance, especially when repeated over a period of time, may result in some wildlife species altering food habits or moving to other areas. Hunting will occur outside of the breeding season for these avian species. Accidental shootings of non-game birds are believed to be negligible. Hunters' foot trails and temporary blinds in the tidal marsh could slightly alter wetland vegetation; however, these impacts and those to refuge fish populations and other wildlife are expected to be negligible.

Impacts to Other Priority Public Uses:
Bandon Marsh NWR is committed to providing quality opportunities for wildlife-dependent recreation. The Refuge supports all six of the Refuge System's priority wildlife-dependent uses: hunting, fishing, wildlife observation and photography, environmental education and interpretation.

Waterfowl hunting has occurred on the Bandon Marsh Unit since 1983 and prior to refuge establishment along with other recreational uses specifically wildlife observation, photography, bank fishing and clamming. Since refuge establishment very few conflicts among users of the Refuge have been documented in relation to waterfowl hunting. This is likely related to the weather along the Oregon coast during the winter months which is often cold and rainy and thus not particularly popular with wildlife viewers or photographers. Very little fall or winter clamming occurs on the Bandon Marsh Unit and there have been no complaints registered between waterfowl hunters and recreational clammers. The impact to clammers is expected to be negligible since clammers are accessing the site at low tide and hunters are accessing the site during high tide. Therefore, the direct impacts to other users are overall expected to be minor. The Service considered an alternative to close the Bandon Marsh Unit to hunting several days per week and close the other days to wildlife observation, with the intent of separating the uses and eliminating potential for conflict. Because these uses are separated in time and location by the primary wildlife species being observed or pursued (spring and early fall for shorebird observation; winter for waterfowl hunting), there have been no reported conflicts to date. The lack of conflicts between the uses and the low potential for development of these conflicts in the future will allow these uses to occur simultaneously.

On the Ni-les'tun Unit concern was raised that people engaged in other public uses including wildlife observation, photography and cutthroat trout fishing would have the potential to flush waterfowl thus impacting waterfowl hunters in the area. To avoid this impact and reduce any conflicts between user groups the decision was made to close the Ni-les'tun Unit to unrestricted walking for the purpose of wildlife observation and photography from October 1 through January 31 annually and to close cutthroat trout fishing during the month of October. The viewing deck and graveled marsh trail will remain open to wildlife observation, photography, and interpretation daily throughout the year.

To ensure safety and minimize conflict between hunters and people engaged in wildlife observation and photography, the Service will provide information about hunting boundaries and seasons to the general public and those utilizing other refuge programs. Information will be provided at the interpretive kiosks, on the refuge website and in refuge offices. In addition, law enforcement patrols will be conducted on a regular basis to ensure compliance with State, Federal, and refuge regulations. The refuge law enforcement officer will also monitor and collect data on hunting activities in the field to ensure it does not interfere with other wildlife-dependent uses. If necessary, the program will be modified accordingly.

<u>Other Impacts:</u>
No significant effects to roads, trails, or other refuge infrastructure from the hunting program are foreseen. Normal road, trail, and facility maintenance will continue to be necessary. There will be a minor impact on some members of the refuge staff as overseeing the construction of the parking lot along North Bank Lane and maintenance of the site will increase staff workload.

Public Review and Comment:

Waterfowl hunting was discussed at two public meetings held in conjunction with the Comprehensive Conservation Plan process. To initiate the CCP process, a Notice of Intent was published in the Federal Register on November 29, 2010 (Volume 75, Number 228). Written comments were solicited from the public about proposed wildlife-dependent recreational uses including waterfowl hunting. Two CCP planning updates were prepared to summarize the progress of the CCP and to discuss issues related the planning process. This compatibility determination was submitted for public review and comment as an appendix to the Draft Comprehensive Conservation Plan and Environmental Assessment for Bandon Marsh NWR. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination:

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

The refuge hunting programs is designed to provide a safe, quality experience with reasonable harvest opportunities, while avoiding significant impacts to other users and non-target wildlife resources. The Refuge has developed the following stipulations to reduce impacts and promote safety:

- Hunter access to the Refuge is allowed from one hour before sunrise to one hour after sunset.
- Only ducks, geese, and coots may be taken in accordance with Oregon Department of Fish and Wildlife bag and possession limits. If any species experiences a population level below sustainable level, the refuge hunt program will be modified accordingly.
- Law enforcement patrols will be conducted on a regular basis to assure compliance with State, Federal, and refuge regulations. The refuge law enforcement officer will also monitor and collect data on hunting activities in the field to assure that it does not interfere with wildlife resources and other wildlife-dependent uses. If necessary, the program will be modified accordingly.
- To minimize conflicts between hunters and visitors participating in other compatible wildlife-dependent recreational activities, the Service will close the Ni-les'tun Unit to unrestricted walking for the purpose of wildlife observation and photography from October 1 through January 31 annually.
- To minimize conflicts with waterfowl hunting, cutthroat trout fishing on the Ni-les'tun Unit will be closed to anglers during the final month of the State season (October 1-31) to prevent safety conflicts.
- Hunters will only be allowed to hunt geese, ducks, and coot in designated areas of the Ni-les'tun Unit three days per week. The established days for hunting will be Wednesday, Saturday, and Sunday. Waterfowl hunting will be allowed seven days per week on Bandon Marsh Unit outside of the Bandon city limits.
- Hunters accessing refuge lands via boat must secure/anchor boat and use established boat launch areas. Boats landing on the riverbank of the Coquille River within the Ni-les'tun Unit will be required to park within a designated location.
- The Refuge will ensure safety and minimize conflict with other priority public uses by providing information about hunting boundaries and seasons to the general public and those utilizing other refuge programs. Information will be provided at interpretive kiosks, on the refuge website and in refuge offices.
- Camping, overnight use, and fires are prohibited.
- The Refuge will provide signs and brochures to promote appropriate use of refuge lands to minimize wildlife and habitat disturbance, including boating practices such as no-wake and slower speeds. These materials will clearly state pertinent refuge-specific regulations.
- Permanent blinds are not allowed; however, hunters will be allowed to use portable blinds or blinds constructed of onsite dead vegetation or driftwood under the condition that they either be removed or disassembled at the end of each day.
- Dogs used for hunting will be allowed but they must be engaged in hunting activity and under the immediate control of a licensed hunter (see 50 CFR 26.21(b)).
- Hunters must comply with all State and Federal regulations regarding waterfowl hunting including provisions outlined in 50 CFR 32.2 which states:
    - Each person shall secure and possess the required State license and waterfowl validation.

- Each person 16 years of age and older shall secure and possess a Federal Migratory Bird Hunting Stamp while hunting migratory waterfowl.
- Each person shall comply with the terms and conditions authorizing access or use of wildlife refuges.
- The distribution of bait and the hunting over bait is prohibited on wildlife refuges.
- The use or possession of alcoholic beverages while hunting is prohibited.
- Only approved nontoxic shot is allowed on refuge lands to hunt waterfowl.

Justification:

Hunting is a wildlife-dependent recreational use as define in the National Wildlife Refuge System Improvement Act. More specifically, it is one of the six priority public uses of the National Wildlife Refuge System and is by definition an appropriate use on a National Wildlife Refuge, and if it is officially determined to be compatible, should be allowed. Refuge hunting programs are designed to provide high-quality, safe experiences, with a reasonable opportunity to harvest game species. By expanding this use on Bandon Marsh NWR, the Service will increase the visitors' knowledge and appreciation of fish and wildlife, which may lead to increased public stewardship of wildlife and their habitats on the Refuge. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System.

It is anticipated that an adequate amount of quality, non-hunted estuarine habitat will be available to the majority of waterfowl along the Coquille River. Furthermore, it is anticipated that birds will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened, hunting pressure will not cause premature departure from the area, the physiological condition and production of waterfowl and other waterbirds will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall status will not be impaired. Thus, allowing waterfowl hunting under the stipulations described above will not materially detract or interfere with the purposes for which the Refuge was established or the refuge mission.

Mandatory Re-Evaluation Date:

____X____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

__________ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________ Categorical Exclusion without Environmental Action Statement

__________ Categorical Exclusion and Environmental Action Statement

____X____ Environmental Assessment and Finding of No Significant Impact

__________ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	(Signature)	12-19-12 (Date)

B.4 Compatibility Determination

Use: Fishing and Clamming

Refuge Name: Bandon Marsh National Wildlife Refuge

County and State: Coos County, Oregon

Establishing and Acquisition Authorities:

Bandon Marsh National Wildlife Refuge (NWR) was authorized by Public Law 97-137, of December 29, 1981 and established by the authority of the Fish and Wildlife Act of 1956, as amended [16 U.S.C. 742a-742j] to protect migratory bird habitat. Additional lands were added to the Refuge in the 1990s through the Refuge Recreation Act of 1962, as amended [16 U.S.C. 460k-4]. Public Law 105-321 (95 Stat. 1709; Oregon Public Lands Transfer and Protection Act of 1998) amended P.L. 97-137 to authorize boundary expansion of Bandon Marsh NWR from 300 to 1,000 acres. Legal authorities used for establishment of the Refuge include the Endangered Species Act of 1973, as amended [16 U.S.C. 1531-1544] and the Migratory Bird Conservation Act of 1929, as amended [16 U.S.C. 715-715d, 715e, 715f-715r].

Refuge Purpose(s):

- "For the preservation and enhancement of the highly significant wildlife habitat … for the protection of migratory waterfowl, numerous species of shorebirds and fish … and to provide opportunity for wildlife-oriented recreation and nature study on the marsh" [95 Stat. 1709, dated Dec. 29, 1981] and Public Law 97-137 – Dec. 29, 1981 and H.R. 2241 March 2, 1981.
- "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)].
- "particular value in carrying out the national migratory bird management program" [16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife)].

National Wildlife Refuge System Mission:

"The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

Description of Use:

The National Wildlife Refuge System Improvement Act of 1997 defined six wildlife-dependent recreational uses as appropriate and required that they receive priority consideration in refuge planning when they are compatible with the refuge mission. Fishing is one of the six wildlife-dependent recreational uses. Because there is often substantial overlap between activities associated with fishing and clamming, these uses are evaluated together in this compatibility determination.

This wildlife-dependent recreational use is supported by boating on the Ni-les'tun Unit of Bandon Marsh NWR; therefore boating impacts which are associated with sport fishing are also considered in this review.

Under the management direction described in the CCP for Bandon Marsh NWR, the U.S. Fish and Wildlife Service will continue to allow recreational bank fishing and clamming on the Bandon Marsh Unit. In addition, under the CCP's management direction the Service will open a portion of the Ni-les'tun Unit to cutthroat trout fishing. All recreational fishing and clamming will be conducted in accordance with State, Federal, and refuge-specific regulations and seasons to ensure that it does not interfere with the conservation of fish and wildlife and their habitats, or conflict with other public use activities.

On the Bandon Marsh Unit two types of recreational fishing occur: bank fishing and clamming. Bank fishing for salmonids, perch, cutthroat trout, etc. is allowed along the south bank of the Coquille River on the Bandon Marsh Unit. Anglers are permitted to use pole and line or rod and reel while bank fishing, and in accordance with ODFW regulations for fishing in the Coquille River and are allowed to use either bait or artificial lures. Clamming is allowed within the mudflats of the Bandon Marsh Unit and provides a recreational experience to harvest softshell clams by digging with a hand shovel or using a clam gun (i.e., aluminum or PVC piped suction device). In addition to the harvest of clams, the harvest of shrimp and other marine invertebrates for bait is included within the term clamming. The entire mudflat habitat within the Unit is open to clamming under ODFW sport fishing regulations. The continuation of fishing access within the Bandon Marsh Unit along the southern bank of the Coquille River provides an opportunity for people who do not own or have access to a boat. Access to both of these fishing activities (bank fishing and clamming) on the Unit is not on designated trails and will require users to walk across mudflats, over tidal creeks with large woody debris or driftwood, or along the narrow edge of the Coquille River. All of these estuarine habitats are affected by tidal waters which limits access and availability of mudflat habitat for clamming. For the Bandon Marsh Unit anglers will access the area by using the paved public parking lot located on the west side of Riverside Drive. Anglers may also access the Bandon Marsh Unit by boat from the Coquille River. There are two boat launches nearby. One launch is at Bullards Beach State Park and another is located further south at the Port of Bandon.

Under the CCP's management direction, the Service will allow fishing for cutthroat trout in the creeks south of North Bank Lane within the Ni-les'tun Unit. The navigable waters within Redd, No Name, and Fahys Creeks will be open to cutthroat trout fishing. Anglers will be permitted to use pole and line or rod and reel, and artificial lures (e.g., spinners, flies) only. Fishing access to these tidally influenced creeks south of North Bank Lane is limited and challenging due to tidal conditions and the presence of large woody debris or driftwood within the tidal creeks. To access fishing opportunities in the Ni-les'tun Unit, anglers can either use the boat launches at Bullards Beach, Port of Bandon, or Rocky Point, or they can walk-in by using the refuge parking lot located on North Bank Lane across from the refuge office. In addition, a small graveled parking area will be developed on refuge-owned lands adjacent to North Bank Lane near the western edge of the Ni-les'tun Unit that will accommodate three to four vehicles.

Because of the potential safety hazard posed by boating in an area with strong tidal influence, anglers may use either motorized or non-motorized boats to access fishing areas on both refuge units. Boats landing on the riverbank of the Coquille River within the Ni-les'tun Unit will be restricted to a designated location which will be open year round. The season for cutthroat trout fishing will coincide with ODFW's season for trout fishing which typically begins the last weekend in May;

however, fishing on the Refuge will end on September 30 to avoid conflicts with the waterfowl hunting season which begins in early October and continues through January.

Opening the area to cutthroat trout fishing, by boat or on foot, provides a wildlife-dependent form of recreation to all age groups and additionally provides an opportunity for people who do not own or have access to a boat.

Anglers must comply with all State and Federal regulations regarding fishing and clamming including refuge-specific provisions outlined in the Code of Federal Regulations (50 CFR 32.5).

Availability of Resources:

There are minimal costs associated with the management of a fishing program at Bandon Marsh NWR. The largest one-time expense will be the development of the graveled parking lot on the Ni-les'tun Unit. Other one-time and recurring expenses will consist primarily of posting and maintaining "Public Fishing Area" and "Boat Landing Area" signs, law enforcement patrols, and production and dissemination of materials regarding fishing access and regulations.

Costs to Administer and Manage a Fishing Program at Bandon Marsh NWR under the CCP's Management Direction

Activity or Project	One-time Expense	Recurring Expense
Development of fishing opening package for Ni-les'tun	$5,000	
Brochures, signs	$2,000	$500
Develop graveled 3-4 vehicle parking lot on North Bank Lane near RV park	$93,000	$2,000
Law enforcement patrols		$5,000
Staff		$5,000

Anticipated Impacts of the Use(s):

The Service is committed to providing quality opportunities for fish and wildlife-oriented recreation at Bandon Marsh NWR. As part of the Service mission and refuge goals for Bandon Marsh, all six of the Refuge System's priority wildlife-dependent uses will be offered at Bandon Marsh including fishing, hunting, wildlife observation, photography, environmental education, and interpretation. Offering fishing and clamming will help fulfill refuge purposes and goals and does not conflict with the mission of the Refuge System.

<u>Impacts to Wildlife and Habitat:</u>
Effect of disturbance intensity: Some researchers have attempted to correlate disturbance events in wildlife to the intensity, proximity, or loudness of human disturbance. While studying shorebirds on an eastern coastal refuge, Burger (1986) found that the level of disturbance in the shorebirds increased (fewer remained, more flew) as the total number of disturbances and the number of children, joggers, people walking, dogs, aircraft, and boats increased, and the duration of the disturbance and distance from the disturbance decreased.

Effect of human proximity: Other researchers have studied the effect of human proximity on wildlife. At what distance do humans on foot elicit a disturbance response? From an examination of the available studies, it appears that the distance varies dramatically from species to species. Burger and Gochfeld (1991) found that sanderlings foraged less during the day and more during the night as the number of people within 100 meters (328 feet) increased. Elk in Yellowstone National Park were disturbed when people were at average distances of 573 meters (1,880 feet; Cassirer 1990). These elk temporarily left the drainage and their home range core areas and moved to higher elevations, steeper slopes, and closer to forested areas. Average return time to the drainage was two days. Erwin (1989) studied colonial wading and seabirds in Virginia and North Carolina. Mixed colonies of common terns-black skimmers responded at the greatest distances, with respective means of 142 meters and 130 meters (466 feet and 427 feet); mixed wading bird species were more reluctant to flush (30-50 meters average, or 98-164 feet). There were few relationships between flushing distance and colony size. Similarly, there were few differences between responses during incubation compared to post-hatching periods.

Miller et al. (2001) defined an “area of influence” as the area that parallels a trail or line of human movement within which wildlife will flush from a particular activity with a certain probability. In a study analyzing response distance from hiking and mountain biking in sagebrush-grassland habitat in Utah, Taylor and Knight (2003) found that at 100 meters (328 feet) from the line of movement of an off-trail trial, mule deer showed a 96 percent probability of flushing. That probability did not drop to 70 percent until the perpendicular distance increased to 390 meters (1,280 feet).

Taylor and Knight (2003) also found that the area of influence around a recreationist on a trail did not differ between mountain biking and hiking. This may mean that wildlife do not differentiate between hikers and bikers, but are instead reacting to the presence of a moving human on a trail, regardless of the person’s activity. However, the area of influence differed considerably between on-trail and off-trail trials.

An analysis of over 4,000 human activity events near bald eagle nests in Central Arizona (Grubb and King 1991) found distance to disturbance to be the most important classifier of bald eagle response, followed in decreasing order of discriminatory value by duration of disturbance, visibility, number of units per event, position relative to affected eagle, and sound.

Breeding bald eagles in north-central Minnesota (Fraser et al. 1985) flushed at an average distance of 476 meters (1,562 feet) at the approach of a pedestrian. Skagen (1980), also studying bald eagles in northwest Washington, found a decrease in the proportion of eagles feeding when human activity was present within 200 meters (656 feet) of the feeding area in the previous 30 minutes. A between-season variation occurred in the use of feeding areas relative to human presence, which correlated with food availability. Eagles appeared more tolerant of human activity in the season of low food availability. In a review of several studies of the reaction of waterfowl and other wetland birds to people on foot, distances greater than 100 meters (328 feet) in general did not result in a behavioral response (DeLong 2002).

Effects from pedestrian access: Wildlife is frequently more sensitive to disturbance from people on foot than in vehicles (Skagen 1980, Grubb and King 1991, MacArthur et al. 1982). Numerous studies have confirmed that people on foot can cause a variety of disturbance reactions in wildlife, including flushing or displacement (Erwin 1989, Fraser et al. 1985, Freddy 1986), heart rate increases (MacArthur et al. 1982), altered foraging patterns (Burger and Gochfeld 1991), and even, in some cases, diminished reproductive success (Boyle and Samson 1985). These studies and others have shown that the severity of the effects depends upon the distance to the disturbance and its duration, frequency, predictability, and visibility to wildlife (Knight and Cole 1995). Taylor and Knight

(2003), analyzing mule deer, pronghorn antelope, and bison response to mountain biking and hiking on- and off-trail found that the variables best explaining wildlife response included wildlife species, perpendicular distance of animals to trail (closest distance of animal to trail, regardless of recreationist position), trail position (on-trail or off-trail), and degree of vegetation cover.

Effects on migrant birds versus resident birds: Klein (1989) studied the effect of visitation on migrant and resident waterbirds at Ding Darling National Wildlife Refuge and found that resident birds were less sensitive to human disturbance than migrants. Migrant ducks were particularly sensitive when they first arrived on-site in the fall. They usually remained more than 80 meters (262 feet) from a visitor footpath on a dike, even at very low visitor levels. Herons, egrets, brown pelicans, and anhingas were most likely to habituate to humans, thus exposing them to direct disturbance as they fed on or near the dike. Shorebirds showed intermediate sensitivity. Strauss (1990) observed piping plover chicks spent less time feeding (50 percent versus 91 percent) and spent more time running (33 percent versus 2 percent), fighting with other chicks (4 percent versus 0.1 percent), and standing alert (9 percent versus 0.1 percent) when pedestrians or moving vehicles were closer than 100 meters (328 feet) than when they were undisturbed. In addition, plover chicks spent less time out on the feeding flats (8 percent versus 97 percent) and more time up in the grass (66 percent versus 0.1 percent) during periods of human disturbance.

Predictability of disturbance (habituation): Dwyer and Tanner (1992) noted that wildlife habituate best to disturbance that is somewhat predictable or “background.” Investigating 111 nests of sandhill cranes in Florida, Dwyer and Tanner found that nesting cranes seemed to habituate to certain forms of human disturbance and nested within 400 meters (1,312 feet) of highways, railroads, and mines; cranes also were tolerant of helicopter flyovers. Visits to nests and development-induced alterations of surface water drainage were implicated in 24 percent of the nest failures. Taylor and Knight (2003) found that for mule deer, the area of influence around off-trail trials was much greater than that for on-trail trials, suggesting habituation to trails. However, the time it takes for wildlife to habituate, and what wildlife use is like compared to pre-disturbance uses, remains a fertile question. A study by Fairbanks and Tullous (2002) measured the distance of pronghorn from recreational trails on Antelope Island State Park in Utah. The study gathered data the year before the trails were opened for public use, and compared these to data gathered in three consecutive years after recreational use began. Groups of pronghorn were observed significantly farther from trails in years with recreational use than in the year before recreational areas were opened.

Fishing-specific impacts: Fishing, when practiced as a solitary and stationary activity, tends to be less disturbing to wildlife than hunting or motorized boating (Tuite et al. 1983). Direct habitat impacts include a certain amount of litter and general garbage left at fishing sites. Installation and use of parking areas and access trails can decrease impacts to vegetation and soil adjacent to fishing areas, by concentrating visitors on hardened surfaces.

Fishing will cause minor and localized disturbance to birds and other wildlife using refuge mudflats and tidal marsh. Fishing activities may influence the composition of bird communities, as well as distribution, abundance, and productivity of waterbirds (Tydeman 1977, Bouffard 1982, Bell and Austin 1985, Bordignon 1985, Edwards and Bell 1985, and Cooke 1987). 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 from using otherwise suitable habitat (Jahn and Hunt 1964). In Britain, anglers displaced waterfowl from their preferred feeding and roosting areas and caused wigeon, green-winged teal, pochard, and mallard to depart from a reservoir prematurely (Jahn and Hunt

1964). On fishing days, anglers influenced the numbers, behavior, and diurnal distribution of avian scavengers present at sites in Washington when compared to nonfishing days (Knight et al. 1991). Shoreline activities, such as human noise, could cause some birds to flush and go elsewhere. In addition, vegetation trampling, and deposition of human waste are expected to occur (Liddle and Scorgie 1980). Disturbance and destruction of riparian vegetation, and impacts to bank stability and water quality, may result from high levels of bank fishing activities.

Effects from boat proximity: Boating, both motorized and non-motorized, can alter the distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). More sensitive species may find it difficult to secure adequate food or loafing sites as their preferred habitat becomes fragmented and recreation related disturbance increase (Skagen et al. 1991, Pfister et al. 1992). However, disturbance to birds in general was reduced when boats traveled at or below five mph speed limit.

Motorized boats can generally have more impact on wildlife than non-motorized boats because motorboats produce a combination of movement and noise (Tuite et al. 1983, Knight and Cole 1995). Motorized boats can also cover a larger area in a relatively short time, in comparison to non-motorized boats. Motorized boats introduce noise and pollution, in the form of gas and oil, and particulates in the air, in estuarine and riverine habitats of the Refuge. Hydrocarbon pollution has been found to bio accumulate with the complex food web, posing a serious threat to the marine environment (Tjarnlund et al. 1993). Hydrocarbons can also be transferred to eggs from the plumage of incubating birds. Extremely small amounts of petroleum hydrocarbons can be toxic to eggs and birds that ingest these contaminants (Hoffman 1989).

Canoes and kayaks can cause significant disturbance effects based on their ability to penetrate into shallower marsh areas (Speight 1973, Knight and Cole 1995). In the Ozark National Scenic Riverway, green heron activity declined on survey routes when canoes and boat use increased on the main river channel (Kaiser and Fritzell 1984). Canoes or slow moving boats have also been observed to disturb nesting great blue herons (Vos et al. 1985). Huffman (1999) found that non-motorized boats within 30 meters (98 feet) of the shoreline in south San Diego Bay caused all wintering waterfowl to flush between the craft and shore. However, compared to motorboats, canoes and kayaks appear to have less disturbance effects on most wildlife species (Jahn and Hunt 1964, Huffman 1999, DeLong 2002).

The total number of boats and people can be an inappropriate measure of recreational intensity because the presence of a single boat might be just as disturbing as that of many (Tuite et al. 1983, Knight and Knight 1984). Even a low level of boating activity affects the duration and pattern of use by wildlife (Bratton 1990).

Refuge-specific Impacts:
People engaging in fishing and clamming generally access the Refuge by motorized vehicles travelling on public roads, and using pullouts and parking lots. Pullouts, parking lots, and public roads have minimal direct impacts because they occupy a relatively small acreage. A limited group of individuals access the Refuge via boat from the Coquille River.

Currently the Bandon Marsh Unit provides fishing and clamming opportunities. Under the CCP's management direction, the Complex will add seasonal fishing in tidal creeks/sloughs within the Ni-les'tun Unit south of North Bank Lane by foot or boat access. Along creek/slough edges, foot travel will result in a minor amount of habitat degradation (vegetation modification and soil compaction) from fishing activities. Direct habitat impacts will likely include a certain amount of litter and general garbage left at fishing sites.

Pedestrian access: Pedestrian access for fishing on the Refuge creates the highest potential for disturbance or damage to natural resources. Foot travel associated with bank fishing, cutthroat trout fishing and clamming could potentially result in temporary and minor vegetation trampling and local erosion affecting stream and tidal channel structure, stability, and sedimentation. Due to the low number of anglers expected to fish on the Refuge, these impacts are expected to be minor.

To reduce wildlife disturbance potential caused by anglers and to create a buffer for sensitive cultural resources, bank fishing along the Coquille River is only permitted on the Bandon Marsh Unit.

Boat access: Boat access to the Ni-les'tun Unit for cutthroat trout fishing creates a potential for disturbance to migratory and resident birds. This may cause birds that use the waters of the river and the estuary creek edges to flush. The disturbance to wildlife is expected to be localized and of short duration, resulting in a minor impact. Nearby resting and feeding areas will be available for use by any displaced wildlife. Boats landing on the riverbank of the Coquille River within the Ni-les'tun Unit will be restricted to a designated area.

Both fishing and clamming visitation are projected to increase under the CCP's management direction. Given this, future disturbance effects are likely to be somewhat higher than present. Most studies cited above have demonstrated immediate, rather than long-term responses to disturbance. Long-term responses are inherently more difficult and expensive to determine. Because the area open to fishing on the Ni-les'tun Unit is limited, effects on refuge wildlife from opening this unit to bank and creek/slough fishing are expected to be minor.

Bank fishing and clamming currently occur within the Bandon Marsh Unit and, under the management direction of the CCP, cutthroat trout fishing will be allowed within the Ni-les'tun Unit of the Refuge. Over the life of the CCP, none of these uses is expected to threaten research, wildlife observation, photography, interpretation, waterfowl hunting or environmental education activities due to the limited numbers of individuals engaged in fishing and clamming, limited areas where the use will be allowed and the amount of sanctuary otherwise available to wildlife.

Impacts to listed species: The listed species found on Bandon Marsh NWR is the threatened coho salmon, Pacific smelt (eulachon), and green sturgeon. The highest potential for impacts to coho salmon and green sturgeon is from accidental capture during cutthroat trout fishing. Impacts to these fish species are reduced through limiting cutthroat trout fishing to artificial lures only and reducing the season by a month, and by the small scope and limited size of this fishing opportunity. Anglers will also be expected to comply with state fishing regulations which are designed to prevent adverse effects to coho salmon, green sturgeon, and other listed fish. In addition, specific public education (e.g., handouts) can assist in raising awareness and preventing undue impacts to this species. It is expected no impact or a neutral effect on eulachon will occur because of fishing activities. Effects from bank fishing and clamming access on coho, green sturgeon, and eulachon are expected to be negligible.

Sport fishing for cutthroat trout in waters of the Refuge is an approved recreational activity by the National Marine Fisheries Service under a Section 7 consultation of the Endangered Species Act within a Biological Opinion (PFMC 1999) and under ODFW's Oregon Coastal Coho, Coastal Rivers

Coho Sports Fishery Fisheries and Management Plan (National Marine Fisheries Service concurred with under limit 4 of the Endangered Species Act 4(d) rule; ODFW 2009, NMFS 2009).

Impacts to other priority public uses:
Bandon Marsh NWR is committed to providing quality opportunities for wildlife-dependent recreation. The Refuge will continue to support all six of the Refuge System's priority wildlife-dependent uses: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. The direct impacts to refuge visitors engaged in the other priority public uses either via foot or boat from fishing are expected to be negligible.

Bank fishing, fishing for cutthroat trout, and clamming generally result in little disturbance to other visitors. However, some anglers may inadvertently flush waterfowl being pursued by hunters on the Bandon Marsh Unit. This conflict will be expected to be minimal at Bandon Marsh Unit, because waterfowl hunting will occur only during late fall and winter, a time of year when visitors engaged in fishing and clamming are fewer in number. To minimize safety conflicts between hunters and those engaged in cutthroat trout fishing during the waterfowl hunting season, the Ni-les'tun Unit south of North Bank Lane will be closed to anglers as well as wildlife observation and photography from October 1 through January 31. This closure will help prevent inadvertent flushing of waterfowl in addition to minimizing safety conflicts on refuge lands and waters.

Other Effects:
No significant effects to roads, trails, or other infrastructure from the fishing programs are foreseen. Normal road, trail, and facility maintenance will continue to be necessary. There will be a minor impact on some members of the refuge staff as overseeing the construction of the parking lot along North Bank Lane, maintenance of the site, and increased compliance patrols will increase staff workload.

Public Review and Comment:

Fishing and clamming were discussed at two public meetings held in conjunction with the Comprehensive Conservation Plan process. To initiate the CCP process, a Notice of Intent was published in the Federal Register on November 29, 2010 (Volume 75, Number 228). Written comments were solicited from the public about proposed wildlife-dependent recreational uses including fishing and clamming. Three CCP planning updates were prepared to summarize the progress of the CCP and to discuss issues related the planning process. This compatibility determination was submitted for public review and comment as an appendix to the Draft Comprehensive Conservation Plan and Environmental Assessment for Bandon Marsh NWR. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination:

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Fishing is allowed only during daylight hours.
- Anglers will be permitted to use pole and line or rod and reel. Anglers must attend their line.

- The Refuge will provide signs and brochures to promote appropriate use of refuge lands to minimize wildlife and habitat disturbance, including boating practices such as no-wake and slower speeds. These materials will clearly state pertinent refuge-specific regulations.
- The Refuge will ensure safety and minimize conflict with other priority public uses by providing information about fishing and clamming to the general public and those utilizing other refuge programs. These materials will clearly state pertinent State, Federal, and refuge-specific regulations. Information will be provided on the refuge website, in a fishing tear sheet and in refuge offices.
- To minimize safety conflicts with waterfowl hunting on the Ni-les'tun Unit the creeks/sloughs south of North Bank Lane will be closed to angling during the final month of state-regulated season (October 1-31).
- On the Ni-les'tun Unit cutthroat trout fishing is allowed by foot or by boat on lands south of North Bank Lane only. The season for cutthroat trout fishing will begin when ODFW's season for trout fishing begins which is the last weekend in May. Per refuge regulations the season will end on September 30.
- For the Ni-les'tun Unit only: artificial lures may be used and bait will be prohibited at all times.
- Bank fishing on the Coquille River is only permitted on the Bandon Marsh Unit.
- For the Bandon Marsh Unit anglers will be permitted to use either bait or artificial lures per ODFW regulations.
- For the Bandon Marsh Unit anglers will access the area by using the paved public parking lot associated with this unit located on the west side of Riverside Drive or they may access the Unit by boat using nearby public boat launches.
- For the Ni-les'tun Unit anglers will access the site using nearby public boat launches, the refuge parking lot located on North Bank Lane or the graveled parking area developed by the Refuge located on refuge-owned lands adjacent to North Bank Lane near the western edge of the Ni-les'tun Unit.
- Pets and dogs will only be allowed outside of vehicles in parking areas (not on trails) and must be kept on-leash any time they are outside vehicles.
- Camping, overnight use, and fires are prohibited.
- The Service will implement a program to monitor fish population numbers and habitat use and reserves the right to modify existing programs to accommodate existing or changing conditions.
- Periodic monitoring and evaluation of sites and programs will be conducted to assess if objectives are being met and the resource is not being unacceptably degraded. If disturbance to wildlife or damage to habitat reaches unacceptable levels, the Refuge will further restrict fishing activities in areas where unacceptable impacts occur.

Justification:

Wildlife-dependent recreational uses including fishing receive enhanced consideration in the Comprehensive Conservation Planning process. Given the location of seasonal closures within the area and the limited locations of bank and cutthroat trout fishing and clamming, these uses will be expected to have a minor direct impact on refuge resources. The associated disturbance to wildlife from these activities, though larger than at present, is also expected to be minor. 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 these activities to occur. The relatively limited number of individual animals and plants expected to be adversely affected will not cause wildlife populations to materially decline, the physiological condition and production of refuge 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 fishing and clamming under the stipulations described above will not materially detract or interfere with the purposes for which the Refuge was established or the refuge mission. Furthermore, trout fishing on the Ni-les'tun Unit will create the opportunity for greater awareness among anglers about the importance of estuaries and unimpeded coastal creeks for salmonids. Fishing provides visitors with the joy of experiencing wildlife on their public lands, and as such, helps fulfill the mission of the National Wildlife Refuge System.

Mandatory Re-Evaluation Date:

____X____ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

__________ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________ Categorical Exclusion without Environmental Action Statement

__________ Categorical Exclusion and Environmental Action Statement

____X____ Environmental Assessment and Finding of No Significant Impact

__________ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Actin (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	Robert West (Signature)	12-19-12 (Date)

B.5 Compatibility Determination

Use: Research, Scientific Collecting, and Surveys

Research: Planned, organized, and systematic investigation of a scientific nature.

Scientific collecting: Gathering of refuge natural resources or cultural artifacts for scientific purposes.

Surveys: Scientific inventory or monitoring.

Refuge Name: Bandon Marsh National Wildlife Refuge

County and State: Coos County, Oregon

Establishing and Acquisition Authorities:

Bandon Marsh National Wildlife Refuge (NWR) was authorized by Public Law 97-137, of December 29, 1981 and established by the authority of the Fish and Wildlife Act of 1956, as amended [16 U.S.C. 742a-742j] to protect migratory bird habitat. Additional lands were added to the Refuge in the 1990s through the Refuge Recreation Act of 1962, as amended [16 U.S.C. 460k-4]. Public Law 105-321 (95 Stat. 1709; Oregon Public Lands Transfer and Protection Act of 1998) amended P.L. 97-137 to authorize boundary expansion of Bandon Marsh NWR from 300 to 1,000 acres. Legal authorities used for establishment of the Refuge include the Endangered Species Act of 1973, as amended [16 U.S.C. 1531-1544] and the Migratory Bird Conservation Act of 1929, as amended [16 U.S.C. 715-715d, 715e, 715f-715r].

Refuge Purpose(s):

- “For the preservation and enhancement of the highly significant wildlife habitat … for the protection of migratory waterfowl, numerous species of shorebirds and fish … and to provide opportunity for wildlife-oriented recreation and nature study on the marsh” [95 Stat. 1709, dated Dec. 29, 1981] and Public Law 97-137 – Dec. 29, 1981 and H.R. 2241 March 2, 1981.
- “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)].
- “particular value in carrying out the national migratory bird management program” [16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife)].

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 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

Description of Use(s):

The refuge staff receives periodic requests from non-Service entities (e.g., universities, state or territorial agencies, other Federal agencies, nongovernmental organizations) to conduct research, scientific collecting, and surveys on refuge lands. These project requests can involve a wide range of natural and cultural resources as well as public-use management issues including basic absence/presence surveys, collection of new species for identification, habitat use and life-history requirements for specific species/species groups, practical methods for habitat restoration, extent and severity of environmental contaminants, techniques to control or eradicate pest species, effects of climate change on environmental conditions and associated habitat/wildlife response, identification and analyses of paleontological specimens, wilderness character, modeling of wildlife populations, bioprospecting, and assessing response of habitat/wildlife to disturbance from public uses. Projects may be species-specific, refuge-specific, or evaluate the relative contribution of the refuge lands to larger landscapes (e.g., ecoregion, region, flyway, national, international) issues and trends.

The Service's Research and Management Studies (4 RM 6) and Appropriate Refuge Uses (603 FW 1.10D(4)) policies indicate priority for scientific investigatory studies that contribute to the enhancement, protection, use, preservation, and management of native wildlife populations and their habitat as well as their natural diversity. Projects that contribute to refuge-specific needs for resource and/or wilderness management goals and objectives, where applicable, will be given a higher priority over other requests.

Availability of Resources:

Refuge staff responsibilities for projects by non-Service entities will be primarily be limited to the following: review of proposals, prepare SUP(s) and other compliance documents (e.g., Section 7 of the Endangered Species Act of 1973, Section 106 of the National Historic Preservation Act), and monitor project implementation to ensure that impacts and conflicts remain within acceptable levels (compatibility) over time. Additional administrative support, logistical and operational support may also be provided depending on each specific request. Estimated costs for one-time (e.g., prepare SUP) and annually re-occurring tasks by refuge staff and other Service employees will be determined for each project. Sufficient funding in the general operating budget of the Refuge must be available to cover expenses for these projects. The terms and conditions for funding and staff support necessary to administer each project on the Refuge will be clearly stated in the SUP(s).

The Refuge has the following staffing and funding to administratively support and monitor research that is currently taking place on refuge lands (see table below). Any substantial increase in the number of projects will create a need for additional resources to oversee the administration and monitoring of the investigators and their projects. Any substantial additional costs above those itemized below may result in finding a project not compatible unless expenses are offset by the investigator(s), sponsoring agency, or organization.

Category and Itemization	One-time ($)	Annual ($/yr)
Administration and management		$1,000
Maintenance		$500
Monitoring		$1,750
Special equipment, facilities, or improvement		
Totals		**$3,250**

Itemized costs in the previous table are current estimates calculated using 30% of the base cost for a GS-11 Refuge Biologist and a 3% cost of a GS-11 Refuge Manager.

Anticipated Impacts of the Use(s):

Use of the Refuge to conduct research, scientific collecting, and surveys will generally provide information that will benefit fish, wildlife, plants, and their habitats. Scientific findings gained through these projects provide important information regarding life-history needs of species and species groups as well as identify or refine management actions to achieve resource management objectives in refuge management plans (especially CCPs). Reducing uncertainty regarding wildlife and habitat responses to refuge management actions in order to achieve desired outcomes reflected in resource management objectives is essential for adaptive management in accordance with 522 DM 1.

If project methods impact or conflict with refuge-specific resources, priority wildlife-dependent public uses, other high-priority research, wilderness, and refuge habitat and wildlife management programs, then it must be clearly demonstrated that its scientific findings will contribute to resource management and that the project cannot be conducted off refuge lands for the project to be compatible. The investigator(s) must identify methods/strategies in advance required to minimize or eliminate the potential impact(s) and conflict(s). If unacceptable impacts cannot be avoided, then the project will not be compatible. Projects that represent public or private economic use of the natural resources of any national wildlife refuge (e.g., bioprospecting), in accordance with 16 U.S.C. 715s, must contribute to the achievement of the national wildlife refuge purposes or the National Wildlife Refuge System mission to be compatible (50 CFR 29.1).

Impacts will be project- and site-specific, and they will vary depending upon nature and scope of the field work. Data collection techniques will generally have minimal animal mortality or disturbance, habitat destruction, no introduction of contaminants, or no introduction of non-indigenous species. In contrast, projects involving the collection of biotic samples (plants or animals) or requiring intensive ground-based data or sample collection will have short-term impacts. To reduce impacts, the minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) will be collected for identification and/or experimentation and statistical analysis. Where possible, researchers will coordinate and share collections to reduce sampling needed for multiple projects. For example, if one investigator collects fish for a diet study and another research examines otoliths, then it may be possible to accomplish sampling for both projects with one collection effort.

Investigator(s) obtaining required State or Territorial, and Federal collecting permits will also ensure minimal impacts to fish, wildlife, plants, and their habitats. If, even after incorporating the above strategies, projects would result in long-term or cumulative effects, projects would not be compatible. A Section 7 consultation under the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884, as amended Public Law 93-205) will be required for activities that may affect a federally listed species and/or critical habitat. Only projects that have no effect or will result in not likely to adversely affect determinations will be considered compatible.

Spread of invasive plants and/or pathogens is possible from ground disturbance and/or transportation of project equipment and personnel, but it will be minimized or eliminated by requiring proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary (see Attachment 4). If after all practical measures are taken and unacceptable spread of invasive species is anticipated to occur, then the project will be found not compatible without a restoration or mitigation plan.

There also could be localized and temporary effects from vegetation trampling, collecting of soil and plant samples, or trapping and handling of wildlife. Impacts may also occur from infrastructure necessary to support a projects (e.g., permanent transects or plot markers, exclosure devices, monitoring equipment, solar panels to power unattended monitoring equipment). Some level of disturbance is expected with these projects, especially if investigator(s) enter areas closed to the public and collect samples or handle wildlife. However, wildlife disturbance (including altered behavior) will usually be localized and temporary in nature. Where long-term or cumulative unacceptable effects cannot be avoided, the project will not be found compatible. Project proposals will be reviewed by refuge staff and others, as needed, to assess the potential impacts (short-term, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems.

At least 6 months before initiation of field work (unless an exception is made by prior approval of the refuge manager), project investigator(s) must submit a detailed proposal using the format provided in Attachment 1. Project proposals will be reviewed by refuge staff and others, as needed, to assess the potential impacts (short-term, long-term, and cumulative) relative to benefits of the investigation to refuge management issues and understanding of natural systems. This assessment will form the primary basis for allowing or denying a specific project. Projects which result in unacceptable refuge impacts will not be found compatible. If allowed and found compatible after approval, all projects also will be assessed during implementation to ensure impacts and conflicts remain within acceptable levels.

If the proposal is approved, then the refuge manager will issue a SUP(s) with required stipulations (terms and conditions) of the project to avoid and/or minimize potential impacts to refuge resources as well as conflicts with other public-use activities and refuge field management operations. After approval, projects also are monitored during implementation to ensure impacts and conflicts remain within acceptable levels based upon documented stipulations.

The combination of stipulations identified above and conditions included in any SUP(s) will ensure that proposed projects contribute to the enhancement, protection, conservation, and management of native wildlife populations and their habitats on the Refuge. As a result, these projects will help fulfill refuge purpose(s); contribute to the Mission of the NWRS; and maintain the biological integrity, diversity, and environmental health of the Refuge.

Projects which are not covered by the CCP (objectives under Goal 5 [Gather scientific information (surveys, research, and assessments) to support adaptive management decisions under objectives for Goals 1-4.]) will require additional NEPA documentation.

Public Review and Comment:

This CD was prepared concurrent with the Bandon Marsh NWR CCP/EA. Public notice was provided and open houses were held and written comments were solicited from the public during the scoping period for the CCP/EA. Public review and comment were solicited during the Draft CCP/EA comment period. Appendix K of the CCP contains a summary of the comments and Service responses.

Determination: (check one below)

__________ Use is Not Compatible

____X____ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Each project will require a SUP. Annual or other short-term SUPs are preferred; however, some permits will be a longer period, if needed, to allow completion of the project. All SUPs will have a definite termination date in accordance with 5 RM 17.11. Renewals will be subject to refuge manager review and approval based timely submission of and content in progress reports, compliance with SUP stipulations, and required permits.

- Projects will adhere to scientifically defensible protocols for data collection, where available and applicable.
- Investigators must possess appropriate and comply with conditions of State or Territorial and Federal permits for their projects.
- If unacceptable impacts to natural resources or conflicts arise or are documented by the refuge staff, then the refuge manager can suspend, modify conditions of, or terminate an on-going project already permitted by SUP(s) on a refuge(s).
- Progress reports are required at least annually for multiple-year projects. The minimum required elements for a progress report will be provided to investigator(s) (see Attachment 2).
- Final reports are due one year after completion of the project unless negotiated otherwise with the refuge manager.
- Continuation of existing projects will require approval by the refuge manager.
- The refuge staff will be given the opportunity to review draft manuscript(s) from the project before being submitted to a scientific journal(s) for consideration of publication.
- The refuge staff will be provided with copies (reprints) of all publications resulting from a refuge project.
- The refuge staff will be provided with copies of raw data (preferably electronic database format) at the conclusion of the project.
- Upon completion of the project or annually, all equipment and markers (unless required for long-term projects), must be removed and sites must restored to the refuge manager's satisfaction. Conditions for clean-up and removal of equipment and physical markers will be stipulated in the SUP(s).
- All samples collected on refuge lands are the property of the Service even while in the possession of the investigator(s). Any future work with previously collected samples not clearly identified in the project proposal will require submission of a subsequent proposal for review and approval. In addition, a new SUP will be required for additional project work. For samples or specimens to be stored at other facilities (e.g., museums), a memorandum of understand will be necessary (see Attachment 3).
- Sampling equipment as well as investigator(s) clothing and vehicles (e.g., ATV, boats) will be thoroughly cleaned (free of dirt and plant material) before being allowed for use refuge lands to prevent the introduction and/or spread of pests. Where necessary, utilize quarantine methods (see Attachment 4)

- The NWRS, specific refuge, names of refuge staff and other Service personnel that supported or contributed to the project will be appropriately cited and acknowledged in all written and oral presentations resulting from projects on refuge lands.
- At any time, refuge staff may accompany investigator(s) in the field.
- Investigator(s) and support staff will follow all refuge-specific regulations that specify access and travel on the Refuge.

Justification:

Research, scientific collecting, and surveys on refuge lands are inherently valuable to the Service because they will expand scientific information available for resource management decisions. In addition, only projects which directly or indirectly contribute to the enhancement, protection, use, preservation, and management of refuge wildlife populations and their habitats generally will be authorized on refuge lands. In many cases, if it were not for the refuge staff providing access to refuge lands and waters along with some support, the project would never occur and less scientific information would be available to the Service to aid in managing and conserving the refuge resources. By allowing the use to occur under the stipulations described above, it is anticipated that wildlife species which could be disturbed during the use will find sufficient food resources and resting places so their abundance and use will not be measurably lessened on the Refuge. Additionally, it is anticipated that monitoring, as needed, will prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats. As a result, these projects will not materially interfere with or detract from fulfilling refuge purposes; contributing to the Mission of the NWRS; and maintaining the biological integrity, diversity, and environmental health of the Refuge.

Mandatory Re-Evaluation Date:

__________ Mandatory 15-year re-evaluation date (for wildlife-dependent public uses)

____X____ Mandatory 10-year re-evaluation date (for all uses other than wildlife-dependent public uses)

NEPA Compliance for Refuge Use Decision: (check one below)

__________ Categorical Exclusion without Environmental Action Statement

__________ Categorical Exclusion and Environmental Action Statement

____X____ Environmental Assessment and Finding of No Significant Impact

__________ Environmental Impact Statement and Record of Decision

Refuge Determination:

Prepared by:	Rebecca G. Chuck (Signature)	12/18/12 (Date)
Refuge Manager/ Project Leader Approval:	Rebecca G. Chuck Acting (Signature)	12/18/12 (Date)

Concurrence:

Refuge Supervisor:	(Signature)	12/18/12 (Date)
Regional Chief, National Wildlife Refuge System:	(Signature)	12-19-12 (Date)

Attachment 1

FORMAT FOR PROPOSALS TO CONDUCT RESEARCH OR LONG-TERM MONITORING ON NATIONAL WILDLIFE REFUGES

A Special Use Permit (SUP) is required to conduct research and/or long-term monitoring on refuge lands. To receive a SUP, a detailed project proposal using the following format must be submitted to the refuge manager approximately 6 months prior to the start of the project.

Title:

Principal Investigator(s):
Provide the name(s) and affiliation(s) of all principal investigator(s) that will be responsible for implementation of the research and/or long-term monitoring described in the proposal. In addition, provide a brief description or attach vitae of expertise for principal investigator(s) germane to work described in the proposal.

Background and Justification:
In a narrative format, describe the following as applicable:

- *The resource management issue (e.g., decline in Pisonia rainforest) and/or knowledge gap regarding ecological function that currently exists with any available background information.*
- *Benefit of project findings (e.g., management implications) to resources associated with the Refuge.*
- *Potential consequences if the conservation issue and/or knowledge gap regarding ecological function is not addressed.*

Objectives:
Provide detailed objective(s) for the proposed project.

Methods and Materials:
Provide a detailed description of the methods and materials associated with field and laboratory work (if applicable) to be conducted for the project. Methods should include the following:
- *study area(s)*
- *number of samples;*
- *sampling dates and locations*
- *sampling techniques*
- *data analyses including* ***statistical methods*** *and* ***significance levels****.*

Previously published methods should be cited without explanation; whereas, new or modified techniques should be described in detail. Include number of personnel as well as all facilities and equipment (e.g., vehicles, boats, structures, markers) required to collect samples/data. Provide a clear description of the relationships among study objectives, field methods, and statistical analyses.

Permits:
Identify all State or Territorial and Federal permits required if applicable.

Potential Impacts to Refuge Resources:
Describe potential impacts to threatened or endangered species as well as other refuge plants, wildlife, and fish species that could result from the implementation of project activities on the Refuge. Consider the cumulative impacts associated with this project.

Animal Welfare Plan:
If appropriate, attach a copy of the Institutional Animal Care and Use review and/or animal welfare plans that are required by the principle investigator's affiliation.

Partnerships and Funding Sources:
List other participating institutions, agencies, organizations, or individuals as well as the nature and magnitude of their cooperative involvement (e.g., funding, equipment, personnel).

Project Schedule:
Provide estimated initiation and completion dates for field sampling, laboratory work, data analyses, and report/manuscript preparation. If the project is divided into phases to be accomplished separately provide separate initiation and completion dates for each phase.

Reports and Raw Data:
Establish a schedule for annual progress and final reports; include adequate time for peer review of the final report/manuscript. Draft reports/manuscripts should be submitted to the refuge manager for review prior to submission for consideration of publication. At the conclusion of a research study (manuscripts accepted for publication), an electronic copy of the data (e.g., GIS vegetation layers, animal species composition and numbers, genetics) should be provided to the refuge manager. For long-term monitoring projects, the Service also requires raw data for management and planning purposes for the Refuge.

Publications:
Describe the ultimate disposition of study results as publications in scientific journals, presentation at professional symposiums, or final reports.

Disposition of Samples:
If the project entails the collection of biotic and/or abiotic (e.g., sediment) samples, then describe their storage. Although the samples may be in the possession of scientists for the purposes of conducting the project in accordance with the SUP, the Service retains ownership of all samples collected on refuge lands. If the samples will be used for subsequent research activities that are not described within the original proposal, a new proposal must be submitted to the refuge manager to obtain a SUP before initiation of the follow-up project. After conclusion of the research activities, consult with the refuge manager regarding the final disposition of the samples. If specimens will be curated at a museum, then prepare a MOU using the format provided in Attachment 3.

Attachment 2

ANNUAL PROGRESS REPORTS FOR REFUGE RESEARCH AND LONG-TERM MONITORING PROJECTS

Study title:

Fiscal year:

Progress:
In a narrative format, summarize the work that was completed on the study including the number and types of samples collected and/or data analyses.

Important findings:
In narrative format, generally describe any conclusions and/or management recommendations that may be drawn from the work completed to date.

Describe problems encountered:
In narrative format, describe any problems that were encountered during the year and their effects upon the study.

Proposed resolution to problems:
For each problem encountered, describe the actions that have been taken to remediate it.

Preparer:

Date prepared:

Attachment 3

**MEMORANDUM OF UNDERSTANDING
FOR CURATORIAL SERVICES
BETWEEN THE**

**(Name of the Federal agency)
AND THE
(Name of the Repository)**

This Memorandum of Understanding is entered into this (**day**) day of (**month and year**), between the United States of America, acting by and through the (**name of the Federal agency**), hereinafter called the Depositor, and the (**name of the Repository**), hereinafter called the Repository, in the State/Territory of (**name of the State/Territory**).

The Parties do witnesseth that

WHEREAS, the Depositor has the responsibility under Federal law to preserve for future use certain collections of paleontological specimens and/or biological samples as well as associated records, herein called the Collection, listed in Attachment A which is attached hereto and made a part hereof, and is desirous of obtaining curatorial services; and

WHEREAS, the Repository is desirous of obtaining, housing and maintaining the Collection, and recognizes the benefits which will accrue to it, the public and scientific interests by housing and maintaining the Collection for study and other educational purposes; and

WHEREAS, the Parties hereto recognize the Federal Government's continued ownership and control over the Collection and any other U.S. Government-owned personal property, listed in Attachment B which is attached hereto and made a part hereof, provided to the Repository, and the Federal Government's responsibility to ensure that the Collection is suitably managed and preserved for the public good; and

WHEREAS, the Parties hereto recognize the mutual benefits to be derived by having the Collection suitably housed and maintained by the Repository;

NOW THEREFORE, the Parties do mutually agree as follows:

1. The Repository shall:

    a. Provide for the professional care and management of the Collection from the (**names of the resources**) sites, assigned (**list site numbers**) site numbers. The collections were recovered in connection with the (**name of the Federal or federally-authorized project**) project, located in (**name of the nearest city or town**), (**name of the county, if applicable**) county, in the State/Territory of (**name of the State/Territory**)-

    b. Assign as the Curator, the Collections Manager and the Conservator having responsibility for the work under this Memorandum, persons who are qualified museum professionals and whose expertise is appropriate to the nature and content of the Collection.

c. Begin all work on or about (**month, date and year**) and continue for a period of (**number of years**) years or until sooner terminated or revoked in accordance with the terms set forth herein.

d. Provide and maintain a repository facility having requisite equipment, space and adequate safeguards for the physical security and controlled environment for the Collection and any other U.S. Government-owned personal property in the possession of the Repository.

e. Not in any way adversely alter or deface any of the Collection except as may be absolutely necessary in the course of stabilization, conservation, scientific study, analysis and research. Any activity that will involve the intentional destruction of any of the Collection must be approved in advance and in writing by the Depositor.

f. Annually inspect the facilities, the Collection and any other U.S. Government-owned personal property. Every (**number of years**) years inventory the Collection and any other U.S. Government-owned personal property. Perform only those conservation treatments as are absolutely necessary to ensure the physical stability and integrity of the Collection, and report the results of all inventories, inspections and treatments to the Depositor.

g. Within five (5) days of discovery, report all instances of and circumstances surrounding loss of, deterioration and damage to, or destruction of the Collection and any other U.S. Government-owned personal property to the Depositor, and those actions taken to stabilize the Collection and to correct any deficiencies in the physical plant or operating procedures that may have contributed to the loss, deterioration, damage or destruction. Any actions that will involve the repair and restoration of any of the Collection and any other U.S. Government-owned personal property must be approved in advance and in writing by the Depositor.

h. Review and approve or deny requests for access to or short-term loan of the Collection (or a part thereof) for scientific and educational uses. In addition, refer requests for consumptive uses of the Collection (or a part thereof) to the Depositor for approval or denial.

i. Not mortgage, pledge, assign, repatriate, transfer, exchange, give, sublet, discard or part with possession of any of the Collection or any other U.S. Government-owned personal property in any manner to any third party either directly or indirectly without the prior written permission of the Depositor, and redirect any such request to the Depositor for response. In addition, not take any action whereby any of the Collection or any other U.S. Government-owned personal property shall or may be encumbered, seized, taken in execution, sold, attached, lost, stolen, destroyed or damaged.

2. The Depositor shall:

    a. On or about (month, date and year), deliver or cause to be delivered to the Repository the Collection, as described in Attachment A, and any other U.S. Government-owned personal property, as described in Attachment B.

    b. Assign as the Depositor's Representative having full authority with regard to this Memorandum, a person who meets pertinent professional qualifications.

    c. Every (number of years) years, jointly with the Repository's designated representative, have the Depositor's Representative inspect and inventory the Collection and any other U.S. Government-owned personal property, and inspect the repository facility.

    d. Review and approve or deny requests for consumptively using the Collection (or a part thereof).

3. Removal of all or any portion of the Collection from the premises of the Repository for scientific or educational purposes; any conditions for handling, packaging and transporting the Collection; and other conditions that may be specified by the Repository to prevent breakage, deterioration and contamination.

4. The Collection or portions thereof may be exhibited, photographed or otherwise reproduced and studied in accordance with the terms and conditions stipulated in Attachment C to this Memorandum. All exhibits, reproductions and studies shall credit the Depositor, and read as follows: "Courtesy of the (**name of the Federal agency**)." The Repository agrees to provide the Depositor with copies of any resulting publications.

5. The Repository shall maintain complete and accurate records of the Collection and any other U.S. Government-owned personal property, including information on the study, use, loan, and location of said Collection which has been removed from the premises of the Repository.

6. Upon execution by both parties, this Memorandum of Understanding shall be effective on this (**day**) day of (**month and year**), and shall remain in effect for **(number of years**) years, at which time it will be reviewed, revised, as necessary, and reaffirmed or terminated. This Memorandum may be revised or extended by mutual consent of both parties, or by issuance of a written amendment signed and dated by both parties. Either party may terminate this Memorandum by providing 90 days written notice. Upon termination, the Repository shall return such Collection and any other U.S. Government-owned personal property to the destination directed by the Depositor and in such manner to preclude breakage, loss, deterioration, and contamination during handling, packaging, and shipping, and in accordance with other conditions specified in writing by the Depositor. If the Repository terminates, or is in default of, this Memorandum, the Repository shall fund the packaging and transportation costs. If the Depositor terminates this Memorandum, the Depositor shall fund the packaging and transportation costs.

7. Title to the Collection being cared for and maintained under this Memorandum lies with the Federal Government.

IN WITNESS WHEREOF, the Parties hereto have executed this Memorandum.

Signed: (signature of the Federal Agency Official) Date: (date)

Signed: (signature of the Repository Official) Date: (date)

Attachment 3A: Inventory of the Collection

Attachment 3B: Inventory of any other U.S. Government-owned Personal Property

Attachment 3C: Terms and Conditions Required by the Depositor

Attachment 4

ALIEN SPECIES QUARANTINE RESTRICTIONS FOR NATIONAL WILDLIFE REFUGES

A. Introduction

Thank you for your interest in conducting research/monitoring on the Refuge. To protect wildlife and habitat communities found on the Refuge, visitation is carefully regulated and requires that each individual, or group, secure a Special Use Permit (SUP) to gain access to the Refuge. Each SUP clearly outlines the responsibilities of each permittee, including specific quarantine policies, which may be more detailed than the policies listed within this document. Details for securing a SUP can be found by contacting the refuge manager. Prospective scientific researchers must apply for the SUP at least 6 months prior to their proposed study period.

One of the gravest threats to the Refuge is the introduction of alien plant and animal species. The practices described below are complex, but the Service has found them to be effective at greatly reducing additional introductions of invasive species on the Refuge.

B. Definitions

1. **Clothing** - all apparel, including shoes, socks, over and under garments.
2. **Soft gear** - all gear such as books, office supplies, daypacks, fannypacks, packing foam or similar material, camera bags, camera/binocular straps, microphone covers, nets, holding or weighing bags, bedding, tents, luggage, or any fabric or material capable of harboring seeds or insects.
3. **New Clothing/Soft Gear** - new retail items, recently purchased and never used.
4. **Refuge Dedicated Clothing/Soft Gear** - items that have ONLY been used at the Refuge, and which have been stored in a quarantined environment between trips to the Refuge.
5. **Sensitive Gear - computers, optical** equipment, and other sensitive equipment.
6. **Non-Sensitive Equipment and Construction Materials** - building materials, power and hand tools, generators, misc. machinery etc.
7. **Suitable Plastic Packing Container -** packing containers must be constructed of smooth, durable plastic which can be easily cleaned and will not harbor seeds or insects. Packing containers may be re-used for multiple trips to the Refuge, but must be thoroughly cleaned before each trip and strictly dedicated to refuge-related projects.
    - Examples of APPROPRIATE plastic packing containers are 5 gallon plastic buckets and plastic totes constructed with a single layer and having a smooth surface. All appropriate packing containers must have tight fitting plastic lids.
    - An example of an INAPPROPRIATE plastic packing container is US mail totes. Mail totes are typically constructed of cardboard-like plastic that provides a porous multi-layered surface, allowing seeds and insects to easily hitch-hike.

C. Special Use Permit (SUP)

All persons requesting use of the Refuge must secure a SUP, as described in Section A above, and agree to comply with all refuge requirements to minimize the risk of alien species introductions.

D. Quarantine Inspections

All personal gear, supplies, equipment, machinery, vehicles (e.g., ATVs, trucks, trailers), and vessels (e.g., planes, boats, ships, barges) will be inspected for quarantine compliance by Service staff prior to entering the Refuge and again before departing the Refuge. A concerted effort will be made to ensure that alien pests are not transported. Service staff on the Refuge will inspect outbound cargo prior to transport.

E. Prohibited Items (Transport of the following items are strictly prohibited)

1. Rooted plants, cuttings, flowers, and seeds (raw or propagative).
2. Soil, sand, gravel, or any other material that may harbor unwanted plant and animal species.
3. Animals (no exceptions).
4. Cardboard (paper and plastic cardboard harbors seeds and insects).

F. Regulated Items (Transport of the following items are strictly regulated)

1. Food items have the potential to carry alien pests and are therefore selected, packed and shipped with great care for consumption on the Refuge. Foods will not be allowed on the Refuge without prior authorization.
2. Because wood products often harbor seeds and insect, only treated wood that has been painted or varnished may be allowed on the Refuge. Approved wood products must also be frozen for 48 hours or fumigated as described in Section K below.

G. Packing Procedures

Ensure that the environment selected for packing has been well cleaned and free of seeds and insects. Keep packing containers closed as much as possible throughout the packing process so insects cannot crawl in before the containers have been securely closed. Quarantine procedures should be performed as close to the transportation date as possible to ensure that pests do not return as hitch-hikers on the packing containers.

H. Packing Containers

1. All supplies and gear must be packed and shipped in SUITABLE PLASTIC PACKING CONTAINERS (see Section A for definitions of packing containers). Packing containers must be constructed of smooth, durable plastic that has been thoroughly cleaned prior to use.
2. Packing containers may be re-used for multiple trips to the Refuge, but must be thoroughly cleaned before each trip and strictly dedicated to refuge-related projects. Cardboard containers are strictly prohibited because they can harbor seeds and insects.

I. Clothing and Soft Gear

1. All persons entering the Refuge must have NEW or REFUGE DEDICATED clothing and soft gear (including all footwear).
   a. Freeze all clothing and soft gear for 48 hours (including both new and refuge dedicated).
   b. Fumigation under a tarp or in a large container is also an option.

J. Sensitive Equipment

All sensitive gear (e.g., optical equipment, computers, satellite phones, other electronic equipment) must be thoroughly inspected and cleaned.

K. Non-Sensitive Equipment and Construction Materials

1. All non-sensitive equipment, machinery, and construction materials that are water resistant must be steam cleaned or pressure washed to ensure the removal of all dirt, insects, and seeds from external surfaces.
2. All non-water resistant items must be tented and fumigated to kill unwanted pests or frozen for 48 hours.
3. Quarantine procedures should be performed as close to the transportation date as possible to ensure that pests do not return to the equipment or packing containers.

L. Aircraft Quarantine

Aircraft personnel will ensure that the plane has been thoroughly cleaned and free of any alien species prior to flying to the Refuge. The aircraft captain will notify the Service at least 10 full working days prior to all flights departing for the Refuge in order to arrange a quarantine inspection of all cargo bound for the Refuge. Inspections will take place the scheduled day of departure.

M. Commercial Ships and Barges, and Private Sailing and Motor Vessel Quarantine

1. Ship owners or captains will notify the Service at least 10 full working days prior to all vessels departing for the Refuge in order to arrange a quarantine inspection of all vessels and cargo bound for the Refuge. The inspection will be scheduled as close to the departure date as possible.
2. Ship owners or captains will ensure that all ships and barges entering the Refuge have had their hulls cleaned of fouling marine/freshwater organisms. The ships and barges must depart for the Refuge within 14 days of having had the hulls cleaned. All ship and barge hulls must be re-cleaned should the vessel return to a port for greater than 14 days before returning to the Refuge. Results of all hull cleanings must be submitted to the Service 2 full working days prior to the vessel departure. Contact the refuge office for additional details.
3. No discharge of ballast water, grey water, sewage, or waste of any kind will be allowed by any vessel within the refuge boundary (e.g., 12-mile territorial sea).

(Date)

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Appendix C. Implementation

C.1 Introduction

Implementation of the comprehensive conservation plan (CCP) will require increased funding, which will be sought from a variety of sources including Congressional allocations and public and private partnerships and grants. There are no guarantees that additional federal funds will be made available to implement any of these projects. Activities and projects identified will be implemented as funds become available.

The CCP identifies several projects to be implemented over the next fifteen years. Some of the projects are included in the Refuge Operational Needs System (RONS - new staff), or Service Asset Maintenance and Management System (SAMMS - deferred maintenance projects) which are used to request funding from Congress. Visitor Facility and Enhancement (VFE) projects considered for funding must be requested through the Division of Visitor Services. Currently, a backlog of maintenance needs exists for Bandon Marsh Refuge. Prioritized staffing needs identified in the RONS will be necessary to implement the CCP to meet refuge goals and objectives and legal mandates. The SAMMS database documents and tracks repairs, replacements, and maintenance of facilities and equipment. Smaller projects will be implemented as funding allows, and funding will be sought for these projects through a variety of sources.

Annual Refuge Revenue Sharing payments, associated with Bandon Marsh NWR in Coos County, will continue. USFWS paid the Coos County $18,890 in 2010 for 908 acres of refuge lands within Coos County, including Bandon Marsh NWR and the Coquille Point Unit of Oregon Islands NWR.

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. General monitoring activities are discussed in Chapter 2 under Goal 5, which addresses the collection of scientific information (inventories, monitoring, feasibility studies, assessments, and research) to support adaptive management decisions on Bandon Marsh NWR.

C.2 Step-down Plans

The Comprehensive Conservation Plan is one of several necessary plans used by managers, biologists, and staff for refuge management. The CCP provides guidance in the form of goals, objectives, and strategies for several refuge program areas but may lack some of the specifics needed for implementation. Step-down management plans will be developed for individual program areas within approximately 5 years after CCP completion. All step-down plans require appropriate NEPA compliance and implementation may require additional county, state, and federal permits. Project-specific plans, with appropriate NEPA compliance, may be prepared outside of these step-down plans. Step-down plans for the Refuge follow in Table C-1.

Table C-1. Bandon Marsh NWR Step-down Management Plans

Step-down Management Plan	Status (date completed and/or date to be prepared/updated)
Habitat Management Plan (HMP)	CCP meets requirement for HMP
Waterfowl Hunt Plan	Initiate planning after completion of CCP
Fishing Plan	Initiate planning after completion of CCP
Integrated Pest Management Plan	Prepared concurrently with CCP, Appendix G
Fire Management Plan	Updated 2012
Visitor Services Plan	Initiate planning after completion of CCP
Inventory and Monitoring Plan	Initiate planning after completion of CCP

C.3 Costs to Implement CCP

The following sections detail both one-time and recurring costs for various projects as described within the CCP. One-time costs reflect the initial costs associated with a project, whether it is purchase of equipment, contracting services, construction, a research project, or other activity. Recurring costs reflect the future operational and maintenance costs associated with the project. The following tables primarily document projects with a physically visible, trackable "on-the-ground" component, such as visitor and administrative facilities, habitat restoration, research, and monitoring and surveys. The scope and costs for "administrative" activities such as the development and implementation of cooperative documents (e.g., memorandum of understanding, agreements), reporting, and establishment of partnerships are difficult to estimate in advance and thus are not accounted for in the tables below.

C.3.1 One-time Costs

One-time costs are project costs that have a start-up cost associated with them, such as purchasing equipment necessary for wildlife and habitat monitoring, or designing, constructing and installing an interpretive sign. Some cost estimates are for projects that can be completed in three years or less. One-time costs can include the cost of temporary or term salary associated with a short-term project. Salary for existing and 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, and grants. Projects listed below in Table C-2 show one-time start-up and implementation costs, such as those associated with building and facility needs including replacement of buildings, public use facilities, road/trail improvements, and new signs. One-time costs in Table C-2 are also associated with projects such as habitat restoration, invasive plant and animal control, and research. In many cases, new research projects, because of their relatively high initial establishment cost, are considered one-time projects and include costs of contracting services or hiring a temporary staff position for the short-term project. Some project costs are estimated from past projects; 2011 RONS or SAMMS proposals; others are not yet in any project database and their costs have been estimated, particularly if the scope of the project is unknown at this time due to lack of baseline data. Estimates of costs for Visitor Facility projects not yet in a database but have been calculated by the Portland Regional Office's Engineering Division.

Table C-2. One Time Costs (in thousands) for Research and Assessments; Inventories, Surveys, and Monitoring, Habitat Management and Restoration, Facilities and Public Use-Related Actions

Project Description	Type	Current Management	Future Management	Potential Fund Source
Research				
Research disturbance of nesting birds to document disturbance type, impacts, and other parameters	Study	7	10	1260 funds, grants
Research predator-prey relationships to document specific parameters and effects to populations	Study	7	10	1260 funds, grants
Conduct research on salt marshes to determine accretion and subsidence rates	Study	7	10	1260 funds, grants
Conduct research on the potential effects of climate change and sea level rise on salt marshes	Study	8	11	1260 funds, grants, partnerships
Subtotal (thousands)		**29**	**41**	
Surveys and Assessments				
Conduct long-term hydrological, biological, and physical monitoring to determine effectiveness of salt marsh restoration projects	Project	59	91	1260 funds
Conduct forest assessments to determine condition and needs for active management	Project	0	8	1260 funds
Monitor water quality returning to river and bay to determine pollution levels	Project	0	8	1260 funds
Conduct baseline vegetation surveys and monitoring	Survey	49	91	1260 funds, Partnerships
Monitor sedimentation rates and vegetation response within the bay or salt marsh	Survey	0	8	1260 funds, Partnerships
Monitor hydrological flows and tidal elevations/cycles to understand hydrological influence and parameters	Project	0	10	1260 funds, Partnerships
Conduct water resource assessment and hydrological assessment	Project	5	8	1260, RO WRD
Conduct baseline assessment of water chemistry and monitor changes over time	Project	5	8	1260, RO WRD
Subtotal (thousands)		**118**	**232**	
Habitat Management and Restoration				
Restore Sitka spruce/western hemlock forest	Project	0	30	1260 funds
Develop step-down forest management plan	Project	0	8	1260 funds
Outplant rare, native species (Henderson's checkermallow)	Project	0	3	1260 funds
Install and maintain woody debris, spawning gravel, and stream side vegetative cover to enhance salmonid habitat	Project	6	6	1260 funds
Subtotal (thousands)		**6**	**47**	
Facilities				
Replace current office with a small office/visitor contact station	Project	0	1,800	1260 funds (DM)

Table C-2. One Time Costs (in thousands) for Research and Assessments; Inventories, Surveys, and Monitoring, Habitat Management and Restoration, Facilities and Public Use-Related Actions

Project Description	Type	Current Management	Future Management	Potential Fund Source
Build a 15-space parking lot to accommodate staff and visitors	Project	0	53	1260 funds (DM)
Add two additional RV sites for volunteers on Smith Tract	Project	0	15	1260 funds (DM)
Remodel existing maintenance shop on Smith Tract to include office for Friends Group	Project	0	0	1260 funds (DM)
Replace current residence on Smith Tract with small bunkhouse/office for Friends Group and locate on higher ground	Project	0	300	1250 funds, DM
Subtotal (thousands)		**0**	**2,168**	
Public Use				
Develop a bird checklist	Project	0	4	1260 funds
Construct a loop trail that connects the Ni-les'tun parking lot with Fahys Creek and the uplands behind the refuge office. Includes elevated boardwalk/viewing blind at Ni-les'tun Unit.	Project	0	700	1260 funds, VFE
Develop additional interpretive panels for the marsh/forest boardwalk trail	Project	0	12	1260 funds, grants
Develop informational tear sheet on waterfowl hunting regulations	Project	0	4	1260 funds
Develop and post a boat parking area along the Coquille River bank	Project	0	5	1260 funds
Develop a small graveled parking area adjacent to North Bank Lane near the western edge of the Ni-les'tun Unit, at the NE corner of the Coquille River RV Park. Includes minor roadway marking for safe access.	Project	0	93	1260 funds, Refuge Roads funding
Subtotal (thousands)		**0**	**818**	
Total of all one time project costs		**153**	**3,306**	

C.3.2 Annual Operational (recurring) Costs

Operational 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 code 1260.

Table C-3 displays projected annual operating costs to implement strategies under the CCP. The CCP will require increased funding for new or expanded public uses and facilities, habitat management and restoration activities, and new monitoring needs. This table includes such things as salary and operational expenditures such as travel, training, supplies, utilities, and maintenance costs. Project costs listed in Table C-3 include administrative support for all programs and projects as well as permanent and seasonal staff needed year after year to accomplish each project; these staffing costs are not isolated in this table but are included as part of the entire project cost.

Table C-3. Annual Operational (recurring) Costs

Activity Description	Current Management Cost Est. (K)	Future Management Cost Est. (K)	Potential Fund Source
Research: Facilitate and cooperate in specific research projects to benefit refuge resources	8	25	1260, Special Projects, Grants
Surveys and assessments: Aerial, boat-based and land survey and assessments; continue GIS-based inventory and monitoring programs for plants and wildlife; invasive species monitoring; monitor biodiversity trends; provide administrative and material support for all biological activities.	68	133	1260 and special project funds
Habitat management and restoration: inventory, remove, control and prevent new establishment of invasive plants and treat infestations with IPM.	39	85	1260 and special project funds
Facilities maintenance: Maintain and make minor repairs on refuge infrastructure and facilities, equipment, vehicles, boats and interpretive and regulatory signs.	93	117	1260, SAMMS (DM)
Public use opportunities and education: Provide funding for and manage a variety of both on-refuge and off-refuge interpretive and education programs; maintain interpretive panels located on and off refuge to offer interpretation through self-guided experience; conduct and manage volunteer program; patrol, enforce regulations and educate visitors to the sensitivity of wildlife resources, replace boundary and regulatory signage as needed.	90	164	1260, VFE funds
Total Recurring Costs	**298**	**524**	

C.3.3 Maintenance Costs

The refuge maintenance program funding need over the next 15 years is defined as funds needed to repair or replace buildings, equipment, and facilities. Maintenance actions include 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. Maintenance costs include the maintenance “backlog” needs that have come due but are as yet unfunded, as well as the increased maintenance need associated with new facilities.

The facilities associated with Bandon Marsh NWR that require maintenance include trails, kiosks, interpretive panels, regulatory signs, roads, parking lots, fencing, and administrative office, shop and garage buildings. Major equipment includes boats, vehicles, heavy equipment, and ATVs. Operational (non-project) maintenance funding for the Oregon Coast NWR Complex is expended on all six Complex refuges including Bandon Marsh NWR and varies significantly by year. Operational funding is determined by station, regional office, and Washington office priorities and allocations.

C.3.4 Staffing

Current (2012) staffing and future staffing to implement the programs detailed within the CCP are shown in Table C-4. Current positions described below serve all six refuges within the Oregon Coast NWR Complex. There is no separate budget for the individual refuges such as Bandon Marsh NWR, thus the staffing costs presented include the entire Complex staff in Table C-4. Although three positions, two permanent full time (PFT) and one term full time (TFT) are currently stationed at the Bandon Marsh NWR office, the Complex and Bandon Marsh staff positions expend varying amounts of time on the Refuge and the remainder of Complex staff time is expended on the other five refuges in the Complex. The future Environmental Education/Outreach Specialist and Volunteer Coordinator will work part of the time on Bandon Marsh NWR and the rest of the time on the other refuges in the Complex. The South Coast Biologist and South Coast Wildlife Refuge Officer will work part of the time on Bandon Marsh NWR and the remainder of the time on the southern half of Oregon Islands NWR. The North Coast Manager will not expend time on Bandon Marsh NWR.

Table C-4. Current and Future Staffing

Current Position	Status	GS & Grade	Annual Salary* Cost (K) (FY12 $$)	% Expended on Bandon Marsh NWR	Annual Salary* (K) Expended on Bandon Marsh NWR
Project Leader	PFT	GS-0485-13	126.1	20	25.2
Deputy Project Leader	PFT	GS-0485-12	113.0	10	11.3
Wildlife Biologist	PFT	GS-0486-11	93.1	10	9.3
Administrative Officer	PFT	GS-0341-09	82.9	25	20.7
Visitor Services Manager	PFT	GS-0025-11	88.9	20	17.8
Wildlife Refuge Law Enforcement Officer	PFT	GL-1801-09	79.2	25	19.8
Facilities Operations Specialist	PFT	GS-1640-09	76.9	-	0
Office Automation Clerk	TPT	GS-0326-04	8.8	10	0.8
South Coast Refuge Manager	PFT	GS-0485-12	117.3	40	46.9
Restoration Biologist	TFT	GS-0401-11	84.3	40	33.7
Maintenance Worker	PFT	WG-4749-08	65.0	50	32.5
Total salary currently expended on Bandon Marsh NWR					**218**
Future Position	**Status**	**GS & Grade**	**Annual Salary* Cost (K) (FY12 $$)**	**% Planned for Bandon Marsh NWR**	**Annual Salary* (K) Planned for Bandon Marsh NWR**
Environmental Education Specialist	PFT	GS-1001-07	49.3	20	9.9

Table C-4. Current and Future Staffing

Wildlife Refuge LE Officer	PFT	GL-1801-09	79.2	20	15.8
Volunteer Coordinator/ Interpreter	PFT	GS-0025-07	49.3	30	14.8
South Coast Wildlife Biologist	PFT	GS-0486-09	60.3	50	30.1
North Coast Refuge Manager	PFT	GS-0485-11	80	0	0
Complex Wildlife Biologist	PFT	GS-0486-09	60.3	10	6
Total current and future staffing costs for Bandon Marsh NWR					**294.6**

* = salary and benefits
PFT: Permanent Full Time, TFT = Term Full Time, TPT = Temporary Part Time
GS: General Schedule Federal Employee, WG: Wage Grade Federal Employee, GL: Law Enforcement Officers (LEOs)

C.3.5 Budget Summary

Table C-5 summarizes the data from Tables C-2 and C-3 and displays the overall funding needed for the Oregon Coast National Wildlife Refuge Complex to implement the CCP for Bandon Marsh NWR.

Table C-5. Budget Summary (one-time projects and annual funding needs for Bandon Marsh NWR as identified in the CCP)

Budget Category	Current Management		Future Management	
	One-time Cost (K)	Annual Recurring Cost (K)	One-time Cost (K)	Annual Recurring Cost (K)
Research	29	8	41	25
Surveys and assessments	118	68	232	133
Habitat management and restoration	6	39	47	85
Facilities and maintenance	0	93	2,168	117
Public use, education and law enforcement	0	90	818	164
Totals	**153**	**298**	**3,306**	**524**

C.4 Partnership Opportunities

Partnerships are an important component of the implementation of this CCP and are reflected in the goals, objectives, and strategies identified in Chapter 2. Bandon Marsh NWR's location adjacent to a popular tourist destination and retirement community (City of Bandon) along the Oregon coast facilitates many opportunities for partnerships. Current and past partners include federal and state agencies, the Coquille Indian Tribe, nonprofit and non-governmental organizations, school volunteers, and individuals.

The Oregon Coast NWR Complex already enjoys significant positive relationships with numerous partners including state and federal agencies, Tribes, volunteers, Friends Groups, schools, conservation organizations, municipalities, and individuals. Refuge Complex staff will work to strengthen existing partnerships and will actively look for new partnerships to assist in achieving the goals, objectives, and strategies set forth in this CCP.

Coquille Indian Tribe

The Refuge has a close working relationship with the Coquille Indian Tribe that is based in North Bend, Oregon. The Tribe and the Refuge have collaborated on a number of projects particularly the Ni-les'tun Tidal Marsh Restoration, which involved cooperating on cultural resource investigations, fisheries habitat restoration and monitoring, design of the restoration, and public outreach. The Refuge will continue to partner with the Coquille Indian Tribe to manage fisheries and create interpretive panels that focus on the Refuge and area Native American culture. In addition the Service will continue to partner with the Tribe on cultural resources inventory, evaluation, and project monitoring, consistent with the regulations of the National Historic Preservation Act.

Friends of Southern Oregon Refuges/Shoreline Education for Awareness

Shoreline Education for Awareness (SEA) was founded in Bandon, Oregon, in 1990, and it has been an all-volunteer organization supported by membership dues and donations received while interpreting the marine environment for visitors. In 2005, SEA entered into a Memorandum of Understanding with the Refuge Complex to make the organization an official refuge friends group known as the Friends of the Southern Oregon Coast Refuges/SEA. This Friends Group plays a critical role in training and recruiting seasonal volunteer wildlife interpreters to serve the public at a variety of locations on the south coast of Oregon. SEA is also an active advocate for protecting refuge wildlife and habitat.

Oregon Department of Fish and Wildlife (ODFW)

The ODFW's management responsibilities along the coast, including lands and waters, fish and wildlife, threatened and endangered species, and other wildlife and habitat programs which frequently overlap with Service resources and responsibilities. ODFW and the Refuge Complex share mutual interests in wildlife surveys, developing joint research projects, education and outreach programs, species management and dissemination of data, results, and information to a wider audience. ODFW has been closely involved with Refuge Complex staff in fisheries habitat surveys and restoration, waterfowl surveys, predator management, and restoration project permits. Increased cooperation between ODFW and the Refuge Complex will assist both agencies in meeting their missions and mandates, and provide a more systematic and accessible process for sharing information, expertise and funding.

Oregon Parks and Recreation Department (OPRD)

The OPRD manages Oregon beaches, numerous coastal State Parks, and State Scenic Viewpoints along the Oregon coast. Bullards Beach State Park is immediately adjacent to Bandon Marsh NWR. The OPRD's management responsibilities, including lands, facilities, and interpretive and educational programs, frequently overlap with Refuge Complex goals and responsibilities for public outreach and education. The Refuge Complex works closely with OPRD to maintain visitor use facilities, develop new facilities, collaborate on interpretive panel messages, develop joint educational and interpretive programs, and utilize shared volunteers.

Law Enforcement Entities

The Refuge Complex has only one full time Law Enforcement Officer, and enforcement coverage on Bandon Marsh NWR as well as all the other five refuges will continue to rely on coordination with city police, county sheriff departments, Oregon State Police, and federal officers from USCG, NMFS, USFWS and BLM. Specific LE tasks include: (1) Clarifying jurisdictions of Service and all other enforcement agencies regarding refuge regulations, determine the extent of proprietary state law authority on Federal lands, and enable joint enforcement of wildlife protection and refuge trespass laws and regulations; and (2) Developing LE assistance agreements with OSP; county sheriffs and associated Marine Patrol officers; city police departments in cities where refuge lands are located; USCG; and NOAA for enforcement of wildlife and refuge regulations including joint enforcement of Marine Mammal Protection Act regulations.

Volunteers

Volunteers are an important component at Bandon Marsh NWR to complete biological and maintenance duties. The Refuge actively recruits and enlists volunteers from the local, regional, and national areas to assist the Refuge with a variety of tasks from removal of invasive species to highly technical work of videography. Each spring and summer, the Refuge Complex and state and federal partners station volunteer wildlife interpreters on mainland sites overlooking Oregon Islands NWR and to assist with interpretation of wildlife resources at Bandon Marsh NWR. Volunteer wildlife interpreters are on duty a minimum of four days per week to orient visitors, make them aware of the wildlife resources in coastal Oregon, and educate them as to how they can help reduce negative wildlife/human interactions. Having volunteers interact with visitors has been well-received by the visitors, staff from OPRD, and Refuge Friends Groups. Volunteers are extremely important in helping reduce wildlife disturbance, educating the public, and disseminating information on the mission of the National Wildlife Refuge System.

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Appendix D. Wilderness Review

D.1 Introduction

D.1.1 Refuge Overview

The loss of tidal wetlands, through agricultural dike construction and subsequent draining, has been identified as a major factor contributing to the decline of fishery resources and overall estuarine productivity throughout coastal Oregon. The Coquille River estuary is one of the most extensively diked and drained estuaries of the Oregon coast, suffering a 94% loss in tidal marshes and swamps from 1870 to 1970 (Good 2000). Revised estimates by Brophy (2011) using Scranton (2004) and Hawes et al. (2008) indicate a 95% loss of tidal marsh and 93% loss of tidal swamp within the estuary. Bandon Marsh National Wildlife Refuge (Refuge or NWR), the Bandon Marsh Unit, was established in 1983 to conserve the last substantial tract of salt marsh in the Coquille River estuary and to protect the physical and biological integrity of that tidal salt marsh (USFWS 1981). In 2000, the Ni-les'tun Unit was established to protect and restore intertidal marsh, freshwater marsh, and riparian areas to provide a diversity of habitats for migratory birds including waterfowl, shorebirds, wading birds and songbirds, and to restore intertidal marsh habitat for anadromous fish such as Chinook and chum salmon, steelhead, cutthroat trout, and the threatened coho salmon (USFWS 1999). Currently, the total land base of Bandon Marsh NWR is 889 acres. The total approved refuge boundary includes 1,000 acres.

D.1.2 Policy and Direction for Wilderness Reviews

U.S. Fish and Wildlife Service policy (Part 602 FW 3.4 C. (1) (c)) requires that wilderness reviews be completed as part of the CCP process. This review includes the re-evaluation of refuge lands existing during the initial 10-year review period of The Wilderness Act of 1964, as amended (16 U.S.C. 1131-1136), as well as new lands and waters added to the Refuge System since 1974. A preliminary inventory of the wilderness resources is to be conducted during pre-acquisition planning for new or expanded refuges (341 FW 2.4 B, "Land Acquisition Planning"). Refuge System policy on Wilderness Stewardship (610 FW 1-5) includes guidance for conducting wilderness reviews (610 FW 4 – Wilderness Review and Evaluation).

A wilderness review is the process of determining whether the Service should recommend Refuge System lands and waters to Congress for wilderness designation. The wilderness review process consists of three phases: wilderness inventory, wilderness study, and wilderness recommendation.

Wilderness Inventory

The inventory is a broad look at a refuge to identify lands and waters that meet the minimum criteria for wilderness—size, naturalness, and outstanding opportunities for solitude or primitive and unconfined type of recreation. All areas meeting the criteria are preliminarily classified as Wilderness Study Areas (WSAs). If WSAs are identified, the review proceeds to the study phase.

Wilderness Study

During the study phase, WSAs are further analyzed:

1. for all values of ecological, recreational, cultural, economic, symbolic
2. for all resources, including wildlife, vegetation, water, minerals, soils
3. for existing and proposed public uses
4. for existing and proposed refuge management activities within the area,
5. to assess the refuge's ability to manage and maintain the wilderness character in perpetuity, given the current and proposed management activities. Factors for evaluation may include, but are not limited to, staffing and funding capabilities, increasing development and urbanization, public uses, and safety.

We evaluate at least an "All Wilderness Alternative" and a "No Wilderness Alternative" for each WSA to compare the benefits and impacts of managing the area as wilderness as opposed to managing the area under an alternate set of goals, objectives, and strategies that do not involve wilderness designation. We may also develop "Partial Wilderness Alternatives" that evaluate the benefits and impacts of managing portions of a WSA as wilderness.

In the alternatives, we evaluate:

1. the benefits and impacts to wilderness values and other resources
2. how each alternative would achieve the purposes of the Wilderness Act and the National Wilderness Preservation System
3. how each alternative would affect achievement of refuge purpose(s) and the Refuge's contribution toward achieving the Refuge System mission
4. how each alternative would affect maintaining and, where appropriate, restoring biological integrity, diversity, and environmental health at various landscape scales
5. other legal and policy mandates
6. whether a WSA can be effectively managed as wilderness by considering the effects of existing private rights, land status and service jurisdiction, refuge management activities and refuge uses, and the need for or possibility of eliminating Section 4(c) prohibited uses

Wilderness Recommendation

If the wilderness study demonstrates that a WSA meets the requirements for inclusion in the National Wilderness Preservation System, a wilderness study report should be written that presents the results of the wilderness review, accompanied by a Legislative Environmental Impact Statement (LEIS). The wilderness study report and LEIS that support wilderness designation are then transmitted through the Secretary of the Interior to the President of United States, and ultimately to the United States Congress for action. Refuge lands recommended for wilderness consideration by the wilderness study report would retain their WSA status and be managed as "wilderness according to the management direction in the final CCP until Congress makes a decision on the area or we amended the CCP to modify or remove the wilderness recommendation" (610 FW 4.22B). When a WSA is revised or eliminated, or when there is a revision in "wilderness stewardship direction, we include appropriate interagency and tribal coordination, public involvement, and documentation of compliance with NEPA" (610 FW 3.13).

D.1.3 Criteria for Evaluating Lands for Possible 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 as 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 outlined in Section 2(c) of the Act and are further expanded upon in Refuge System policy (610 FW 4). The first three criteria are evaluated during the inventory phase; the fourth criterion is evaluated during the study phase.

1. Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
2. Has outstanding opportunities for solitude or a primitive and unconfined type of recreation;
3. Has at least five thousand acres of land or is of a sufficient size as to make practicable its preservation and use in an unimpaired condition; and
4. May also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Criterion 3 is further defined in Section 3(c) of the Act as 1) a roadless area of 5,000 contiguous acres or more, or 2) a roadless island. Roadless is defined as the absence of improved roads suitable and maintained for public travel by means of 4-wheeled, motorized vehicles that are intended for highway use.

D.1.3 Relationship to Previous Wilderness Reviews

No previous wilderness reviews have been prepared for Bandon Marsh NWR.

D.2 Wilderness Inventory

The following constitutes the inventory phase of the wilderness review for the Bandon Marsh National Wildlife Refuge.

D.2.1 Lands Considered under This Wilderness Review

All FWS-owned lands and waters (in fee title) within the Bandon Marsh NWR boundary were considered during this wilderness review.

D.2.2 Inventory Units

The first step of a wilderness assessment is to divide a refuge or other management entity into preliminary wilderness evaluation units. The boundaries of these artificial units can follow the refuge boundary, but may not cross permanent roadways, private or other non-Federal lands, or non-Service owned waterways. These roads, non-Federal lands, or waterways can form the boundary for an individual evaluation unit. Other obvious incompatible wilderness uses or structures (such as refuge headquarters, residential areas, rights-of-way, and non-jurisdictional waters) may also be eliminated from any evaluation units at this time. Once boundaries have been established for each individual evaluation unit, the criteria in Sections D.2.3 are applied to determine each unit's suitability as potential wilderness and the need for further evaluation under the Wilderness Study.

In determining units to be evaluated for wilderness character per this inventory, the Refuge was mapped using geographic information system (GIS) software. Using the major constraints set by the Wilderness Act, specifically land ownership/refuge boundary and permanent road systems, initial large evaluation units were developed by including all contiguous lands within those intractable confines. Through this process, two units – the Bandon Marsh and Ni-les'tun Units – were defined for evaluation:

The 307-acre **Bandon Marsh Unit** is located near the mouth of the Coquille River with approximately 25% of the Unit within the city limits of Bandon. The Unit is bordered on the north and west sides by the Coquille River, on the south by privately owned salt marsh and mudflats, and on the east by privately owned forested lands and Riverside Drive. Habitats within the Unit include salt marsh and mudflats, a narrow fringe of forested wetlands and upland forest along its east (landward) boundary, and a high marsh natural levee along its west and north boundary with the Coquille River. The intertidal marsh ranges from low marsh and mudflats exposed only at low tide, to high marsh inundated only at seasonally high tides combined with high river flows. Two freshwater streams enter the marsh from the east, but the hydrology is dominated by the ocean tides and the tidally influenced Coquille River that enter the marsh via a network of tidal channels.

The **Ni-les'tun Unit** is 582 acres and consists largely of recently restored salt marsh and mudflats, small acreages of forested wetlands, riparian corridors, upland forest, and former spruce forest that was converted to upland pasture. The Ni-les'tun Unit's tidal marsh restoration project, completed in summer 2011, restored 418 acres of historic tidal wetlands within the lower Coquille River estuary and is the largest tidal wetlands restoration project ever accomplished in Oregon. This historic salt marsh area had been diked and drained and converted to pastures. Until completion of restoration activities in August of 2011, this site had not experienced natural tidal flooding events for approximately 100 years. Most of the artificial features of the pastures, including drainage ditches, dikes, and tidegates, were removed during the restoration project, allowing natural tidal exchange to take place once again. The influx of varying levels of tidally driven brackish riverine water will allow re-establishment of mudflats and salt marsh plants, and development of sinuous interconnecting tidal channels providing fish and wildlife habitat within the refuge unit. As the land and ecological processes return to a functioning intertidal marsh, flocks of resident and migratory birds, and young fish will use the restored habitat. The restoration represents a significant increase in habitat available to native salmonids, migratory birds and other wildlife in the lower Coquille River estuary.

D.2.3 Process of Analysis

The following evaluation process was used in identifying the suitability of refuge units for wilderness designation:

- Determination of refuge unit sizes.
- Assessment of the units' capacity to provide opportunities for solitude or primitive and unconfined recreation.
- Assessment of "naturalness" of refuge units.

General guidelines used for evaluating areas for wilderness potential during this wilderness inventory process include:

1. The area should provide a variety of habitat types and associated abiotic features, as well as a nearly complete complement of native plants and wildlife indicative of those habitat types. Non-native and invasive species should comprise a negligible portion of the landscape.
2. The area should be spatially complex (vertically and/or horizontally) and exhibit all levels of vegetation structure typical of the habitat type, have an interspersion of these habitats, and provide avenues for plant and wildlife dispersal.
3. The area should retain the basic natural functions that define and shape the associated habitats, including but not limited to, flooding regimes, fire cycles, unaltered hydrology and flowage regimes, basic predator-prey relationships including herbivory patterns.
4. Due to their size, islands may not meet the habitat guidelines in 1 and 2 above. Islands should, however, exhibit the natural cover type with which they evolved and they should continue to be shaped and modified by natural processes. Islands should be further analyzed during the study portion of the review if they provide habitat for a significant portion of a population, or key life cycle requirements for any resources of concern or listed species.
5. Potential wilderness areas should be relatively free of permanent structures or man-made alterations. Areas may be elevated to the study phase if existing structures or alterations can be removed or remediated within a reasonable timeframe, and prior to wilderness recommendation to the Secretary of the Interior.

Supplemental Values–the Wilderness Act states that an area of wilderness may contain ecological, geological, or other features of scientific, educational, scenic, or historical value. Supplemental values of the area are optional, but the degree to which their presence enhances the area's suitability for wilderness designation should be considered. The evaluation should be based on an assessment of the estimated abundance or importance of each of the features.

More detail on the factors considered and used for each assessment step follows.

Unit Size: Roadless areas meet the size criteria if any one of the following standards apply:

- An area with over 5,000 contiguous acres solely in Service ownership.
- 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.

Outstanding Solitude or Primitive or Unconfined Recreation:

A designated wilderness area must provide outstanding opportunities for solitude or a primitive and unconfined type of recreation. Possession of only one of these outstanding opportunities is sufficient for an area to qualify as wilderness, and it is not necessary for one of these outstanding opportunities to be available on every acre. Furthermore, an area does not have to be open to public use and access to qualify under these criteria.

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. Primitive recreation activities may provide opportunities to experience challenge and risk, self-reliance, and adventure.

Naturalness and Wildness: the area generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.

This criterion must be evaluated in the context of current natural conditions and societal values and expectations without compromising the original intent of the Wilderness Act. It is well recognized that there are few areas remaining on the planet that could be truly classified as primeval or pristine, with even fewer, if any, existing in the conterminous United States. Likewise, few areas exist that do not exhibit some impact from anthropogenic influences, be it noise, light, or air pollution; water quality or hydrological manipulations; past and current land management practices; roads or trails, suppression of wildfires; invasions by non-native species of plants and animals; or public uses. While allowing for the near-complete pervasiveness of modern society on the landscape, the spirit of the Wilderness Act is to protect lands that still retain the wilderness qualities of being: 1) natural, 2) untrammeled, 3) undeveloped. These three qualities are cornerstones of wilderness character. For areas proposed or designated as wilderness, wilderness character must be monitored to determine baseline conditions and thereafter be periodically monitored to assess the condition of these wilderness qualities. Proposed and designated wilderness areas by law and policy are required to maintain wilderness character through management and/or restoration in perpetuity.

Defining the first two qualities (natural and untrammeled) requires knowledge and understanding of the ecological systems which are being evaluated as potential wilderness. Ecological systems are comprised of three primary attributes—composition, structure, and function. Composition is the components that make up an ecosystem, such as the habitat types, native species of plants and animals, and abiotic (physical and chemical) features. These contribute to the diversity of the area. Structure is the spatial arrangement of the components that contribute to the complexity of the area. Composition and structure are evaluated to determine the naturalness of the area. Function is the processes that result from the interaction of the various components both temporally and spatially, and the disturbance processes that shape the landscape. These processes include, but are not limited to, predator-prey relationships, insect and disease outbreaks, nutrient and water cycles, decomposition, fire, windstorms, flooding, and both general and cyclic weather patterns. Ecological functions are evaluated to determine the wildness or untrammeled quality of the area.

The third quality assessment is whether an area is undeveloped. Undeveloped refers to the absence of permanent structures such as roads, buildings, dams, fences, and other man-made alterations to the landscape. Exceptions can be made for historic structures or structures required for safety or health considerations, providing they are made of natural materials and relatively unobtrusive on the landscape.

D.2.4 Summary of Inventory Results and Conclusion

Table D-1 summarizes the above evaluation factors for each of the units that were delineated and evaluated as described in Sections D.1.1 and D.2.3.

In this inventory, neither the 307-acre Bandon Marsh Unit nor the 582-acre Ni-les'tun Unit were found to meet the minimum wilderness criteria for size, outstanding opportunities for solitude and primitive/unconfined recreation, or naturalness. While the Refuge contains excellent examples of once-common but now rare habitat types, the small acreage, discontinuous refuge lands, and the presence of heavily used roads adjacent to the Refuge results in a determination that Bandon Marsh National Wildlife Refuge does not satisfy minimum wilderness suitability criteria.

Table D-1. Results of Wilderness Inventory for Bandon Marsh NWR

Refuge Unit	Size	Outstanding Opportunities for Solitude or Primitive/unconfined Recreation	Naturalness	Summary: Area Will Move Forward for Wilderness Study
Bandon Marsh Unit	No	NE	NE	No
Ni-les'tun Unit	No	NE	NE	No

Notes:
NE – Not evaluated (once any wilderness criteria was not met, further evaluation was not conducted.)

D.3 References

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Appendix E. Biological Resources of Concern

E.1 Introduction

Management direction of individual refuges is driven by refuge purposes and statutory mandates, coupled with species and habitat priorities. Management on a refuge should first and foremost address the individual refuge purposes. Additionally, management should address maintenance and, where appropriate, restoration of biological integrity, diversity, and environmental health as well as management for NWRS Resources of Concern. In this approach, a refuge contributes to the goals of the NWRS (601 FW 1) and achievement of the NWRS Mission.

In concert with this approach, and as an initial step in planning, the planning team identified resources of concern for Bandon Marsh National Wildlife Refuge (NWR or Refuge). As defined in the Policy on Habitat Management Plans (620 FW 1), resources of concern are:

> "all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, State, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW 1.4G)."

To provide a framework for development of goals and objectives in the CCP, the planning team identified resources of concern, following the process outlined in the handbook Identifying Refuge Resources of Concern and Management Priorities: A Handbook (USFWS 2008b).

E.2 Comprehensive Resources of Concern

A comprehensive list of potential resources of concern was created early in the planning process. The team identified species, species groups, and communities of concern, based upon a review of the Refuge's establishing history and purposes, a description of the key habitat types existing at the Refuge and a review of numerous conservation plans (see Section 1.7 of the CCP), many of which highlight priority species or habitats for conservation. The Comprehensive Resources of Concern list is contained in Table E-1.

Table E-1. Bandon Marsh National Wildlife Refuge Table of Comprehensive Resources of Concern

Species/Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Habitat															
Diverse coastal wetlands (tidal salt marsh) and upland buffers	X	X											X		
Freshwater Wetlands	X	X											X		
Temperate Pacific Tidal Salt and Brackish Marsh	X	X											X		
Temperate Pacific Freshwater Emergent Marsh	X	X											X		
Temperate Pacific Intertidal Mudflat		X											X		
North Pacific Intertidal Freshwater Wetland		X											X		
North Pacific Hypermaritime Sitka Spruce Forest		X													
North Pacific Wet-Mesic Douglas-fir-Western Hemlock Forest		X													
North Pacific Lowland Riparian Forest and Shrubland		X													
Developed Low Intensity		X													
Water		X													
Birds															
Migratory waterfowl	X														
Shorebirds	X				X	X	X	X							
Raptors	X				X	X	X	X	X						
Neotropical songbirds	X				X	X	X	X	X						

Table E-1. Bandon Marsh National Wildlife Refuge Table of Comprehensive Resources of Concern

Species/Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Greater white-fronted goose								GBBDC					X		
Black brant										X			X		
Aleutian Canada goose	X		DL	DL						X			X		S2
Western Canada goose													X		
Tundra swan													X		
Wood duck								GBBDC							
Gadwall													X		
American wigeon								GBBDC					X		
Mallard								GBBDC					X		
Blue-winged teal													X		
Cinnamon teal													X		
Northern shoveler													X		
Northern pintail								GBBDC					X		
Green-winged teal													X		
Canvasback													X		
Redhead								GBBDC					X		
Ring-necked duck								GBBDC							S3
Greater scaup								GBBDC					X		
Lesser scaup								GBBDC					X		S3
Harlequin duck								GBBDC							S2
Bufflehead															S2
Barrow’s goldeneye															S3
Common loon								X							SH
Pied-billed grebe												H			
Horned grebe												H			S2
Western grebe					X										S2
California brown pelican			DL	LE				T/E		X					S2
Brandt’s cormorant												H			
Pelagic cormorant					X							H			
American bittern								X				H			
American bald eagle			DL	DL	X	X	X	T/E	X	X					

Table E-1. Bandon Marsh National Wildlife Refuge Table of Comprehensive Resources of Concern

Species/Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Northern harrier								BCC/N							S3
American peregrine falcon			DL	DL	X	X	X	BCC/N		X					S2
Sora												H			
Black-bellied plover											4				
Western snowy plover			LT	LT		X	X	T/E		X	5				S2
Semipalmated plover											3				
Killdeer											4				
Spotted sandpiper											3				
Greater yellowlegs											4				
Willet											2				
Lesser yellowlegs					X		X				2				
Whimbrel					X	X	X	BCC/N			4				
Marbled godwit					X	X	X	BCC/N			4				
Black turnstone								BCC/N			4				
Sanderling											4				
Western sandpiper											4				
Least sandpiper											3				
Dunlin							X				4				
Short-billed dowitcher					X	X	X	BCC/N			4				
Long-billed dowitcher											3				
Common snipe											4				
Red-necked phalarope											4				
Red phalarope											4				
Glaucous-winged gull															S2
Caspian tern					X			BCC/BCR		X					
Band-tailed pigeon			SOC	NSS				GBBDC	X	X					S3
Mourning dove								GBBDC							
Northern pygmy-owl									X						

Table E-1. Bandon Marsh National Wildlife Refuge Table of Comprehensive Resources of Concern

Species/Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Northern saw-whet owl									X						
Vaux's swift									X						
Rufous hummingbird					X	X	X	BCC/N	X						
Belted kingfisher									X						
Pacific-slope flycatcher								X	X						
Steller's jay									X						
Chestnut-backed chickadee									X						
Bewick's wren							X	X							
Golden-crowned kinglet									X						
Varied thrush									X						
American pipit															SU
Orange-crowned warbler									X						
Townsend's warbler									X						
Hermit warbler								X	X						
MacGillivray's warbler									X						
Purple finch					X				X						
Red crossbill									X						
Mammals															
Mammals	X														
Humans	X														
Marine Mammals	X														
Red tree vole			SOC	NSS						X					S1
Townsend's big-eared bat			SOC	SC						X					S2
Hoary bat										X					S3
Silver-haired bat			SOC	SV						X					S3
California myotis			SOC	SV						X					S3
Long-legged myotis			SOC	SV						X					S3

Table E-1. Bandon Marsh National Wildlife Refuge Table of Comprehensive Resources of Concern

Species/Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Amphibians															
Amphibians	X														
Clouded salamander			NFS	SV						X					S3
Coastal tailed frog			SOC	SV						X					
Northern red-legged frog															S3
Western toad			NFS	SV						X					S3
Southern Torrent Salamander			SOC	SV						X					
Reptiles															
Reptiles	X														
Western pond turtle			SOC	SC						X					S2
Plants															
Saltmarsh bird’s beak			LE	LE						X					
Henderson’s checkermallow			SOC	SC						X					S1
Western lily			LE	LE						X					S1
Fish															
Anadromous fish (Chinook salmon, coho salmon, chum salmon, steelhead trout)	X													X	
Resident fish	X														
Chinook salmon	X													X	SNR
Coho salmon	X		LT	SS						X				X	S2
Chum salmon	X		LT	SC						X				X	S2
Steelhead trout	X		C	SS						X				X	S2
Coastal cutthroat trout	X		SOC	SV						X					S3
Green sturgeon			SOC	NSS						X					S3
Western brook lamprey			SOC	SS						X					
Pacific lamprey			SOC	SS						X					S3
Pacific smelt			LT	SS						X					

Table E-1. Bandon Marsh National Wildlife Refuge Table of Comprehensive Resources of Concern

Species/Habitat	Refuge Purpose Species	BIDEH	Federal T&E	State T&E	BCC - BCR # 5 (Table 6)	BCC - 2008 Region 1 (Table 39)	BCC - National (Table 48)	BMC Region 1 Status	PIF Regional Important Species	State Wildlife Action Plan Priorities (SGCN)	Shorebird Plan- NP Regional Score	Waterbird Plan Category	NA Waterfowl Management Plan	Fisheries Status Review	OR Natural Heritage Program State Rank
Other															
Resident wildlife	X														
Endangered species	X				X	X	X								

Federal Status
LT = Threatened
LE = Endangered
C = Candidate
SOC = Species of Concern
NFS = No federal status
DL = Delisted

State Status
LT = Threatened
LE = Endangered
C = Candidate
SS = Sensitive Species
SV = Sensitive species, vulnerable category
SC = Sensitive species, critical category
NSS = No state status
DL = Delisted

BMC Designations: BCC/N = Birds of Conservation Concern National, GBBDC = Gamebirds Below Desired Condition, T/E = Threatened or Endangered, BCC/BCR = Birds of Conservation Concern/BCR.

SGCN = Species of Greatest Conservation Needs in the Coast Range Ecoregion – Used Oregon Conservation Strategy document.

Shorebird Plan Ranking: 1 = No Risk, 2 = Low Concern, 3 = Moderated Concern, 4 = High Concern, 5 = Highly imperiled, including species listed as threatened or endangered.

Waterbird Plan Category of Conservation: H = High Concern (listed **only** species in the category of high concern).

North American Waterfowl Management Plan: Listed **only** species mentioned in the plan with breeding population objectives or listed habitat to restore/enhance.

Oregon Natural Heritage State Rank: used NatureServe Explorer database to determine state rank. State rank codes include: SX = Presumed Extirpated, SH = Possibly Extirpated, S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, SU = Unrankable, SNR = Not Yet Ranked.

E.3 Priority Resources of Concern

The Priority Resources of Concern (Table E-2) were selected from the Comprehensive Resources of Concern list as particular indicators by which to gauge habitat conditions. The Priority Resources of Concern table includes focal species, including birds, fish, reptiles, amphibians, invertebrates, and plants that were selected as representatives or indicators for the overall condition of important refuge habitats. Most of the biological emphasis of the CCP is focused on maintaining and restoring these priority resources.

Several different conservation focal species may be listed for specific habitats to cover the variety of habitat structures and plant associations. In addition, species with specific "niche" ecological requirements may be listed as a focal species. Other species utilizing the habitat are generally expected to benefit as a result of management for the focal species.

Definitions for the column headings in Table E-2 are as follows:

- **Focal Species:** Species selected as representatives or indicators for the overall condition of the conservation target. In situations where the conservation target may include a broad variety of habitat structures and plant associations, several different conservation focal species may be listed. In addition, species with specific "niche" ecological requirements may be listed as a focal species. Management will be focused on attaining conditions required by the focal species. Other species utilizing the conservation target are generally expected to benefit as a result of management for the focal species.
- **Habitat Type:** The general habitat description utilized by the focal species.
- **Habitat Structure:** The specific and measurable habitat attributes considered necessary to support the focal species.
- **Life History Requirement:** The general season of use for the focal species.
- **Other Benefiting Species:** Other species that are expected to benefit from management for the selected focal species. The list is not comprehensive; see the Table of Potential Resources of Concern for the Refuge for a more complete list.

Table E-2. Bandon Marsh National Wildlife Refuge Priority Resources of Concern

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Birds				
Western sandpiper	Temperate Pacific Intertidal Mudflat	Tidal flooding of mudflats with salt or brackish water. The dominant processes are tectonic uplift or subsidence, isostatic rebound, and sediment deposition.	Migration stop-over grounds, foraging habitat. Year-round for benefiting species.	Least sandpiper, Black turnstone, Long-billed/short-billed dowitcher, Greater yellowlegs, Lesser yellowlegs, Whimbrel, various waterfowl species, raptors including Bald eagle, peregrine falcon

Table E-2. Bandon Marsh National Wildlife Refuge Priority Resources of Concern

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Dowitcher sp.	Temperate Pacific Intertidal Mudflat	Tidal flooding of mudflats with salt or brackish water. The dominant processes are tectonic uplift or subsidence, isostatic rebound, and sediment deposition.	Migration stop-over grounds, foraging habitat. Year-round for benefiting species.	Least sandpiper, Black turnstone, western sandpiper, Greater yellowlegs, Lesser yellowlegs, Whimbrel, various waterfowl species, raptors including Bald eagle, peregrine falcon
Least sandpiper	Temperate Pacific Intertidal Mudflat	Tidal flooding of mudflats with salt or brackish water. The dominant processes are tectonic uplift or subsidence, isostatic rebound, and sediment deposition.	Migration stop-over grounds, foraging habitat. Year-round for benefiting species.	Long-billed dowitcher, short-billed dowitcher, Black turnstone, western sandpiper, Greater yellowlegs, Lesser yellowlegs, Whimbrel, various waterfowl species, raptors including Bald eagle, peregrine falcon
Northern harrier	Temperate Pacific Tidal Salt and Brackish Marsh	Intertidal high marsh flooded with salt or brackish water.	Breeding and year-round for benefiting species.	Western Canada goose, Long-billed marsh wren, savanna sparrow, white-tailed kite, peregrine falcon, merlin
Chestnut-sided chickadee	North Pacific Intertidal Freshwater Wetland/ Forest	This forested wetland is driven by daily tidal flooding of freshwater and associated soil saturation. Vegetation structure and composition are varied and depend on substrate characteristics and the tidal flooding regime of particular sites. Dominant species include *Picea sitchensis, Alnus rubra.*	Breeding and year-round for benefiting species	Spotted towhee, Varied thrush, Fox sparrow, wrentit, brown creeper, downy woodpecker, pileated woodpecker
Fish				
Chinook salmon	Temperate Pacific Tidal Salt and Brackish Marsh	Barrier free, estuary channels or freshwater streams/river connected to ocean, channel beds with diverse microhabitat for cover/feeding opportunities, pools, water quality/chemistry/temperature conducive to fish survival	Anadromous fish nursery, rearing, foraging, year-round utilization	Coho salmon, steelhead, coastal cutthroat trout

Table E-2. Bandon Marsh National Wildlife Refuge Priority Resources of Concern

Focal Species	Habitat Type	Habitat Structure	Life History Requirement	Other Benefiting Species
Coho salmon	Temperate Pacific Tidal Salt and Brackish Marsh	Barrier free, estuary channels or freshwater streams/river connected to ocean, channel beds with diverse microhabitat for cover/feeding opportunities, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish nursery, rearing, foraging, year-round utilization	Chinook salmon, steelhead, coastal cutthroat trout
Steelhead trout	Temperate Pacific Tidal Salt and Brackish Marsh	Barrier free, estuary channels or freshwater streams/river connected to ocean, channel beds with diverse microhabitat for cover/feeding opportunities, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish nursery, rearing, foraging, year-round utilization	Chinook salmon, coho salmon, coastal cutthroat trout
Coastal cutthroat trout	Riverine and stream habitat, brackish/freshwater marsh	Barrier free, streams connected to ocean, gravel channel beds, pools, water quality/chemistry/temperature conducive to fish production and survival	Anadromous fish rearing, spawning, foraging, year-round utilization	Chinook salmon, coho salmon, steelhead
Amphibians				
Clouded salamander	Freshwater marsh, coastal forested wetland	Water quality/chemistry/temperature conducive to amphibian production and survival, vegetative cover	Year-round utilization to support and sustain life, breeding, foraging	coastal tailed frog, northern red-legged frog, western toad
Coastal tailed frog	Freshwater marsh, coastal bog	Water quality/chemistry/temperature conducive to amphibian production and survival, vegetative cover	Year-round utilization to support and sustain life, breeding, foraging	clouded salamander, northern red-legged frog, western toad
Northern red-legged frog	Freshwater marsh, coastal bog	Water quality/chemistry/temperature conducive to amphibian production and survival, vegetative cover	Year-round utilization to support and sustain life, breeding, foraging	Oregon spotted frog, clouded salamander, coastal tailed frog, western toad
Western toad	Freshwater marsh, coastal bog	Water quality/chemistry/temperature conducive to amphibian production and survival, vegetative cover	Year-round utilization to support and sustain life, breeding, foraging	Oregon spotted frog, clouded salamander, coastal tailed frog, northern red-legged frog
Plants				
Henderson's checkermallow	North Pacific Intertidal Freshwater Wetland	Daily tidal flooding of fresh and brackish water and associated soil saturation	Year-round utilization to support and sustain life, flowering, and pollination	Silverweed – *Argentina anserina*. Misc invertebrates

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Appendix F. Statement of Compliance

STATEMENT OF COMPLIANCE
for Implementation of the
Bandon Marsh National Wildlife Refuge, Coos County, Oregon
Comprehensive Conservation Plan

The following executive orders and legislative acts have been reviewed as they apply to implementation of the Bandon Marsh National Wildlife Refuge Comprehensive Conservation Plan (CCP).

National Environmental Policy Act (1969), as Amended (42 U.S.C. § 4321 et seq.)
The planning process has been conducted in accordance with National Environmental Policy Act (NEPA) implementing procedures, with U.S. Department of the Interior and U.S. Fish and Wildlife Service (Service) procedures, and in coordination with the affected public. The requirements of NEPA (42 U.S. Code [U.S.C.] § 4321 et seq.) and its implementing regulations in 40 Code of Federal Regulations (CFR) 1500-1508 have been satisfied in the procedures used to reach decisions. 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. The start of the scoping period was announced through a *Federal Register* notice, news releases to local newspapers, the Service's refuge planning website, and a planning update. The draft CCP/environmental assessment (EA) was released for a 30-day public comment period. The affected public was notified of the availability of the document 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/EA and/or planning updates were distributed to an extensive mailing list. In addition, the Service participated in a variety of public outreach efforts throughout the planning process (see Appendix J).

The CCP is programmatic in many respects and specific details of certain projects and actions cannot be determined until a later date depending on funding and implementation schedules. Certain projects or actions may require additional NEPA compliance.

National Historic Preservation Act (1966), as Amended (16 U.S.C. § 470 et seq.)
The management of the archaeological and cultural resources of the refuge will comply with the regulations of Section 106 of the National Historic Preservation Act. Historic properties will be maintained and repaired as funding becomes available. Maintenance and improvement of historic resources will result in positive impacts to cultural resources; 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 additional 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 these properties.

Executive Order 12372. Intergovernmental Review
Coordination and consultation with affected Tribal, local and State governments, other Federal agencies, and the landowners has been completed through personal contact by refuge staff, refuge supervisors and/or inclusion of the appropriate entities on the CCP mailing list.

Executive Order 13175. Consultation and Coordination with Indian Tribal Governments
As required under the Secretary of the Interior Order 3206—American Indian Tribal Rights, Federal Tribal Responsibilities, and the Endangered Species Act—the Project Leader notified and consulted interested tribes. Refuge staff consulted with representatives of the Coquille Indian Tribe during the planning process.

Executive Order 12898. Federal Actions to Address Environmental Justice in Minority and Low-Income Populations
All Federal actions must address and identify, as appropriate, disproportionally 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.

Wilderness Preservation Act of 1964 (16 U.S.C. § 1131 et seq.)
The Service has evaluated the suitability of the Refuge for wilderness designation through the "Inventory" phase according to the guidelines of the Wilderness Review process as described in 610 FW 4. In this inventory no areas on the Refuge were found to meet the minimum wilderness criteria for size, naturalness or outstanding opportunities for solitude and primitive/unconfined recreation (see Appendix D for additional details).

Architectural Barriers Act of 1968, as Amended (42 U.S.C. § 4151 et seq.)
The Architectural Barriers Act requires access to Federal facilities for people with disabilities. Access for persons with disabilities has been considered during the planning process, and actions related to access are found in Chapter 2 of the CCP.

National Wildlife Refuge System Administration Act of 1966, as Amended (16 U.S.C. § 668dd-668ee)
This Act requires the Service to develop and implement a comprehensive conservation plan for each refuge. The CCP identifies and describes refuge purposes; the vision and goals for the Refuge; fish, wildlife, and plant populations and related habitats on the Refuge; 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 uses at the Refuge. 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. Compatibility determinations have been prepared for all uses found appropriate (see Appendices A and B).

Executive Order 13186. Responsibilities of Federal Agencies to Protect Migratory Birds
This Order directs 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 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 as described in Chapter 1. The effects to refuge habitats used by

migratory birds of habitat, public use, and cultural resources actions were assessed within Chapter 6 of the draft CCP/EA, which was incorporated by reference into this document.

Endangered Species Act (1973), as Amended (16 U.S.C. § 1531 et seq.)
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. Documentation is required under Section 7 of the Act. Refuge policy requires the refuge manager to document issues that affect or may affect endangered species before initiating projects. Consultation on specific projects will be conducted prior to implementation to avoid any adverse impacts to these species and their habitats.

Coastal Zone Management Act, as Amended (16 U.S.C. § 1451 et seq.)
Section 307(c)(1) of the Coastal Zone Management Act of 1972 as amended, requires each Federal agency conducting or supporting activities directly affecting the coastal zone, to conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state coastal management programs. The implementation of the Bandon Marsh NWR CCP is consistent with the Coastal Zone Management Act.

Executive Order 11990. Protection of Wetlands
The CCP is consistent with Executive Order 11990 because CCP implementation will protect any existing wetlands.

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." The CCP is consistent with Executive Order 11988 because CCP implementation would maintain and enhance riverine, riparian, and wetland habitats located within floodplains on the Refuge, which will minimize flood impacts and continue to contribute to the natural and beneficial fish and wildlife resource values unique to the area.

Integrated Pest Management (IPM), 517 DM 1 and 7 RM 14
In accordance with 517 DM 1 and 7 RM 14, an integrated pest management (IPM) approach has been adopted to eradicate, control, or contain pest and invasive species on the Refuge. In accordance with 517 DM 1, only pesticides registered with the US Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction.

See 602 FW 3, Exhibit 2 for other potential compliance requirements

Chief, Division of Planning, Visitor Services, and Transportation	12-19-12 Date

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Appendix G. Integrated Pest Management

G.1 Background

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. IPM 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 will be used to identify and implement appropriate management strategies that can be modified and/or changed over time to ensure effective, site-specific management of pest species to achieve desired outcomes. In accordance with 43 CFR 46.145, adaptive management will be particularly relevant where long-term impacts may be uncertain and future monitoring will be needed to make adjustments in subsequent implementation decisions. After a tolerable pest population (threshold) is determined considering achievement of refuge resource objectives and the ecology of pest species, one or more methods, or combinations thereof, will be selected that are feasible, efficacious, and most protective of non-target resources, including native species (fish, wildlife, and plants), and Service personnel, Service authorized agents, volunteers, and the public. Staff time and available funding will be considered when determining feasibility/practicality of various treatments.

IPM techniques to address pests are presented as CCP strategies (see Chapter 2 of this CCP) 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:

- 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 Consequences) of the Bandon Marsh National Wildlife Refuge draft CCP/EA. 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.

G.2 Pest Management Laws and Policies

In accordance with Service policy 569 FW 1 (Integrated Pest Management), plant, invertebrate, and vertebrate 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 USC 668dd-668ee);
- Plant Protection Act of 2000 (7 USC 7701 *et seq*.);
- Noxious Weed Control and Eradication Act of 2004 (7 USC 7781-7786, Subtitle E);
- Federal Insecticide, Fungicide, and Rodenticide Act of 1996 (7 USC 136-136y);
- National Invasive Species Act of 1996 (16 USC 4701);
- Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 USC 4701);
- Food Quality Protection Act of 1996 (7 USC 136);
- Executive Order 13148, Section 601(a);
- Executive Order 13112; and
- Animal Damage Control Act of 1931 (7 USC 426-426c, 46 Stat. 1468).

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” from Department policy 517 DM 1 (Integrated Pest Management Policy). Similarly, 569 FW 1 defines pests as “invasive plants and introduced or native organisms that may interfere with achieving our management goals and objectives on or off our lands, or that jeopardize human health or safety.” 517 DM 1 also 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, the terms pest and invasive species are used interchangeably because 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 569 FW 1, 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.

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 re-establish 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.

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."

Animal species damaging/destroying federal property and/or detrimental to the management program of a refuge may be controlled as described in 50 CFR 31.14 (Official Animal Control Operations). For example, the incidental removal of beaver damaging refuge infrastructure (e.g., clogging with subsequent damaging of water control structures) and/or negatively affecting habitats (e.g., removing woody species from existing or restored riparian) managed on refuge lands may be conducted without a pest control proposal. We recognize beavers are native species and most of their activities or refuge lands represent a natural process beneficial for maintaining wetland habitats. Exotic nutria, whose denning and burrowing activities in wetland dikes causes cave-ins and breaches, can be controlled using the most effective techniques considering site-specific factors without a pest control proposal. Along with the loss of quality wetland habitats associated with breaching of impoundments, the safety of refuge staff and public (e.g., auto tour routes) driving on structurally compromised levees and dikes can be threatened by sudden and unexpected cave-ins.

Trespass and feral animals also may be controlled on refuge lands. Based upon 50 CFR 28.43 (Destruction of Dogs and Cats), dogs and cats running at large on a national wildlife refuge and observed in the act of killing, injuring, harassing or molesting humans or wildlife may be disposed of in the interest of public safety and protection of the wildlife. Feral animals should be disposed by the most humane method(s) available and in accordance with relevant Service directives (including Executive Order 11643). Disposed wildlife specimens may be donated or loaned to public institutions. Donation or loans of resident wildlife species will only be made after securing State approval (50 CFR 30.11 [Donation and Loan of Wildlife Specimens]). Surplus wildlife specimens may be sold alive or butchered, dressed and processed subject to federal and state laws and regulations (50 CFR 30.12 [Sale of Wildlife Specimens]).

G.3 Strategies

To fully embrace IPM as identified in 569 FW 1, the following strategies, where applicable, would be carefully considered on the Refuge for each pest species.

G.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 un-infested 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 to 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 re-introductions by various mechanisms including vehicles, personnel, livestock, and horses. Because invasive species are frequently the first to establish 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 un-infested 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 un-infested 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. Where possible, 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 staff, 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 on-going 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 reasonably available.
- The refuge staff would provide information, training, and appropriate pest identification materials to 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. Where possible, the refuge staff would drain water from motor, live well, bilge, and transom wells while on land before leaving the site. If possible, 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.
- Where feasible, the refuge staff would maintain a 100-foot buffer of aquatic pest-free clearance around boat launches and docks or quarantine areas when cleaning around culverts, canals, or irrigation sites. Where possible, the refuge staff would inspect and clean equipment before moving to new sites or 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 the U.S. Forest Service's *Preventing and Managing Invasive Plants Final Environmental Impact Statement* (2005).

G.3.2 Mechanical/Physical Methods

These methods would remove and destroy, disrupt the growth of, or interfere with the reproduction of pest species. For plants 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, shearing, girdling, mowing, and mulching of the pest plants.

For animal species, Service employees or their authorized agents could use mechanical/physical methods (including trapping) to control pests as a refuge management activity. Based upon 50 CFR 31.2, trapping can be used on a refuge to reduce surplus wildlife populations for a "balanced conservation program" in accordance with federal or state laws and regulations. In some cases, non-lethally trapped animals would be relocated to off-refuge sites with prior approval from the state.

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.

G.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 non-susceptible crops, moisture management, addition of beneficial insect habitat, reducing clutter, proper trash disposal, planting or seeding desirable species to shade or out-compete invasive plants, applying fertilizer to enhance desirable vegetation, prescriptive grazing, and other habitat alterations.

G.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/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 (the 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 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% 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 USEPA under FIFRA, most biological control agents are regulated by the U.S. Department of Agriculture (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:

> 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 non-indigenous 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, sub-species 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, MT, 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 species, non-target species, and the environment.

Biological control agents formulated as pesticide products and registered by the USEPA (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, U.S. Department of Agriculture-Animal and Plant Health Inspection Service, 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 (43 CFR 46.135) 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 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.

G.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 best management practices (BMPs) to reduce/eliminate potential effects to non-target 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 569 FW 1. 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://systems.fws.gov/pups). Only Service employees would be authorized to access PUP records for a 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 non-target 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 a 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 refuge lands in the context of an IPM approach.

G.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 (Masters et al. 1996, Masters and Sheley 2001, Brooks et al. 2004). 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 time frame. 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.

G.4 Priorities for Treatments

For many refuges, the magnitude (number, distribution, and sizes of infestations) of 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), NWRS 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 un-infested 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 or managing source populations. Maxwell et al. (2009) found treating fewer populations that are sources represents an effective long-term strategy to reduce of total number of invasive populations and decreasing meta-population growth rates.

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.

G.5 Best Management Practices (BMPs)

BMPs can minimize or eliminate possible effects associated with pesticide usage to non-target species and/or sensitive habitats as well as degradation of water quality from drift, surface runoff, or leaching. Based upon the Department of Interior Pesticide Use Policy (517 DM 1) and the Service Integrated Pest Management policy (569 FW 1), the use of applicable BMPs (where feasible) also 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 non-target resources would be an IPM approach to prevent, control, eradicate, and contain pests.

G.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 triple rinse and recycle (where feasible) pesticide containers.
- All unused pesticides would be properly discarded at a local “safe send” collection.
- 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 prevent 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.

G.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 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 NWRS 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, MSDSs, and Pesticide Use Proposal (PUPs) for each pesticide, determining the target pest, appropriate mix rate(s), 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 where it does not detrimentally influence effective control of pest species.
- Use low-impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, other larger tank wand applications), where practical.
- Use low-volume rather than high-volume foliar applications where low-impact methods above are not feasible or practical, to maximize herbicide effectiveness and ensure correct and uniform application rates.
- 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<7 mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85°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 non-target 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 >30% forecast for rain within 6 hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 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 non-toxic 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 on-site by applicators after treatments to eliminate the potential spread of pests to un-infested areas.
- Cleaning boots (or use rubber boots to aid in sanitation) and brush off clothing in a place where monitoring is feasible to control for new seed transportation.

G.6 Safety

G.6.1 Personal Protective Equipment

All applicators would wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE would 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 an NIOSH-approved respirator. 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 would be consistent with label requirements, USEPA and 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.

G.6.2 Notification

The restricted entry interval (REI) is the time period required after the application at which point someone 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 re-entry 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 who have requested notification. Special efforts would be made to contact nearby individuals who are beekeepers or who have expressed chemical sensitivities.

G.6.3 Medical Surveillance

Medical surveillance may be required for Service personnel and approved volunteers who mix, apply, and/or monitor use of pesticides (see 242 FW 7 [Pesticide Users] and 242 FW 4 [Medical Surveillance]). In accordance with 242 FW 7.12A, Service personnel would be medically monitoring if one or more of the following criteria is met: exposed or may be exposed to concentrations at or above the published permissible exposure limits or threshold limit values (see 242 FW 4); use pesticides in a manner considered "frequent pesticide use"; or use pesticides in a manner that requires a respirator (see 242 FW 14 for respirator use requirements). In 242 FW 7.7A, "**Frequent Pesticide Use** means when a person applying pesticide handles, mixes, or applies pesticides, with a Health Hazard rating of 3 or higher, for 8 or more hours in any week or 16 or more hours in any 30-day period." Under some circumstances, individuals may be medically monitored who use pesticides infrequently (see Section G.7.7), experience an acute exposure (sudden, short-term), or use pesticides with a health hazard ranking of 1 or 2. This decision would consider the individual's health and fitness level, the pesticide's specific health risks, and the potential risks from other pesticide-related activities. 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.

G.6.4 Certification and Supervision of Pesticide Applicators

Appropriate refuge staff or approved volunteers handling, mixing, and/or applying or directly supervising others engaged in pesticide use activities would be trained and state or federally (BLM) licensed to apply pesticides to refuge lands or waters. In accordance with 242 FW 7.18A and 569 FW 1.10B, certification is required to apply restricted use pesticides based upon USEPA regulations. For safety reasons, all individuals participating in pest management activities with general use pesticides also are encouraged to attend appropriate training or acquire pesticide applicator certification. The certification requirement would be for a commercial or private applicator depending upon the state. 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.

G.6.5 Record Keeping

Labels and Material Safety Data Sheets

Pesticide labels and material safety data sheets (MSDSs) would be maintained at the refuge shop and laminated copies in the mixing area. These documents also 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 while mixing is in progress. In addition, approved PUPs stored in the PUPS database typically contain website links (URLs) to pesticide labels and MSDSs.

Pesticide Use Proposals (PUPs)

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 Service guidelines (Director's memo [December 12, 2007]), 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 a habitat management plant (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://systems.fws.gov/pups). Only Service employees can access PUP records in this database.

Pesticide Usage

In accordance with 569 FW 1, 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, non-government applicators including cooperators and their pest management service providers with Service permission. For clarification, pesticide means all insecticides, insect and plant growth regulators, desiccants, 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 (lbs. or gallons)
- Total amount of active ingredient(s) used (lbs.)
- Target pest(s)
- Efficacy (% 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, % cover, density) as well as habitat and/or wildlife response to treatments may be collected and stored in a relational database (e.g., Refuge Habitat Management Database), preferably a geo-referenced data management system (e.g., Refuge Lands GIS) to facilitate data analyses and subsequent reporting. 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. Monitoring could also identify short- and long-term impacts to natural resources and environmental quality associated with IPM treatments in accordance with adaptive management principles identified in 43 CFR 46.145.

G.7 Evaluating Pesticide Use Proposals

Pesticides would only be used on refuge lands for habitat management as well as croplands/facilities maintenance after approval of a PUP. In general, proposed pesticide uses on refuge lands 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 and other screening measures. Potential effects to environmental quality would be based upon pesticide characteristics of environmental fate (water solubility, soil mobility, soil persistence, and volatilization) and other quantitative screening tools. Ecological risk assessments as well as characteristics of environmental fate and potential to degrade environmental quality for pesticides would be documented in Chemical Profiles (see Section G.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. In general, only pesticide uses with appropriate BMPs (see Section G.4) for habitat management and cropland/facilities maintenance on refuge lands that would potentially have minor, temporary, or localized effects on refuge biological and environmental quality (threshold values not exceeded) would be approved.

G.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 refuge lands. 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. This quantitative methodology provides an efficient mechanism 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 in the field 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 U.S. Environmental Protection Agency (2004). Assumptions for these risk assessments are presented in Section G.7.2.3.

The toxicological data used in ecological risk assessments are typically results of standardized laboratory studies provided by pesticide registrants to the USEPA 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. 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 G.7.5.

Table G-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.

G.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 USEPA's Ecological Risk Assessment Process (USEPA 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 NWRS. 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 G-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 USEPA (1998 [Table G-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 used 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 USC 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. A RQ<LOC would indicate the proposed pesticide use "may affect, not likely to adversely affect" individuals (listed species) and it would not pose an unacceptable risk for adverse effects to populations (non-listed species) for each taxonomic group (Table G-2). In contrast, an RQ>LOC would indicate a "may affect, likely to adversely affect" for listed species and it would also pose unacceptable ecological risk for adverse effects to nonlisted species.

Table G-2. Presumption of Unacceptable Risk for Birds, Fish, and Mammals (USEPA 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

Environmental Exposure

Following release into the environment through application, pesticides would experience several different routes of environmental fate. Pesticides which 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 non-target 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, Pope et al. 1999, Butler et al. 1998, Ramsay et al. 1995, EXTOXNET 1993). Pesticides which would be injected into the soil may also be subject to the latter two fates. The aforementioned possibilities are by no means complete, but it does 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 USEPA screening-level approach (USEPA 2004). This screening-level approach is not affected by product formulation because it evaluates pesticide 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 (USEPA 2004, USEPA 2012, Pfleeger et al. 1996) through the USEPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3 (USEPA 2005). To estimate the maximum (initial) pesticide residue on short grass (<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 lb. ai/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 G-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, zero 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 G-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 (a.i.) 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 G-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% 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% of the applied granules remain available to wildlife. It would be assumed that only 1% of the granules are available on the soil surface following in-furrow applications.

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% body weight/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}/ft^2) for comparison to USEPA Level of Concerns (USEPA 1998). The T-REX version 1.2.3 (USEPA 2005) contains a submodel which automates Kanaga exposure calculations for granular pesticides and treated seed.

The following formulas would be used to calculate EECs depending upon the type of granular pesticide application:

- In-furrow applications assume a typical value of 1% granules, bait, or seed remain unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}580\ mg/lbs)(1\%\ exposed))] / \{[(43{,}560\ ft.^2/acre)/(row\ spacing\ (ft.))] / (row\ spacing\ (ft.)\}$$

or

$$mg\ a.i./ft^2 = [(lbs\ product/1{,}000\ ft.\ row)(\%\ a.i.)(1{,}000\ ft\ row)(453{,}580\ mg/lb.)(1\%\ exposed)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Incorporated banded treatments assume that 15% of granules, bait, and seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/1{,}000\ row\ ft.)(\%\ a.i.)(453{,}580\ mg/lb.)(1\text{-}\%\ incorporated)] / (1{,}000\ ft.)(band\ width\ (ft.))$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Broadcast treatment without incorporation assumes 100% of granules, bait, seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/acre)(\%\ a.i.)(453{,}590\ mg/lb.)] / (43{,}560\ ft.^2/acre)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

Where:

- *% of pesticide biologically available = 100% without species specific ingestion rates*
- *Conversion for calculating mg a.i./ft.^{2} using ounces: 453,580 mg/lb. /16 = 28,349 mg/oz.*

The following equation would be used to calculate an 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 G-3) of the surrogate.

$$RQ = EEC / [LD_{50}\ (mg/kg) * body\ weight\ (kg)]$$

As with other risk assessments, an RQ>LOC would be a presumption of unacceptable ecological risk. An RQ<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 <25 feet of the high water mark of aquatic habitats for habitat management treatments; whereas, no-spray buffers (≥25 feet) would be used for croplands/facilities maintenance treatments.

Habitat Treatments

For the worst-case exposure scenario to non-target aquatic habitats, EECs (Table G-4) would be would be derived from Urban and Cook (1986) that assumes an intentional overspray to an entire, non-target water body (1-foot depth) from a treatment <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 G.4.2) would likely minimize/eliminate potential drift to non-target aquatic habitats during actual treatments. If there would be unacceptable (acute or chronic) risk to fish and wildlife with the simulated 100% overspray (RQ>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 G-4. Estimated Environmental Concentrations (ppb) of Pesticides in Aquatic Habitats (1 foot depth) Immediately after Direct Application (Urban and Cook 1986)

Lbs/acre	EEC (ppb)
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	1103.5
4.00	1471.4
5.00	1839
6.00	2207
7.00	2575
8.00	2943
9.00	3311
10.00	3678

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 USEPA 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 (SDTF 2003, AgDRIFT 2001) would be used to derive EECs resulting from drift of pesticides to refuge aquatic resources from ground-based pesticide applications >25 feet from the high water mark. The Spray Drift Task Force AgDRIFT model is publicly available at http://www.agdrift.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 droplet size, EPA-defined wetland, and a ≥25-foot distance (buffer) from treated area to water.

Use of Information on Effects of Biological Control Agents, Pesticides, Degradates, and Adjuvants

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 Bureau of Land Management, U.S. Forest Service, National Park Service, U.S. Department of Agriculture-Animal and Plant Health Inspection Service, and the 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 also would reduce the bulk of a Service NEPA document, which only would identify the documents that are incorporated by reference. In addition, relevant portions would be summarized in the Service 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 43 CFR 46.135, the Service would specifically 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 Bureau of Land Management (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* (USFS 2005) and *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic EIS* (PEIS) (Bureau of Land Management 2007). In accordance with 43 CFR 46.120(d), use of existing NEPA documents by supplementing, tiering to, incorporating by reference, or adopting previous NEPA environmental analyses would avoid redundancy and unnecessary paperwork.

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 incorporated by reference:

- 2,4-D
- Chlorsulfuron
- 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 Bureau of Land Management would be incorporated by reference:

- Bromacil
- Chlorsulfuron
- Diflufenzopyr
- Diquat
- Diuron
- Fluridone
- Imazapic
- Overdrive (diflufenzopyr and dicamba)
- Sulfometuron methyl
- Tebuthiuron
- Pesticide degradates and adjuvants (*Appendix D – Evaluation of risks from degradates, polyoxyethylene-amine (POEA) and R-11, and endocrine disrupting chemicals*)

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 USEPA'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, 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. Non-target 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 (USEPA 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 are 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 would 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 are 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 would be applied judiciously considering the potential for an underestimate or overestimate of risk. For example, the number of days exposure exceeds a Level of Concern may influence the suitability of a pesticide use. The greater the number of days the EEC exceeds the Level of Concern translates into greater the 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 would require justification and it would 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 it 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 (USEPA 2004).
- Exposure through incidental ingestion of pesticide contaminated soil is not considered in the USEPA risk assessment protocols. Research suggests <15% 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 would 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 USEPA 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 USEPA (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% 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 USEPA 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 risk 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 USEPA 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 USEPA for assessing dermal exposure to pesticides, they would 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 the 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 USEPA is actively developing protocols to quantify drinking water exposures from puddles and dew. If and when protocols are formally established by the USEPA for assessing exposure to pesticides through drinking water, these protocols would 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 USEPA relies on Fletcher (1994) for setting the assumed pesticide residues in wildlife dietary items. The USEPA (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 USEPA represent a 95th percentile estimate. However, research conducted by Pfleeger et al. (1996) indicates USEPA residue assumptions for short grass was not exceeded. Baehr and Habig (2000) compared USEPA residue assumptions with distributions of measured pesticide residues for the USEPA's UTAB database. Overall residue selection level tends 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 above-ground 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 non-target 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 effects to non-target 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 level of concern, 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 the 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 USEPA 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 non-target 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 effects to non-target 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.
- USEPA 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, USEPA 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.

G.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 is 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 would be 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 USEPA (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 non-target 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 USEPA 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 non-target 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 non-target 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 USEPA’s IRIS, the Hazardous Substance Data Bank, the Registry of Toxic Effects of Chemical Substances [RTECS]).
- USEPA’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).
- Material Safety Data Sheets (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, and 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.

A USEPA-approved label specifies whether a product can be mixed with one or more pesticides. Without product-specific toxicological data, it would not be 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 USEPA 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.

G.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 refuge lands. 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 (t½), represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially). Persistence in the soil can be categorized as the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996). Half-life data are usually available for aquatic and terrestrial environments.

Another measure of pesticide persistence is dissipation time (DT_{50}). It represents the time required for 50% 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 published literature. If field or foliar dissipation data are not available, soil half-life data may be used. The average or representative half-life value of most important degradation mechanism would 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 would 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 would 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 parts per million [ppm]). Pesticide with solubility <0.1 ppm are virtually insoluble in water, 100-1000 ppm are moderately soluble, and >10,000 ppm highly soluble (USGS 2000). As pesticide solubility increases, there would be greater potential for off-site movement.

The Groundwater Ubiquity Score (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 <0.1 would 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 >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. GUS, water solubility, t½, and K_{oc} values are available for selected pesticides from the OSU 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/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 affects pesticide degradation.
- Soil pH would influence chemical reactions that occur in the soil which in turn determines whether or not a pesticide would 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 best management practices (see below) would be used in an IPM framework to treat pests while minimizing effects to non-target 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 persists. In some situations, a hard pan exists above the water table that would prevent pesticide contamination from leaching.

G.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 $I<10$ would have a low potential to volatilize; whereas, pesticides with $I>1,000$ 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.

G.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 USEPA. 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 are 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

G.5), 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 refuge lands. 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.

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.

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.

Common chemical name(s): Service personnel would record the common name(s) listed on the pesticide label or material safety data sheet (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.

Pesticide Type: Service personnel would record the type of pesticide for an active ingredient as one of the following: herbicide, desiccant, fungicide, fumigant, growth regulator, insecticide, piscicide, or rodenticide.

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.

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.

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 % composition.

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), Occupational Safety and Health Administration (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. MSDS(s) may be obtained from the manufacturer, manufacturer's website or from an on-line database maintained by Crop Data Management Systems, Inc. (see list below).

G.7.7 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 are available in 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.

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 G-1 in Section G.7.1).

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 G-1 in Section G.7.1).

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, new born 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 G-1 in Section G.7.1).

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 G-1 in Section G.7.1).

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 G-1 in Section G.7.1).

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 G-1 in Section G.7.1).

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 the 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 G-1 in Section G.7.1).

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 G-1 in Section G.7.1).

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 non-vascular and vascular plants, respectively.

G.7.8 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 USEPA 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 effects 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.

G.7.9 Environmental Fate

Water Solubility: Service personnel would record values for water solubility (S_w), which describes the amount of pesticide that dissolves in a known quantity of water. S_w is expressed as mg/L (ppm). Pesticide S_w values would be categorized as one of the following: insoluble <0.1 ppm, moderately soluble = 100 to 1000 ppm, highly soluble >10,000 ppm (USGS 2000). As pesticide S_w increases, there would be greater potential to degrade water quality through runoff and leaching.

S_w would be used to evaluate potential for bioaccumulation in aquatic species [see **Octanol-Water Partition Coefficient (K_{ow})** below].

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).

Soil Persistence: Service personnel would record values for soil half-life (t½), which represents the length of time (days) required for 50% of the deposited pesticide to degrade (completely or partially) in the soil. Based upon the t½ value, soil persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996).

Threshold for Approving PUPs:

If soil t½ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

*If soil t½ >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 ground water table is <10 feet and average annual precipitation >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 t½ values would be used in evaluating the potential to degrade groundwater by leaching (see **Potential to Move to Groundwater** below).

Soil Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade and move from a treated site; whereas, soil t½ describes the rate for degradation only. As for t½, 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 t½, which is derived in a laboratory. However, soil t½ 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 <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If soil DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

If soil DT_{50} >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 ground water table is <10 feet and average annual precipitation >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 t½) would be used in evaluating the potential to degrade groundwater by leaching (see Potential to Move to Groundwater below), if available.

Aquatic Persistence: Service personnel would record values for aquatic t½, which represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially) in water. Based upon the t½ value, aquatic persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et al. 1996).

Threshold for Approving PUPs:

If aquatic t½ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

If aquatic t½ >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 ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Aquatic Dissipation: Dissipation time (DT_{50}) represents the time required for 50% of the deposited pesticide to degrade or move (dissipate); whereas, aquatic t½ describes the rate for degradation only. As for t½, 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 <30 days, moderately persistent = 30 to 100 days, and persistent >100 days.

Threshold for Approving PUPs:

If aquatic DT_{50} ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.

If aquatic DT_{50} >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 ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

Potential to Move to Groundwater: Groundwater Ubiquity Score (GUS) = $\log_{10}$(soil t ½) x [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 <1.0, low—1.0 to 2.0, moderate—2.0 to 3.0, high—3.0 to 4.0, or very high >4.0.

Threshold for Approving PUPs:

If GUS ≤4.0, then a PUP would be approved without additional BMPs to protect water quality.

If GUS >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 ground water table is <10 feet and average annual precipitation >12 inches.*
- *Do not use on steep slopes if substantial rainfall is expected within 24 hours or ground is saturated.*

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 x 10^{-7}), where I represents a vapor pressure index. In general, pesticides with I<10 would have low potential to volatilize; whereas, pesticides with I >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 (see References).

Threshold for Approving PUPs:

If I ≤1,000, then a PUP would be approved without additional BMPs to minimize drift and protect air quality.

If I >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 <2 or >10 mph with existing or potential inversion conditions.*
- *Apply the large-diameter droplets possible for spray treatments.*
- *Avoid spraying when air temperatures >85^{o}F.*
- *Use the lowest spray height possible above target canopy.*
- *Where identified on the pesticide label, soil incorporate pesticide as soon as possible during or after application.*

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} >1,000 or S_w<1 mg/L and soil t½>30 days, then there would be high potential for a pesticide to bioaccumulate in aquatic species such as fish (USGS 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}>1,000 or S_w<1 mg/L and soil t½>30 days), then the PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Bioaccumulation/Bioconcentration: 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 >1,000 (Calabrese and Baldwin 1993).

Threshold for Approving PUPs:

If BAF or BCF≤1,000, then a PUP would be approved without additional BMPs.

If BAF or BCF>1,000, then a PUP would not approved, except under unusual circumstances where approval would only be granted by the Washington Office.

Worst-Case Ecological Risk Assessment

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 write "NS" for "not specified on label" in this table.

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 USEPA screening-level approach (USEPA 2004). For each max application rate [see description under **Max Application Rates (acid equivalent)**], Service personnel would record 2 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.

Presumption of Unacceptable Risk/Risk Quotients: Service personnel would calculate and record acute and chronic risk quotients (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 G.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% 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 G.7.2.1.2 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 USEPA'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 (<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 G.7.2 for the procedure that would be used to calculate RQs.

All calculated RQs in both tables would be compared with Levels of Concern (LOCs) established by USEPA (see Table G-2 in Section G.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 G.7.2 for detailed descriptions of acute and chronic RQ calculations and comparison to LOCs to assess risk.

Threshold for Approving PUPs:

If RQs≤LOCs, then a PUP would be approved without additional BMPs.

If RQs>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 non-listed or listed species:*

- *Lower application rate and/or fewer number of applications so RQs≤LOCs*
- *For aquatic assessments (fish) associated with cropland/facilities maintenance, increase the buffer distance beyond 25 feet so RQs≤LOCs.*

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 would provide the appropriate information regarding control of pests to describe in the section.

Specific Best Management Practices (BMPs): Service personnel would record specific BMPs necessary to minimize or eliminate potential effects to non-target species and/or degradation of environmental 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, then 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 G.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.

References: Service personnel would record scientific resources used to provide data/information for a chemical profile. Use the number sequence to uniquely reference data in a chemical profile.

The following on-line 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, U.S. Department of Agriculture, 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, Department of Interior; Bonneville Power Administration, U.S. Department of Energy; and Forest Service, U.S. Department of Agriculture. (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, D.C. (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_5$0:	
Fish ELS/Life Cycle:	
Other:	

Ecological Incident Reports

Environmental Fate

Water solubility (S_w):	
Soil Mobility (K_{oc}):	
Soil Persistence (t½):	
Soil Dissipation (DT_{50}):	
Aquatic Persistence (t½):	
Aquatic Dissipation (DT_{50}):	
Potential to Move to Groundwater (GUS score):	
Volatilization (mm Hg):	
Octanol-Water Partition Coefficient (K_{ow}):	
Bioaccumulation/Bioconcentration:	**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	[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 H. Acronyms, Glossary, and Scientific Names

H.1 Acronyms

ABA	Architectural Barriers Act
ABC	American Bird Conservancy
ADA	Americans with Disabilities Act
ARPA	Archaeological Resources Protection Act
BCC	Birds of Conservation Concern
BIDEH	Biological Integrity, Diversity, and Environmental Health
BLM	Bureau of Land Management
BMC	Birds of Management Concern
BMPs	Best Management Practices
BP	Before Present
CBNWG	Chesapeake Bay Nutria Working Group
CCP	Comprehensive Conservation Plan
CD	Compatibility Determination
CFR	Code of Federal Regulations
CMP	Conceptual Management Plan
Complex	Oregon Coast National Wildlife Refuge Complex
CWA	Clean Water Act
CWA	Coquille Watershed Association
DBH	Diameter at Breast Height
DCP	Disease Contingency Plan
Director	Director of the U.S. Fish and Wildlife Service
DLCD	Department of Land Conservation and Development
EA	Environmental Assessment
EDRR	Early Detection Rapid Response
EE	Environmental Education
EIS	Environmental Impact Statement
ENSO	El Niño/Southern Oscillation
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FIRFA	Federal Insecticide, Fungicide, and Rodenticide Act
FMP	Fire Management Plan
FR	Federal Register
FWS	U.S. Fish and Wildlife Service (also, Service, USFWS)
GHG	Greenhouse Gases
GIS	Geographic Information System
GPS	Global Positioning System
HMP	Habitat Management Plan
HUC	Hydrologic Unit Code
IBAs	Important Bird Areas
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
LCC	Land Conservation Cooperative
LE	Law Enforcement
LNG	Liquefied Natural Gas

LPP	Land Protection Plan
LWCF	Land and Water Conservation Fund
LWD	Large Woody Debris
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSL	Mean Sea Level
MTL	Mean Tide Level
NAGPRA	Native American Graves Repatriation Act
NAS	National Audubon Society
NASA	National Aeronautics and Space Administration
NAVD88	North American Vertical Datum 1988
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
OCBP	Ocean Carbon and Biogeochemistry Program
ODA	State of Oregon Department of Agriculture
ODEQ	State of Oregon Department of Environmental Quality
ODF	State of Oregon Department of Forestry
ODFW	State of Oregon Department of Fish and Wildlife
OPRD	State of Oregon Parks and Recreation Department
OSP	Oregon State Police
PCE	Primary Constituent Element
PDO	Pacific Decadal Oscillation
PFT	Permanent full time
PIBC	Precision Identification Biological Consultants
PIF	Partners in Flight
PPP	Preliminary Project Proposal
PRBO	Point Reyes Bird Observatory
PUP	Pesticide Use Proposal
R1	Region 1 of the FWS (WA, OR, HI, ID)
RNA	Research Natural Area
ROC	Resource of Concern
SAMMS	Service Asset Management System
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SEA	Shoreline Education for Awareness
SHPO	State Historic Preservation Office
SLAMM	Sea Level Affecting Marshes Model
SMU	Species Management Unit

SSSP	Shorebird Sister Schools Program
T & E	Threatened or Endangered Species
TMDL	Total Maximum Daily Load
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers (also, Corps)
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency (also, EPA)
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USHCN	U.S. Historical Climatology Network

H.2 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 a management plan. Analysis of results help managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Alternative. 1. A reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2). 2. Alternatives are different means of accomplishing refuge purposes and goals and contributing to the System mission (Service Manual 602 FW 1.6).

Anadromous. A fish that hatches in freshwater, migrates to the ocean to live and grow, and returns to freshwater to spawn.

Approved refuge boundary. A project boundary which the Regional Director of the U.S. Fish and Wildlife Service approves upon completion of the planning and environmental compliance process. An approved refuge boundary only designates those lands which the Fish and Wildlife Service has authority to acquire and/or manage through various agreements. Approval of a refuge boundary does not grant the Fish and Wildlife Service jurisdiction or control over lands within the boundary, and it does not make lands within the refuge boundary part of the National Wildlife Refuge System. Lands do not become part of the National Wildlife Refuge System unless they are purchased or are placed under an agreement that provides for management as part of the Refuge System.

BIDEH. Biological integrity, diversity and environmental health represented by native fish, wildlife, plants and their habitats as well as those ecological processes that support them.

Biological Diversity. 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 occur (Service Manual 052 FW 1.12B). The System's focus is on indigenous species, biotic communities, and ecological processes. Also referred to as Biodiversity.

Biological Integrity. Composition, structure, and function at the genetic, organism, and community levels that are consistent with natural conditions and the biological processes that shape communities, along with organisms and their genetic material.

Compatible Use. A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the national wildlife refuge (Service Manual 603 FW 2.6). A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Comprehensive Conservation Plan (CCP). A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; and meets other mandates. (Service Manual 602 FW 1.6).

Concern. See definition of issue.

Cover Type. The type of vegetation in an area. Often referred to as percent cover or the % of ground covered by vegetation type (e.g., 20% shrub cover).

Cultural Resources. The remains of sites, structures, or objects used by people in the past.

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 a background literature search, a comprehensive field examination to identify all exposed physical manifestations of cultural resources, or a 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).

Demography. The study of life-history parameters such as adult survival, fledgling success, number of broods raised per year.

Disturbance. Significant alteration of wildlife behavior or habitat structure and composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft over flight).

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.

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 Oregon 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.

Environmental Assessment (EA). 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 Health. The composition, structure, and functioning of soil, water, air, and other nonliving features comparable with historical conditions, including the natural processes that shape the environment.

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).

Fire Regime. A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning.

Focal Resources. Plant and animal species that are most representative of refuge purposes, BIDEH and other FWS and ecosystem priorities. Conservation and management of these species will guide refuge management in the future. See Priority Resources of Concern and Other Benefiting Species.

Forb. A broad-leaved, herbaceous plant; for example, a columbine.

Friends Group. Any formal organization whose mission is to support the goals and purposes of its associated refuge and the National Wildlife Refuge Association overall. Includes friends organizations and cooperative and interpretive associations.

Goal. A 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 1.6).

Habitat. Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat Type. See Vegetation Type.

Habitat Restoration. Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Integrated Pest Management (IPM). Methods of managing undesirable species such as invasive plants: education, prevention, physical or mechanical methods of control, biological control, responsible chemical use, and cultural methods.

Invasive Species. A nonnative species whose introduction causes or is likely to cause economic or environmental harm. Also referred to as exotic or non-native species.

Inventory. A survey that documents the presence, relative abundance, status and/or distribution of abiotic resources, species, habitats, or ecological communities at a particular time. Often referred to as baseline inventory.

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 1.6).

Management Alternative. See Alternative.

Migration. The seasonal movement from one area to another and back.

Mission Statement. Succinct statement of a unit's purpose and reason for being.

Monitoring. The process of collecting information through time to determine changes in the status and/or demographics of abiotic resources, wildlife or plants, habitat, or ecological communities.

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 (Refuge or NWR). A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System.

National Wildlife Refuge System (Refuge System or NWRS). All lands, waters and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish and wildlife, including those that are threatened with extinction.

National Wildlife Refuge System Mission. The mission 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.

Native Species. Species that normally live and thrive in a particular ecosystem.

Non-Governmental Organization (NGO). Any group that is not comprised of Federal, State, tribal, county, city, town, local, or other governmental entities.

Noxious species. Any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. Control of these species is mandated by law.

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 1.6).

Obligate Species. Species that require a specific habitat type or plant species for their existence.

Ocean Acidification. The ongoing decrease in the pH of the Earth's oceans, caused by their uptake of anthropogenic carbon dioxide from the atmosphere.

Other Benefiting Species. Native species, other than priority resources of concern and focal resources that will benefit from management actions.

Paleontology. The study of prehistoric life, including organisms' evolution and interactions with each other and their environments.

Passerine. See songbird

Pinniped. A suborder of carnivores that are marine mammals, have flippers, and eat mostly fish and marine invertebrates (e.g., sea lions, seals).

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., Sitka spruce).

Preferred Alternative. This is the alternative determined (by the decision maker) to best: achieve a refuge's purpose(s), vision, and goals; contributes to the Refuge System mission; addresses the significant issues; and is consistent with principles of sound fish and wildlife management.

Priority Public Use. One of six uses authorized by the National Wildlife Refuge System Improvement Act of 1997 to have priority if found to be compatible with the purposes of a national wildlife refuge or wetland management district. Each of the six uses are wildlife-dependent, recreational uses—hunting, fishing, wildlife observation, photography, environmental education, and interpretation.

Priority Resources of Concern. Habitats that are most representative of refuge BIDEH, as well as other FWS and ecosystem priorities that were chosen as resources that will guide refuge management in the future. See Focal Resources.

Public. Individuals, organizations, and groups; officials of Federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in Service issues and those who do or do not realize that Service decisions may affect them.

Purpose(s) of the Refuge. The purpose of a refuge is 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 (Service Manual 602 FW 1.6).

Refuge Goal. See Goal.

Refuge Purposes. See Purposes of the Refuge.

Restoration. One or more actions that lead to the reestablishment of original or native conditions.

Scoping. The process of obtaining information from the public for input into the planning process for actions and decisions of the U.S. Fish and Wildlife Service.

Songbirds. (Also Passerines) A category of birds that are medium to small, perching land birds. Most are territorial singers and migratory.

Step-down Management Plans. Step-down management plans provide the details necessary to implement management strategies identified in the Comprehensive Conservation Plan (Service Manual 602 FW 1.6).

Strategy. A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6).

Succession. The observed process of change in the species structure of an ecological

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 Oregon within the near future if factors contributing to population decline or habitat degradation or loss continue.

Tidelands. Submerged lands and beaches that are located between ordinary high tide and extreme low tide.

Wildlife-dependent Recreational Use. Use of a national wildlife refuge or wetland management district that involves hunting, fishing, wildlife observation, photography, environmental education, or interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority public uses of the Refuge System.

Vegetation Type, 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 (Service Manual 602 FW 1.6).

H.3 Scientific Names

The following tables contain the common and scientific names of plants and animals that are mentioned in this CCP.

H-1. Common and Scientific Names of Plants Mentioned in this CCP

Common Name	Scientific Name
Baltic rush	*Juncus balticus*
Black twinberry	*Lonicera involucrata*

H-1. Common and Scientific Names of Plants Mentioned in this CCP

Common Name	Scientific Name
Canada thistle	*Cirsium arvense*
Cascara	*Rhamnus purshiana*
Cedar root fungus	*Phytophthora lateralis*
Creeping bentgrass	*Agrostis stolonifera*
Crowberry	*Empetrum nigrum*
Deer fern	*Blechnum spicant*
Douglas-fir	*Pseudotsuga menziesii*
Dwarf birch	*Betula nana*
Dwarf willow	*Salix herbacea*
Eelgrass	*Zostera marina*
English ivy	*Hedera helix*
Evergreen huckleberry	*Vaccinium ovatum*
False huckleberry	*Menziesia ferruginea*
Gorse	*Ulex europaeus*
Grand fir	*Abies grandis*
Henderson's checkermallow	*Sidalcea hendersonii*
Himalayan blackberry	*Rubus armeniacus*
Holly	*Ilex spp.*
Hooker willow	*Salix hookeriana*
Japanese eelgrass	*Zostera japonica*
Licorice fern	*Polypodium glycyrrhiza*
Lodgepole pine or shore pine	*Pinus contorta var. contorta*
Lyngby's sedge	*Carex lyngbyei*
Pacific crabapple	*Malus fusca*
Pacific madrone	*Arbutus menziesii*
Pacific silverweed	*Potentilla anserina spp. pacifica*
Pickleweed	*Salicornia virginica*
Port Orford cedar	*Chamaecyparis lawsoniana*
Red alder	*Alnus rubra*
Red huckleberry	*Vaccinium parvifolium*
Redwood sorrel	*Oxalis oregano*
Reed canarygrass	*Phalaris arundinacea*
Salal	*Gaultheria shallon*
Salmonberry	*Rubus spectabilis*
Saltmarsh bird's beak	*Cordylanthus maritimus maritimus*
Saltmeadow cordgrass	*Spartina patens*
Scotch broom	*Cytisus scoparius*
Seashore saltgrass	*Distichlis spicata*
Seaside arrowgrass	*Triglochin maritima*
Sitka spruce	*Picea sitchensis*
Skunk cabbage	*Symplocarpus foetidus*
Slough sedge	*Carex obnupta*
Smooth cordgrass or saltmarsh cordgrass	*Spartina alterniflora*

H-1. Common and Scientific Names of Plants Mentioned in this CCP

Common Name	Scientific Name
Tall fescue	*Festuca arundinacea*
Thimbleberry	*Rubus parviflorus*
Three-square bulrush	*Scirpus americanus*
Tufted hairgrass	*Deschampsia cespitosa*
Vine maple	*Acer circinatum*
Wax myrtle	*Morella cerifera*
Western hemlock	*Tsuga heterophylla*
Western lily	*Lilium occidentale*
Western red cedar	*Thuja plicata*
Western sword fern	*Polystichum munitum*
Widgeon grass	*Ruppia* spp.

H-2. Common and Scientific Names of Mammals Mentioned in this CCP

Common Name	Scientific Name
Arctic fox	*Alopex lagopus*
Beaver	*Castor canadensis*
Black bear	*Ursus americanus*
Black-tailed deer	*Odocoileus hemionus*
Bobcat	*Lynx rufus*
California myotis	*Myotis californicus*
Deer mouse	*Peromyscus maniculatus*
Harbor seal	*Phoca vitulina*
Hoary bat	*Lasiurus cinereus*
Long-legged myotis	*Myotis volans*
Mink	*Mustela vison*
Mountain lion	*Puma concolor*
Muskrat	*Ondatra zibethicus*
Nutria	*Myocastor coypus*
Raccoon	*Procyon lotor*
Red fox	*Vulpes fulva*
Red tree vole	*Arborimus longicaudus*
River otter	*Lutra canadensis*
Roosevelt elk	*Cervus canadensis roosevelti*
Silver-haired bat	*Lasionycteris noctivagans*
Striped skunk	*Mephitis mephitis*
Townsend's big-eared bat	*Plecotus townsendii*
Vagrant shrew	*Sorex vagrans*

H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
Aleutian Canada goose	*Branta canadensis leucopareia*
American bald eagle	*Haliaeetus leucocephalus*
American bittern	*Botaurus lentiginosus*

H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American pipit	*Anthus rubescens*
American robin	*Turdus migratorius*
American wigeon	*Anas americana*
Band-tailed pigeon	*Columba fasciata*
Barrow's goldeneye	*Bucephala islandica*
Belted kingfisher	*Ceryle alcyon*
Bewick's wren	*Thryomanes bewickii*
Black brant	*Branta bernicla*
Black scoter	*Melanitta nigra*
Black turnstone	*Arenaria melanocephala*
Black-bellied plover	*Pluvialis squatarola*
Blue-winged teal	*Anas discors*
Brandt's cormorant	*Phalacrocorax penicillatus*
Bufflehead	*Bucephala albeola*
California brown pelican	*Pelecanus occidentalis*
Canvasback	*Aythya valisineria*
Caspian tern	*Hydroprogne caspia*
Cedar waxwing	*Bombycilla cedrorum*
Chestnut-backed chickadee	*Parus rufescens*
Cinnamon teal	*Anas cyanoptera*
Common egret	*Bubulcus ibis*
Common goldeneye	*Bucephala clangula*
Common loon	*Gavia immer*
Common merganser	*Mergus merganser*
Common snipe	*Gallinago gallinago*
Common yellowthroat	*Geothlypis trichas*
Dunlin	*Calidris alpina*
Gadwall	*Anas strepera*
Glaucous-winged gull	*Larus glaucescen*
Golden-crowned kinglet	*Regulus satrapa*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Great horned owl	*Bubo virginianus*
Greater scaup	*Aythya marila*
Greater white-fronted goose	*Anser albifrons*
Greater yellowlegs	*Tringa melanoleuca*
Green-winged teal	*Anas crecca*
Hairy woodpecker	*Picoides villosus*
Harlequin duck	*Histrionicus histrionicus*
Hermit thrush	*Catharus guttatus*
Hermit warbler	*Dendroica occidentalis*

H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
Hooded merganser	*Lophodytes cucullatus*
Horned grebe	*Podiceps auritus*
House finch	*Carpodacus mexicanus*
Killdeer	*Charadrius vociferus*
Least sandpiper	*Calidris minutilla*
Lesser scaup	*Aythya affinis*
Lesser yellowlegs	*Tringa flavipes*
Long-billed curlew	*Numenius americanus*
Long-billed dowitcher	*Limnodromus scolopaceus*
Long-tailed duck	*Clangula hyemalis*
MacGillivray's warbler	*Oporornis tolmiei*
Mallard	*Anas platyrhynchos*
Marbled godwit	*Limosa fedoa*
Marbled murrelet	*Brachyramphus marmoratus*
Merlin	*Falco columbarius*
Mourning dove	*Zenaida macroura*
Northern flicker	*Colaptes auratus*
Northern harrier	*Circus cyaneus*
Northern pintail	*Anas acuta*
Northern pygmy-owl	*Glaucidium gnoma*
Northern saw-whet owl	*Aegolius acadicus*
Northern shoveler	*Anas clypeata*
Orange-crowned warbler	*Vermivora celata*
Pacific golden plover	*Pluvialis fulva*
Pacific wren	*Troglodytes pacificus*
Pacific-slope flycatcher	*Empidonax difficilis*
Pelagic cormorant	*Phalacrocorax pelagicus*
Peregrine falcon	*Falco peregrinus*
Pied-billed grebe	*Podilymbus podiceps*
Pileated woodpecker	*Dryocopus pileatus*
Purple finch	*Carpodacus purpureus*
Red crossbill	*Loxia curvirostra*
Red phalarope	*Phalaropus fulicarius*
Red-breasted nuthatch	*Sitta canadensis*
Red-breasted merganser	*Mergus serrator*
Redhead	*Aythya americana*
Red-necked phalarope	*Phalaropus lobatus*
Red-shouldered hawk	*Buteo lineatus*
Ring-necked duck	*Aythya collaris*
Ruddy duck	*Oxyura jamaicensis*
Ruff	*Philomachus pugnax*
Rufous hummingbird	*Selasphorus rufus*
Sanderling	*Calidris alba*

H-3. Common and Scientific Names of Birds Mentioned in this CCP

Common Name	Scientific Name
Savannah sparrow	*Passerculus sandwichensis*
Semi-palmated plover	*Charadrius semipalmatus*
Sharp-tailed sandpiper	*Calidris acuminata*
Short-billed dowitcher	*Limnodromus griseus*
Snow goose	*Chen caerulescens*
Sora	*Porzana carolina*
Spotted sandpiper	*Actitis macularius*
Steller’s jay	*Cyanocitta stelleri*
Surf scoter	*Melanitta perspicillata*
Swainson’s thrush	*Catharus ustulatus*
Townsend’s warbler	*Dendroica townsendi*
Tundra swan	*Cygnus columbianus*
Varied thrush	*Ixoreus naevius*
Vaux’s swift	*Chaetura vauxi*
Western Canada goose	*Branta canadensis moffitti*
Western grebe	*Aechmophorus occidentalis*
Western sandpiper	*Calidris mauri*
Western screech owl	*Megascops kennicottii*
Western snowy plover	*Charadrius alexandrinus nivosus*
Whimbrel	*Numenius phaeopus*
White-winged scoter	*Melanitta fusca*
Willet	*Tringa semipalmata*
Wilson’s snipe	*Gallinago delicata*
Wood duck	*Aix sponsa*
Yellow-rumped warbler	*Dendroica coronata*

H-4. Common and Scientific Names of Amphibians and Reptiles Mentioned in this CCP

Common Name	Scientific Name
Clouded salamander	*Aneides ferreus*
Coastal tailed frog	*Ascaphus truei*
Ensatina salamander	*Ensatina eschscholtzii*
Garter snake	*Thamnophis sirtalis*
Northwestern salamander	*Ambystoma gracile*
Northern red-legged frog	*Rana aurora*
Pacific giant salamander	*Dicamptodon tenebrosus*
Pacific tree frog	*Pseudacris regilla*
Rough-skinned newt	*Taricha granulosa*
Southern alligator lizard	*Elgaria multicarinata*
Southern torrent salamander	*Rhyacotriton variegatus*
Western red-backed salamander	*Plethodon vehiculum*
Western pond turtle	*Actinemys marmorata*
Western toad	*Bufo boreas*

H-5. Common and Scientific Names of Invertebrates Mentioned in this CCP

Common Name	Scientific Name
Asian tunicate	*Styela clava*
Chinese mitten crab	*Eriocheir sinensis*
Dungeness crab	*Metacarcinus magister*
European green crab	*Carcinus maenas*
European saltmarsh snail	*Genus species*
Ghost shrimp	*Callianassa californiensus*
Griffen’s isopod	*Orthione griffenis*
Harris mud crab	*Rhithropanopeus harrisii*
Japanese orange-striped sea anemone	*Diadumene lineata*
Japanese oyster	*Crassostrea gigas*
Lacy crust bryozoan	*Conopeum tenuissimum Canu*
Mud shrimp	*Upogebia pugettensis*
New Zealand burrowing isopod	*Sphaeroma quoianum*
New Zealand mudsnail	*Potamopyrgus antipodarum*
Softshell clam	*Mya arenaria*

H-6. Common and Scientific Names of Fish Mentioned in this CCP

Common Name	Scientific Name
American shad	*Alosa sapidissima*
Bluegill	*Lepomis macrochirus*
Brown bullhead	*Ameiurus nebulosus*
Chinook salmon	*Oncorhynchus tshawytscha*
Chum salmon	*Oncorhynchus keta*
Coastal cutthroat trout	*Oncorhynchus clarki clarki*
Coho salmon	*Oncorhynchus kisutch*
English sole	*Parophrys vetulus*
Green sturgeon	*Acipenser medirostris*
Largemouth bass	*Micropterus salmoides*
Mosquito fish	*Gambusia affinis*
Pacific lamprey	*Entosphenus tridentatus*
Pacific smelt (eulachon)	*Thaleichthys pacificus*
Redtail surf perch	*Amphistichus rhodoterus*
Shiner perch	*Cymatogaster aggregata*
Smallmouth bass	*Micropterus dolomieu*
Sockeye salmon	*Oncorhynchus nerka*
Starry flounder	*Platichthys stellatus*
Steelhead	*Oncorhynchus mykiss*
Striped bass	*Morone saxatilis*
Western brook lamprey	*Lampetra planeri*
Yellow perch	*Perca flavescens*

Appendix I. CCP Team Members

The CCP was developed primarily by the core team members. The team sought expert advice and review from other professionals from several different agencies and organizations. Extended team members provided critical input during wildlife and habitat and visitor services reviews early in the process and continued to provide review and comment as the document evolved. Core and extended team members are listed below.

Core Planning Team

Name	Title	Organization
Roy Lowe	Project Leader, Oregon Coast National Wildlife Refuge Complex	USFWS
Rebecca Chuck	Deputy Project Leader, Oregon Coast National Wildlife Refuge Complex	USFWS
Shawn Stephensen	Refuge Biologist, Oregon Coast National Wildlife Refuge Complex	USFWS
Dave Ledig	South Coast Refuge Manager, Oregon Coast National Wildlife Refuge Complex	USFWS
Dawn Grafe	Supervisory Park Ranger	USFWS
Jane Bardolf (departed 8/2011)	Conservation Planner, Division of Planning, Visitor Services, and Transportation, Region 1	USFWS
Khemarith So (became planner in 10/2011)	Conservation Planner, Division of Planning, Visitor Services, and Transportation, Region 1	USFWS

Extended Planning Team and Reviewers

Name	Area of Assistance	Organization
Robyn Thorson	General review	USFWS
Robin West	General review	USFWS
Ben Harrison	CCP quality and consistency	USFWS
Bob Flores	General review	USFWS
Chuck Houghten	CCP quality and consistency	USFWS
Scott McCarthy	CCP quality and consistency	USFWS
Mike Marxen	Visitor services goals and objectives	USFWS
Cathy Sheppard (retired)	Realty issues	USFWS
Wayne Hill	Realty issues	USFWS
Dave Drescher	GIS coordination and mapping	USFWS
Brad Bortner (retired)	Migratory birds	USFWS
Fred Paveglio (retired)	Biological goals and objectives	USFWS
Kevin Kilbride	Biological goals and objectives, Integrated Pest Management	USFWS
Joe Engler	Biological goals and objectives	USFWS
Bridgette Flanders-Wanner	Biological goals and objectives	USFWS

Extended Planning Team and Reviewers

Name	Area of Assistance	Organization
Nick Valentine	Cultural resources	USFWS
Erin Carver	Socio-economics	USFWS
Sam Lohr	Fisheries	USFWS
Scott Neumann	Law enforcement issues	USFWS
Daniel Huckel	Law enforcement issues	USFWS
Nicole McCarthy	Technical writing and editing	USFWS
Lara Bjork	Technical editing	SWCA Environmental Consultants
Joan Jewett	Public involvement/communication	USFWS
Patrick Stark	Layout and design	USFWS
Craig Cornu	Tidal marsh ecology	South Slough National Estuarine Research Reserve
Tom Gaskill	Public use	South Slough National Estuarine Research Reserve
Lowell Lea	Law enforcement issues	Oregon State Police
Calum Stevenson	Public use	Oregon Parks and Recreation Department
Brad Bales	Waterfowl	Oregon Department of Fish and Wildlife
Mike Gray	Fisheries	Oregon Department of Fish and Wildlife
Scott Groth	Shellfish	Oregon Department of Fish and Wildlife
Stuart Love	Hunting, fishing, waterfowl, elk	Oregon Department of Fish and Wildlife
Laura Brophy	Tidal marsh ecology and plant communities	Green Point Consulting
Don Ivy	Tribal interests	Coquille Indian Tribe
Ed Metcalf	Tribal interests	Coquille Indian Tribe
Rudy Schuster	Visitor Services	USGS – Fort Collins

Appendix J. Public Involvement

Public involvement was sought throughout the development of the CCP, starting in June 2010 with the preparation of a Public Outreach Plan. Public involvement strategies included face-to-face meetings or phone conversations with key agencies, federally elected officials (or their aides), Tribal representatives, and local refuge users. The Refuge also held open houses and sent planning updates to inform the public, invite discussion, and solicit feedback. This CCP was developed concurrently with CCPs for two other refuges within the Oregon Coast NWR Complex (Nestucca Bay and Siletz Bay NWRs), so briefings and planning updates covered all three refuges.

A mailing list (postal and email) of approximately 650 persons and organizations is maintained at the Refuge Complex for Bandon Marsh, Nestucca Bay, and Siletz Bay NWRs and was used to distribute planning updates and public meeting announcements. Below is a brief summary of the events, meetings, and outreach tools that were used in our Bandon Marsh NWR CCP public involvement efforts.

Meetings with Congressional Representatives and/or Their Aides:

- April 7, 2011. Project Leader Roy Lowe met with Travis Joseph of Representative Peter DeFazio’s staff to update the Representative’s office on the status of the CCP process. Location: Washington, D.C.
- April 7, 2011. Project Leader Roy Lowe met with Michele Miranda of Senator Ron Wyden’s staff to update the Senator’s office on the status of the CCP process. Location: Washington, D.C.
- April 7, 2011. Project Leader Roy Lowe met with Jeremiah Baumann of Senator Jeff Merkley’s staff to update the Senator’s office on the status of the CCP process. Location: Washington, D.C.
- February 10, 2012. Project Leader Roy Lowe and Refuge Manager David Ledig met with Amy Amrhein of Senator Jeff Merkley’s staff to discuss the planning process and draft alternatives. Location: Bandon Marsh NWR.
- February 13, 2012. Refuge Manager David Ledig met with Mary Gautreaux of Senator Jeff Merkley’s staff to discuss the planning process and draft alternatives. Location: Bandon Marsh NWR.
- March 30, 2012. Project Leader Roy Lowe met with Travis Joseph of Representative Peter DeFazio’s staff to discuss the planning process and draft alternatives. Location: Washington, D.C.
- March 30, 2012. Project Leader Roy Lowe met with Michele Miranda and Alexandra Hackbarth of Senator Ron Wyden’s staff to discuss the planning process and draft alternatives. Location: Washington, D.C.
- March 30, 2012. Project Leader Roy Lowe met with Adrian Deveny of Senator Jeff Merkley’s staff to discuss the planning process and draft alternatives. Location: Washington, D.C.

Meetings with Tribal Officials:

- February 9, 2011. Project Leader Roy Lowe and refuge staff met with the Tribal Council of the Coquille Indian Tribe to discuss preliminary draft alternatives. Location: Coquille Indian Tribal Offices, North Bend, OR.

Meetings with Local Elected Officials:

- June 15, 2011. Project Leader Roy Lowe and refuge staff met with the City of Bandon Manager and Planner to discuss public use facilities and other issues.
- June 28, 2011. Deputy Project Leader Rebecca Chuck and refuge staff met with Robin Miller and Gina Dearth of the Port of Bandon to discuss the potential of their building along the Coquille River to serve as a visitor center.
- October 12, 2011. Project Leader Roy Lowe met with Coos County Commissioner Cam Perry and updated him on the CCP planning process and discussed preliminary draft alternatives.
- October 19, 2011. Project Leader Roy Lowe and Refuge Manager David Ledig met with Coos County Commissioner Fred Messerle and updated him on the CCP planning process and discussed preliminary draft alternatives.
- September 20, 2012. Project Leader Roy Lowe and Refuge Manager David Ledig met with Bandon City Council Member Claudine Hundhausen at the Bandon Marsh office and provided update on the status of Bandon Marsh CCP and Land Protection Plan (LPP) study.

Meetings with Local/Regional Community Organizations Involving CCP Issues:

- September 25, 2010. Refuge Manager David Ledig presented the Bandon Marsh NWR/Ni-les'tun Unit Restoration to approximately 75 Ducks Unlimited members at their annual meeting. The CCP was discussed in the presentation, and comments on Bandon Marsh NWR management were solicited.
- October 24, 2010. Project Leader Roy Lowe presented the Bandon Marsh NWR/Ni-les'tun Restoration to 40 members of Shoreline Education for Awareness/Friends of Southern Oregon Coastal Refuges. The CCP was discussed in the presentation, and comments on Bandon Marsh NWR management were solicited.
- January 1, 2011. Refuge Manager David Ledig presented the Bandon Marsh NWR/Ni-les'tun Unit Restoration to approximately 25 Audubon Christmas Bird Count (CBC) participants at their annual Coquille Valley CBC meeting. The CCP was discussed in the presentation, and comments on Bandon Marsh NWR management were solicited.
- September 26, 2011. Refuge Manager David Ledig presented the Seabirds of the Bandon Area to approximately 75 individuals at a meeting concerning impacts of artificial lighting on wildlife. The Bandon Marsh CCP was discussed in the presentation, and comments on Bandon Marsh NWR management were solicited.
- December 1, 2011. Project Leader Roy Lowe presented the Bandon Marsh NWR/Ni-les'tun Restoration to approximately 45 staff and students at the Oregon State University – Hatfield Marine Science Center in Newport, OR. The Bandon Marsh CCP was discussed in the presentation, and comments on Bandon Marsh NWR management were solicited.
- October 6, 2012. Refuge Manager David Ledig updated the Board and Members (30 individuals) at the Annual Shoreline for Education Meeting on the status of the Bandon Marsh CCP and LPP study, and comments were solicited.
- October 9, 2012. Project Leader Roy Lowe presented the Bandon Marsh NWR/Ni-les'tun Restoration to approximately 30 members of the Portland Audubon Society in Portland, OR. The Bandon Marsh, Nestucca Bay, and Siletz Bay CCPs were discussed at the end of the presentation, and comments on management were solicited.
- October 10, 2012. Project Leader Roy Lowe presented the Bandon Marsh NWR/Ni-les'tun Restoration project to approximately 20 members of the Cape Arago Audubon Society. The Bandon Marsh CCP was discussed in the presentation, and comments on Bandon Marsh NWR management were solicited,

- October 19, 2012. Project Leader Roy Lowe and Refuge Manager David Ledig presented a program on the Bandon Marsh NWR/Ni-les'tun Restoration, which included status of the Bandon Marsh CCP and LPP study, to 25 members of the Bandon Rotary Club. Comments on the CCP were solicited at the meeting.

Meetings with Agency Representatives:

- March 15-16, 2010. Representatives from ODFW, South Slough National Estuarine Research Reserve, Oregon Department of State Lands, and other USFWS programs participated in the on-site Bandon Marsh NWR Wildlife and Habitat Review.
- April 15, 2010. Representatives from OPRD, ODFW, U.S. Geological Survey, South Slough National Estuarine Research Reserve, Oregon State Police, Shoreline Education for Awareness, the Port of Bandon, the City of Bandon, and the USFWS extended team participated in the on-site Bandon Marsh NWR Visitor Services Review.
- December 1, 2010. Representatives from the Region1 Regional Office and Refuge Project Leaders met with the ODFW to discuss the CCP process and other issues of interest. Location: Tualatin River NWR, Sherwood, OR.
- August 20, 2011. Project Leader Roy Lowe met with ODFW Director Roy Elicker during NOAA MPOC dedication event in Newport, OR, and updated him on the status of Bandon Marsh, Nestucca Bay, and Siletz Bay CCPs.
- January 9, 2012. Refuge Manager David Ledig presented the Bandon Marsh NWR/Ni-les'tun Unit Restoration to approximately 25 biologists (ODFW, BLM, and private consultants) at their monthly Coos Bay Biologists Meeting. The CCP and LPP study were discussed in the presentation, and comments on Bandon Marsh NWR management were solicited.
- January 30, 2012. Project Leader Roy Lowe and refuge staff met with ODFW representatives Mike Gray, Stuart Love, and Scott Groth to discuss the ODFW's comments regarding draft alternatives for hunting and fishing. Location: ODFW office, Charleston, OR.
- February 14, 2012. Refuge Manager David Ledig presented the Bandon Marsh NWR/Ni-les'tun Unit Restoration to the Chairperson (Julie Miller) of the Bandon Chamber of Commerce. The CCP and LPP study were discussed in the presentation, and comments on Bandon Marsh NWR management were solicited.
- April 18, 2012. Refuge Manager David Ledig presented the Bandon Marsh NWR/Ni-les'tun Unit Restoration to approximately 35 researchers/biologists/land managers at the Coquille River Climate Change Vulnerability Meeting. The CCP and LPP study were discussed in the presentation.
- October 31, 2012. Refuge Manager David Ledig and refuge staff introduced the Bandon Marsh CCP and LPP study process to Jim Grimes of the Oregon Department of State Lands. The Draft CCP was presented and comments were solicited.

Public Open Houses/Scoping Sessions:

- December 2, 2010. Public scoping meeting at the Bandon Community Center, Bandon, OR.
  Purpose and format: To provide information on CCP process and preliminary issues to be addressed. The public scoping meeting was in an open-house format. At the open house, refuge staff and the lead planner explained the CCP process; refuge purposes, vision, and management; and preliminary management issues, concerns, and opportunities that had been identified early in the planning process. They also answered questions from attendees and took written comments.
  Attendance: A total of 20 private citizens and representatives from various organizations attended the open house, providing comments on the issues and opportunities presented.

- November 9, 2011. Public Draft Alternatives meeting at the Bandon Community Center, Bandon, OR.
  Purpose and format: To gather public input on the draft alternatives for Bandon Marsh NWR. Format: The draft alternatives meeting was in an open-house format. At the open house, refuge staff gave a presentation on the CCP process, progress to date, how the draft alternatives were developed, and future opportunities for public input. The public was invited to submit comments either in writing or verbally. The attendees then had the opportunity to visit four tables staffed by refuge staff and the lead planner. Each table had a scribe to record verbal comments.
  Attendance: 35 people attended the meeting including Coos County Commissioner Robert Main.

Other Meetings:

- August 17, 2010. Preplanning briefing for Region 1 Refuge Chief and staff, USFWS Regional Office, Portland, OR. Refuge CCP team participated by videoconference.
- May 23-25, 2011. Facilities Review attended by CCP team, contractors from Vigil-Agrimis, and Visitor Services and Communication staff from USFWS Regional Office.
- July 27, 2011. Draft Alternatives briefing for Region 1 Refuge Chief and staff, USFWS Regional Office, Portland, OR. Refuge CCP team participated by videoconference.

Press Coverage: (all three refuges)

- November 5, 2010. News release announcing public scoping meetings sent to 17 newspapers and other online venues. The news release resulted in articles being written or published in the following venues. This list is not inclusive.
  - November 5, 2010 http://www.fws.gov/oregoncoast/news.html
  - November 19, 2010 Medford Mail Tribune
  - November 19, 2010 Pacific City Sun
  - November 25, 2010 Daily Astorian
  - November 26, 2010 and December 2 and 9, 2010 Bandon Western World
  - November 27, 2010 Newport News-Times
  - November 29, 2010 Tillamook Headlight Herald
  - November 29, 2010 Oregon Birders On Line posting
  - December 1, 2010 Lincoln City News Guard
  - December 4, 2010 TheWorldLink.com (Coos Bay)
  - January 31, 2011 Neskowin Community Association online
- October 28, 2011. News release announcing availability of preliminary draft alternatives and public open house meetings sent to 17 coastal newspapers and other online venues and resulted in articles in the following media. This list is not inclusive. The LPP process was separated from the CCP in February 2012. Press coverage regarding the LPP following the separation is not included in this list.
  - October 28, 2010 http://www.fws.gov/oregoncoast
  - October 31, 2011 Salem Statesman Journal
  - November 2, 2011 Lincoln County Birder and Nature Observation online
  - November 3, 2011 Bandon Western World
  - November 22, 2011 Lincoln City News Guard
  - November 4, 2011 Pacific City Sun
  - December 8, 2011 Bandon Western World (Bandon Marsh expansion studied by USFWS)

  - December 13, 2011 The World (Editorial)
  - December 22, 2011 Bandon Western World (Port to USFWS: Land is not for sale)
  - December 22, 2011 Bandon Western World (Letter to the editor)
  - December 26, 2011 The World (Port of Bandon refuses sale to refuge)
  - December 29, 2011 Bandon Western World (Letter to the editor)
  - January 4, 2012 The World (Letter to the editor)
  - January 5, 2012 Bandon Western World (Council hopes ecotourism idea will fly)
  - January 9, 2012 The World (Group fights marsh expansion)
  - January 9, 2012 The World (Is ecotourism a good fit for Bandon?)
  - January 10, 2012 The World (Crowd: Say no to marsh expansion)
  - January 10, 2012 Bandon Western World (Editorial)
  - January 12, 2012 Bandon Western World (Marsh expansion meets stiff opposition)
  - January 19, 2012 Bandon Western World (Letters explain USFWS marsh expansion proposal, port's position)
  - January 25, 2012 The World (Letter to the editor)
  - January 31, 2012 The World (Letter to the editor)
- September 18, 2012. News release announcing availability of the draft CCP/EAs for public review and comment sent to 17 coastal newspapers and other online venues and resulted in articles in the following media. This list is not inclusive.
  - September 21, 2012 Lincoln City News Guard (Wildlife refuge plans available for review)
  - September 27, 2012 Bandon Western World (USFWS releases marsh plans)
- September 20, 2012. Project Leader Roy Lowe and Refuge Manager David Ledig met with Bandon Western World Editor, Amy Strong, to discuss the availability of the Bandon Marsh Draft CCP/EA and the status of the LPP study.
- September 27, 2012. Refuge Manager David Ledig telephoned and spoke to the Coquille Valley Sentinel Editor, Jean Ivy, to discuss the September 18 news release.
- September 27, 2012. Refuge Manager David Ledig telephoned and spoke to The Myrtle Point Herald Editor, Mary Schamehorn, to discuss the September 18 news release.
- December 21, 2012. News release announcing availability of the draft waterfowl hunt plans for public review and comment sent to 19 coastal newspapers and other media and resulted in following articles. This list is not inclusive.
  - December 26, 2012 Sentinel (Draft waterfowl hunt plans for coastal refuges available for public review and comment)
  - December 28, 2012 Pacific City Sun (Public comment wanted on waterfowl hunting plan)
  - January 2, 2013 Salem Statesman Journal (Waterfowl hunt plans for Oregon coastal refuges open for comments)
  - January 3, 2013 The World (Influence hunting at Bandon Marsh)
  - January 7, 2013 The World (Help draft plan for Bandon waterfowl hunting)

Planning Updates:

- November 2010: Planning Update #1 sent to a mailing list of approximately 380 recipients, including private individuals, government agencies, and non-governmental organizations. The planning update included information on how and where to send comments as well as notification of upcoming public open house meetings. In addition, the Planning Update was posted on the refuge website, and copies were available at the CCP open houses and at the refuge office.

- November 2011: Planning Update #2, summarizing preliminary draft alternatives, was distributed to a mailing list of approximately 400 recipients. This planning update included notice of upcoming public open house meeting and provided information on how and where to comment. In addition, the Planning Update was posted on the refuge website.
- September 2012: Planning Update #3 was distributed to a mailing list of approximately 600 recipients and posted on the refuge website. This planning update announced the availability of draft CCP/EAs for public review and comment, provided information on how and where to comment, summarized the public involvement to date, and detailed the different draft management alternatives.
- April 2013: Planning Update #4, announcing the completion of the final CCPs, will be released concurrently with this document. This planning update will summarize comments received on the draft CCP/EAs, detail the Refuges' management directions, and provide information on how and where to obtain copies of the final plans.

Other Tools:

- Website at http://www.fws.gov/oregoncoast/ccp_nes_slz_bdm.htm featuring CCP information, planning updates, maps, press releases, and scoping forms.
- March 2010: Letters sent to invited participants for the Wildlife and Habitat Review.
- April 2010: Letters sent to invited participants for the Visitor Services Review.
- August 25, 2011: Letters sent from Refuge to extended team members updating them on the planning process draft alternatives and inviting their participation. Team agencies included ODFW and OPRD.
- August 25, 2011: Letters sent from Refuge to Don Ivy and Ed Metcalf of the Coquille Indian Tribe updating them on the planning process and draft alternatives and inviting their further participation.
- November 17, 2011. Letters sent from Refuge to landowners within the Bandon Marsh NWR LPP study area informing them on the planning process and inviting their further participation.

Federal Register Notices:

- November 29, 2010: Federal Register published Notice of Intent to Prepare a Draft Comprehensive Conservation Plan and Associated NEPA Document; and Notice of Public Meetings (75 FR 73121).
- September 17, 2012: Federal Register published Notice of Availability of the Draft Comprehensive Conservation Plan and Environmental Assessment; and request for comments (77 FR 57107).
- Federal Register Notice of Availability of the Final Comprehensive Conservation Plan and Finding of No Significant Impact for Environmental Assessment published concurrently with release of this document.

Appendix K. Comments Received During Public/Agency Review Period and Service Responses

K.1 Introduction

The U.S. Fish and Wildlife Service (USFWS or Service) received comments from 47 entities regarding the Draft Comprehensive Conservation Plan/Environmental Assessment (CCP/EA) for Bandon Marsh National Wildlife Refuge (NWR or Refuge) during the 30-day comment period (Table K-1). Comments from nine of those entities also addressed the Nestucca Bay and Siletz Bay NWRs Draft CCP/EAs, which were being developed concurrently. All written comments were reviewed and organized so that an objective analysis, summary, and presentation of the comments could be made.

Each original piece of correspondence was assigned an identification number and identified with the last name and first initial of the individual commenter who signed the letter. Note that for simplicity's sake, the word "letter" is generally used throughout this appendix to refer to any comment or reference document received, whether by letter, fax, email, or comment form. Multiple correspondences from a commenter are counted as one comment letter.

To help analyze the nature and extent of comments received, a number of themes and subthemes were identified within the letters. Comments were coded with the identified themes. Due to the similarity of written comments received, similar comments on a theme were grouped together, and the Service response applies to the comments as a group. Comments that fell outside the scope of the CCP were also considered and were responded to as appropriate.

Table K-1. Source of Comments

Affiliation/Entities	Number of Commenters (September 17, 2012 through October 22, 2012)
Organizations	2
General Public	45
Total	**47**

K.2 Changes Made to the Final CCP

The CCP planning team reviewed and evaluated all of the comments received during the Draft CCP/EA comment period. In some cases, the management direction has been either clarified or modified based upon these comments. Table K-2 shows the major changes between the draft and the final CCP. For additional information, see Chapter 2 and Figure 2-1 in the CCP.

Table K-2. Summary of Changes to Management Direction between the Draft and Final CCP

Key Theme/issue	Alternative C in Draft CCP	Management Direction in Final CCP
Upland Forest Habitat		
Restoration of grasslands (former pastures) to forest	29 acres restored. Manage to accelerate restoration to old-growth forest, including control of invasive species, understory establishment, placement of nurse logs.	No change from draft plan.
Management of existing forest	39 acres actively managed. Continue control of invasive species. Use appropriate forest management techniques (e.g., girdling, falling) to thin trees using multiple entry approach, where needed.	No change from draft plan.
Forested Wetlands and Stream-Riparian Habitat		
Forested wetlands and stream-riparian habitat (wet-mesic Sitka spruce-western hemlock forest)	79 acres of forested wetlands protected and maintained. Continue invasive species control.	No change from draft plan.
	11 acres restored. Import and place nurse logs. Control invasive species. Control grasses with mechanical/mowing and herbicides to protect establishing trees/shrubs. Mechanical removal to thin trees, as needed.	
Coastal stream-riparian corridor	0.5 mile protected and maintained. Control invasive species. Install logs, woody debris, and root wads in channels to promote diverse hydrological and physical structure. Remove fish passage barriers.	No change from draft plan.
Estuarine Habitat		
Salt marsh and intertidal mudflats	Protect and maintain integrity of 750 acres of estuarine habitats through monitoring for presence of invasive species, salmonid use (woody debris installations), vegetation response, invertebrates, water quality parameters, biofilm/algae abundance and composition, and water quality.	No change from draft plan.
Monitoring and Research		
Status monitoring	Continue and expand existing data collection. Collect additional data on fish, amphibians, small mammals, plants, migratory songbirds, water quality, and forest diseases and pests.	No change from draft plan.
Effectiveness monitoring	Monitor CCP and other step-down plan objectives.	No change from draft plan.
Research and scientific assessments	Continue existing research. Identify priority and long-term research needs and cooperate with partners to accomplish. Complete water resource assessment for Refuge.	No change from draft plan.
Hunting		
Bandon Marsh Unit	Waterfowl hunting allowed on 256 acres at Bandon Marsh Unit outside of Bandon City Limits 7 days per week per Oregon Department of Fish and Wildlife (ODFW) regulations.	No change from draft plan.

Table K-2. Summary of Changes to Management Direction between the Draft and Final CCP

Key Theme/issue	Alternative C in Draft CCP	Management Direction in Final CCP
Ni-les'tun Unit	Allow waterfowl hunting on 300 acres of Ni-les'tun Unit 3 days per week.	Same as draft plan but with the following modification: Allow waterfowl hunting on 299 acres of Ni-les'tun Unit 3 days per week.
Wildlife Observation and Photography		
Wildlife observation and photography – Bandon Marsh Unit	Bandon Marsh Unit remains open 7 days per week.	No change from draft plan.
Wildlife observation and photography – Ni-les'tun Unit	Viewing deck and marsh trail open daily. Allow unrestricted walking on part of the Unit daily during non-hunting season (Feb.-Sept.). Close Unit to unrestricted walking during hunting season (Oct.-Jan.). Develop trail connecting restored forest above office with parking lot.	Same as draft plan but with the following clarification: To avoid conflicts between visitors participating in waterfowl hunting and those engaged in wildlife observation or photography, the Ni-les'tun Unit will be closed to unrestricted walking from Oct. 1 through Jan. 31 annually, which coincides with the waterfowl hunting season.
Fishing		
Fishing and clamming – Bandon Marsh Unit	Allowed per ODFW regulations.	Same as draft plan but with the following clarification: Allowed per ODFW regulations and subject to Oregon Department of Agriculture (ODA) and ODFW shellfish safety closures.
Fishing and clamming – Ni-les'tun Unit	Tidally influenced portions of Fahys, Redd, and No Name Creeks open to fishing for cutthroat trout only, per state regulations except artificial lures only and season closes on Sept. 30. Explore options for providing clamming opportunities.	Same as draft plan but with the following clarification: Allow artificial fly and lure fishing for cutthroat trout only, in accordance with refuge and ODFW regulations regarding allowable methods, on the tidal portions of Fahys, No Name, and Redd Creeks on the Ni-les'tun Unit. Fishing season closes on Sept. 30. Explore options for providing clamming opportunities.
Interpretation		
Interpretation	Maintain existing interpretive structures and panels on both units. Develop interpretive panels on new trail system. Offer staff- or partner-led activities (e.g., walks and paddle trips, community-based offsite programs).	No change from draft plan.

Table K-2. Summary of Changes to Management Direction between the Draft and Final CCP

Key Theme/issue	Alternative C in Draft CCP	Management Direction in Final CCP
Environmental Education		
Environmental education (EE) programs	Partners take lead on developing EE center and work with Service to develop curriculum. Continue existing EE programs.	No change from draft plan.
Facilities		
Facilities	Build a small administrative office and a visitor contact station at current office site. Maintain existing and develop new trails and interpretive panels. Participate in a community-based visitor information center off the Refuge.	Same as draft plan but also: Utilize habitat-appropriate native plants for landscaping around buildings, kiosks, and other public use facilities.
Climate Change Adaptation		
Reduce carbon footprint	Replace current vehicles with more fuel-efficient vehicles. Any new or replaced facilities will be appropriately sized and energy-efficient. Use energy-efficient land management techniques where feasible and in line with management goals. Explore ways of offsetting carbon balance, such as carbon sequestration.	No change from draft plan.

K.3 Summary of Comments Received and Service Responses

Wildlife and Habitat Management

1. **Comment:** A primary goal of the Refuge should be to restore refuge lands to pre-European conditions.

   Response: The Service agrees with the goal of restoring refuge lands to historic conditions, defined as the conditions we believe were present prior to substantial human-related changes to the landscape (601 FW 3). The National Wildlife Refuge System Administration Act, as amended, directs the Service to ensure that the biological integrity, diversity, and environmental health (BIDEH) of the National Wildlife Refuge System (NWRS or Refuge System) are maintained for the benefit of present and future generations of Americans. The BIDEH policy (601 FW 3) defines *biological integrity* as “the 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.” *Biological diversity* is defined as “the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur.” *Environmental health* is defined as the “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.” In simple terms, elements of BIDEH are represented by native fish, wildlife, plants, and their habitats, as well as those ecological processes that support them. The BIDEH policy directs refuges to move toward historic conditions unless (a) this would conflict with refuge purpose; (b) no feasible alternative exists for accomplishing refuge purpose other than management for non-historic conditions; or (c) management for non-historic conditions would make a greater contribution to BIDEH at a larger landscape scale (Schroeder et al. 2004).

2. **Comment:** Support for the increased habitat monitoring and management activities presented in Alternative C, the preferred alternative.

   Response: The Service acknowledges the support for habitat monitoring and management activities presented in the preferred alternative.

3. **Comment:** Support for the continued restoration of natural hydrological functions to create and maintain marsh habitat for the benefit of economically important fish species and non-game wildlife species, including shorebirds.

   Response: As stated within Chapter 4 of the CCP, the Refuge System is directed to consider and provide protection for the broad spectrum of fish, wildlife, and habitat resources found on the Refuge and in the associated ecosystem that represents the BIDEH of refuge habitat. To meet this directive, one goal of the Refuge System is to conserve and restore, where appropriate, critical ecosystems (e.g., tidal and freshwater marshes) and ecological processes (e.g., natural hydrological conditions) characteristic of those ecosystems. In addition, the Service identifies resources of concern that are:

   > "all plant and/or animal species, species groups, or communities specifically identified in refuge purpose(s), System mission, or international, national, regional, state, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts (620 FW 1.4G)…"
   >
   > "Habitats or plant communities are resources of concern when they are specifically identified in refuge purposes, when they support species or species groups identified in refuge purposes, when they support NWRS resources of concern, and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health."

   Therefore, resources of concern for a refuge may be a species or species group, or the habitat/plant community that supports a priority species/species groups. At Bandon Marsh NWR, this includes salt marsh and freshwater habitats that support economically and culturally important fish species as well as non-game wildlife, including shorebirds. The Service's intention is to use a "surrogate species" approach, which utilizes individual species or a suite of species to represent the habitat and/or management needs of a larger set of species (USFWS 2012e).

4. **Comment:** The recently restored marsh within the Ni-les'tun Unit has reestablished a mosquito nuisance issue, and the Service should take this into consideration with any future restoration activities on refuge lands.

Response: Under draft Service policy (72 Federal Register 71939), mosquito populations on refuge lands are allowed to fluctuate and function unimpeded unless they pose a threat to wildlife and/or human health. The Refuge will be developing a refuge mosquito management plan/program in conjunction with Coos County and other mosquito experts.

At a minimum, consistent with the Service's draft mosquito management policy, the Refuge will be conducting an inventory to determine mosquito species presence and abundance on refuge lands. These baseline data are required if the goal of following a phased-response mosquito management strategy is to minimize the impacts to refuge resources while addressing legitimate human and wildlife health concerns and complying with Service regulations and policy. The collection of baseline data on mosquito presence and distribution on refuge lands is in accordance with the Service's Inventory and Monitoring Policy (701 FW 2), that all NWRs are required to collect baseline information (inventory) on plants, fish and wildlife.

As described in Chapter 2 and Appendix G of the CCP, mosquito treatments would be allowed on refuge lands in accordance with integrated pest management (IPM) principles applicable to all pests. Proposed pesticide uses for mosquito control would utilize appropriate and practical best management practices. A refuge compatibility determination (CD) will be developed concerning the mosquito control program and will include specific protocols for mosquito population monitoring, disease surveillance, and treatments.

5. **Comment:** Support for the restoration of upland pasture to historic forested lands, including the re-establishment of Port Orford cedar using disease-resistant seedlings and the placement of nurse logs.

   Response: The Service acknowledges the support of restoration of upland pasture to forest and management of existing second-growth forest to meet the goal of restoring and/or managing this habitat to a late-successional old-growth forest. During restoration planning and implementation, the Refuge will use the best available science and forest restoration techniques, including use of disease-resistant and local origin planting stock, to replant and manage the forest to meet this goal. As discussed in Chapter 2, Objectives 1.1 and 2.3, the desired attributes of the forest will include a diverse overstory of conifers, including Port Orford cedar, and a prescribed density of nurse logs, snags, and mosaic of native shrubs. Commercial timber production is not a management goal.

   The large-scale salt marsh and forested wetlands restoration effort that was completed in 2011 included the planting of disease-resistant Port Orford cedar saplings and placement of large nurse logs. These outplantings and nurse logs will be monitored and standard forest restoration techniques will be used, including thinning and invasive species control, to promote recovery of the Refuge's mesic forests.

6. **Comment:** Seal and bird populations along the Pacific Coast affect salmon runs.

   Response: The National Oceanic and Atmospheric Administration is the agency with authority and jurisdiction over the management of seals and sea lions in Oregon. The issue of salmon predation by seals, sea lions, and birds along the Pacific Coast is outside of the scope of the Bandon Marsh NWR CCP, which focuses on management of the resources within refuge-owned lands.

7. **Comment:** Invasive fish species, including the presence of smallmouth bass within the Coquille watershed, are threats to refuge habitats.

   Response: Smallmouth bass have been documented in waters on refuge lands and are removed when found. Further control of this invasive species within the Refuge's small coastal streams will be implemented using the Service's IPM methods as discussed in Appendix G of the CCP.

8. **Comment:** The CCP does not provide long-term data for species and habitat recovery on the Bandon Marsh Unit or recovery data for the recently completed restoration on the Ni-les'tun Unit.

   Response: One-time and long-term studies associated with the Refuge's habitats and species (i.e., physical and biological environment) are detailed in Chapters 3 and 4 of the CCP with references cited. Many of these studies are efforts by refuge staff, cooperating researchers from regional and national universities, other state and federal agencies, local tribes, and volunteers. These studies detail many of the physical (e.g., climate, hydrology, topography, geology, soils, fire, and contaminants) and biological (e.g., vegetation, historic and current distributions/populations of fish and wildlife) aspects of the Refuge's habitats and wildlife species. The Bandon Marsh Unit is a naturally occurring tidally influenced salt marsh, and refuge management has focused on collection of inventory and monitoring data for the habitat and wildlife species. As noted in the CCP, the Service is currently monitoring the effectiveness of the recently restored (2011) Ni-les'tun Unit, and initial reports have been completed that discuss many of the physical and biological changes that have occurred as the marsh recovers. The most recent progress reports are Brophy and van de Wetering (2012 and 2013). These results are part of long-term monitoring effort and are preliminary and incomplete, thus are not detailed within the CCP.

Invasive Species Management

9. **Comment:** The Refuge should eradicate all non-native species from refuge-managed lands. The long-term eradication of non-native species should take precedence over any concerns about incidental damage to native species caused by eradication efforts, and the use of lethal means (e.g., the hunting of nutria) is encouraged if it is the most cost-effective method.

   Response: Throughout the CCP, the terms *pest* and *invasive species* are used interchangeably because both can prevent/impede achievement of refuge wildlife and habitat objectives and/or degrade environmental quality. Service policy (569 FW 1) defines *pests* as "invasive plants and introduced or native organisms that may interfere with achieving our management goals and objectives on or off our lands, or that jeopardize human health or safety." Department of the Interior policy (517 DM 1) 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."

   The control of non-native and invasive species on the Refuge is proactive and receives high management priority. The likelihood of incidental damage to native species caused by eradication efforts must be determined before implementing IPM techniques. A cost-benefit analysis regarding effects to native species health and population plays a critical role in determining the most effective method to control invasive species with least harm to native species. Decisions to use particular tools and techniques and criteria for their use to control invasive species are based on numerous factors and considerations (e.g., the particular species being targeted, associated natural history characteristics, proximity to sensitive resources and non-target species, etc.). While the CCP provides overall direction and priority for the control of invasive species, naming specific treatments for the variety of possible problems would be premature. 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. Considering refuge objectives and the ecology of pest species, once a pest species population reaches a threshold, one or more methods would be selected that are feasible, efficacious, and most protective of non-target resources, including native species (fish, wildlife, and plants), Service personnel, Service-authorized agents, volunteers, and the public. Staff time and available funding will be considered when determining feasibility/practicality of various treatments. Such methods may include lethal removal of individual animals when those methods do not pose a significant threat to non-target animals.

10. **Comment:** The CCP should analyze the cumulative impacts of the IPM use of pesticides with the documented chemical contamination of the area.

    Response: The use of herbicides or pesticides to control invasive plants or animals poses several environmental risks, including drift, volatilization, and persistence in the environment, water contamination, and harmful effects to wildlife. There are few acres on the Refuge potentially subjected to herbicide treatment, and the potential for such risks are considered minimal due to the types of herbicides used (non-persistent) and the precautionary measures taken during application (as referenced in the CCP Appendix G, IPM Program). The effects of pesticides using IPM techniques and methods are not considered significant.

    Potential effects to the biological and physical environment associated with the proposed site-, time-, and target-specific use of pesticides on refuge lands would be evaluated using scientific information and analyses documented in “Chemical Profiles” as discussed in Appendix G of the CCP. These chemical profiles provide quantitative assessment/screening tools and threshold values to evaluate potential cumulative effects to species groups (birds, mammals, and fish) and environmental quality (water, soil, and air). Any pesticide use must receive prior approval through a Pesticide Use Proposal (PUP). PUPs (including appropriate best management practices) would be approved where the chemical profiles provide scientific evidence that potential impacts to biological resources on the Refuge or nearby lands and the physical environment are likely to be only minor, temporary, or localized in nature. These approved pesticides are short-lived with non-binding properties and would not have cumulative synergistic or antagonist effects with contaminants (e.g., heavy metals, organochlorine pesticides, congener-specific PCBs) located on adjacent lands, as discussed in Section 3.8.2.

11. **Comment:** Gorse should be more emphasized in the CCP as it is present and a very difficult species to control once established.

    Response: The Service acknowledges gorse to be an extremely aggressive and difficult invasive species to control. Gorse was included as one of the seven most troublesome invasive and exotic plant species in the CCP under Section 4.10. Past and current efforts to control this upland invasive species on the Refuge, using IPM techniques, have limited its spread and distribution (see Sections 4.10.5 and 4.10.8).

12. **Comment:** The Refuge should prioritize funds and effort towards effectively and quickly controlling existing or preventing new, invasive species on the Refuge. Refuge management should use the principles of Early Detection Rapid Response (EDRR), which calls for regular monitoring for invasive plant species and rapid attack of species that pose a significant threat to key habitats.

    Response: For Bandon Marsh NWR, the magnitude of pest problems is beyond the available capital resources to expect control or eradication during any single field season; therefore it is essential to prioritize treatment of infestations. Some non-native species that are pervasive on refuge lands are the subject of long-term control efforts and will continue to be a high priority for refuge resources. The EDRR model will be used to find and verify the identity of new invasive species as early after entry as possible, when eradication and control are still feasible and less costly. The Service will embark on a systematic effort to eradicate, contain, or control newly discovered invasive species and isolated infestations of a previously established, non-native species, while the infestation is still localized. Regardless of whether the invasive species is well established or newly introduced, it will be essential that the Refuge prioritize 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.

Inventory, Monitoring, Research, and Assessments

13. **Comment:** Support for Alternative C and request that research (e.g., salt marsh restoration ecology), monitoring (e.g., water quality, species populations), and assessments be given a high priority within the budget and staffing.

    Response: The Service acknowledges the comments in support of the preferred alternative for Goal 5, Research and Monitoring, which places a greater emphasis on gathering information and conducting high-priority inventory, surveys, research, and assessments. The CCP strategy of hiring an additional Permanent Full Time Wildlife Biologist to conduct, coordinate, and complete research and monitoring tasks is a priority that, if funded, would go a long way toward enabling staff to adequately addressing the biological complexity of the Refuge.

14. **Comment:** The Refuge should explore the use of other possible indicator species to monitor progress toward the Refuge's goals and objectives. Consideration in selecting species to monitor should include cost-effectiveness, amount of monitoring effort required, and whether population changes can be feasibly detected.

    Response: Conservation of literally thousands of species is entrusted to the Service and its partners. The Service is working to implement landscape-scale conservation through a "surrogate species" approach (USFWS 2012e). Because a suite of surrogate species can help represent the habitat and/or management needs of larger groups of species, these species are used for comprehensive conservation planning that supports multiple species and habitats within a defined landscape or geographic area. With this approach, managers can focus on a set of key elements that can be monitored to determine if planned biological goals are being achieved. Additionally, such an approach can result in more systematic and effective management because it emphasizes the commonalities of species' conservation needs. The Inventory and Monitoring step-down plan to be completed within approximately five years of CCP completion will prioritize inventory, monitoring, and research activities and will take into account considerations such as cost-effectiveness.

15. **Comment:** Research should be conducted in a rigorous and scientifically valid manner that includes peer review and publication of results. These results plus all relevant archived reports should be converted to digital formats and made available for use by other researchers, managers, and interested public.

    Response: The Service is committed to using sound science in its decision-making and to providing the public with information of the highest quality possible. The Service is instituting data standards to improve the quality and compatibility of its data. This approach will increase opportunities to share data and reduce incidents of redundant data development. Federal agencies are required to publish guidelines for ensuring the quality, objectivity, utility, and integrity of information we use and disseminate, and to provide mechanisms for allowing the public to seek correction of that information. In order to ensure the quality and credibility of the scientific information the Refuge uses to make decisions, the Service has implemented a formal "peer review" process for influential scientific documents following the Office of Management and Budget memorandum "Final Information Quality Bulletin for Peer Review" (available online at http://www.whitehouse.gov/sites/default/files/omb /memoranda/fy2005/m05-03.pdf).

Public Access

16. **Comment:** Support to open the Ni-les'tun Unit to public use as developed in Alternative B or Alternative C, the preferred alternative.

    Response: The Service acknowledges the support of either Alternative B or C to allow public use activities on the Ni-les'tun Unit. The establishment of any new public use on a national wildlife refuge requires the prior determination of appropriateness and compatibility, with public review and involvement. Waterfowl hunting, wildlife observation and photography are considered appropriate refuge uses under Service policy, and if compatible with refuge purposes, are to be considered. The development of the CCP and CDs (located in Appendix B of the CCP), together with public involvement and review (summarized in Appendix J), has allowed the Service to open and expand public use on refuge lands to include waterfowl hunting, fishing, wildlife observation and photography, environmental education and interpretation.

17. **Comment:** The Service should charge a fee that could be used on the Refuge to support road, facilities, and habitat maintenance programs, and these fees should be only used for the Oregon Coast NWR Complex.

    Response: In 2004, Congress passed the Federal Lands Recreation Enhancement Act, which allows the government to charge a fee for recreation use of public lands managed by the USFWS and other federal land management agencies. The Service collects fees at more than 100 national wildlife refuges. At least 80 percent of all fees collected at a refuge are reinvested back into that refuge to provide quality recreational facilities and opportunities to our visitors. The remaining 20 percent is used in that geographic region. The Service may not use recreation fees to pay for biological monitoring of threatened and endangered species; however, fees could be used to support visitor facilities and potentially habitat maintenance in areas open to public access. At this time, the Refuge has neither the resources nor the level of visitation to justify having a fee program. The Service will refer to established criteria to determine if charging a fee and establishing a fee collection system are warranted at some point in the future.

Wildlife Observation and Photography

18. **Comment:** Support for the Refuge's existing and proposed wildlife observation and photography opportunities.

    Response: The Service acknowledges the support for the Refuge's existing and proposed wildlife observation and photography opportunities.

19. **Comment:** Access to the Ni-les'tun Unit for walking, wildlife observation and photography during the hunting season should be allowed during the non-hunt days.

    Response: The Service acknowledges that some people want to be able to walk and watch birds and other wildlife throughout the entire Ni-les'tun Unit during the waterfowl hunt season, which occurs from October through January. Specifically the Service is aware that these visitors want to have access to the Ni-les'tun Unit during non-hunt days. Minimizing disturbance to wintering waterfowl and providing waterfowl hunting opportunities on refuges are both priorities for the Service. To accomplish both goals, it is common for refuges to establish an intermittent hunting program including hunting only certain days per week and keeping the area closed to all uses (including wildlife observation and photography) on the days when hunting is restricted. Although intermittent hunting is not as effective as complete closure of an area to hunting, providing days when there is no human-caused disturbance at all, including wildlife observation and photography, can sustain waterfowl use in an area that is hunted all season long. Despite the lack of user conflict at the adjacent Bandon Marsh Unit between hunters and birders, the Service has chosen to limit hunting to three days per week at the Ni-les'tun Unit to provide intermittent sanctuary for wildlife during the waterfowl hunting season. In addition, because this unit has been recently restored to tidal marsh and continues to change and evolve, the Service is still determining the areas of highest use by wildlife. The closure of the unit to all uses on non-hunting days during the waterfowl hunt season will allow the Refuge to monitor and determine the areas of most desirability for waterfowl within this still-evolving restored marsh. After five years of monitoring, we will reevaluate the intermittent program and if warranted, we will consider additional wildlife observation access.

20. **Comment:** Are visitors required to be hunting waterfowl while accessing the Ni-les'tun Unit during waterfowl hunting season?

    Response: Waterfowl hunting will be the only authorized activity on the southern portion of the Ni-les'tun Unit (identified on Figure 2-1 as waterfowl hunting area) between October 1 and January 31. Visitors accessing the waterfowl hunt area during that time period must be participating in an authorized hunting activity.

21. **Comment:** Support for facilities to support wildlife observation with specific recommendations about the design of photography/observation blinds. Support for the construction of additional facilities in support of wildlife observation and photography including an auto tour route.

    Response: The Service has included the construction of additional facilities in support of wildlife observation and photography in the CCP including the development of a loop trail that connects the Ni-les'tun parking lot with Fahys Creek and the uplands behind the refuge office. This trail will be open year-round to interpretation, environmental education, wildlife observation, and photography. The Service does not have plans to build any observation/photography blinds currently but will take the recommendations of the commenters into consideration if we design and build any in the future. The Service did not consider an auto tour route as the topography of the landscape (i.e., a tidal estuary), the limited acreage, and environmental impact of such makes this option unfeasible.

22. **Comment:** Support for banning the usage of audio playback devices to attract birds or other wildlife.

    Response: Human activities on a refuge must be compatible with the primary wildlife purposes of each refuge. The use of audio playback devices is an issue of growing concern to the Service, because the use of technology for birding and wildlife photography continues to increase and evolve. The reason for concern is that when a song is played in a bird's territory, that bird's response to the so-called intruder is recognized by neighboring rivals. As a result, birds that are otherwise too shy and secretive to expose themselves are lured out into the open by the sound of a potential rival, thereby making them more vulnerable to predation. Use of audio playback appears to cause undue stress on the bird, causing the territorial male to waste energy chasing a perceived intruder and distracting birds from more important, energy-intensive activities including nest building, incubation, and/or searching for food. Some birders will use bird calls in the field to verify a call they have heard. On a refuge they may play the call quietly so only they are able to hear it or use headphones, which minimize any potential impact on birds in the wild. When audio playback is used to elicit a response from birds in the wild, there are two refuge regulations that apply: 50 Code of Federal Regulations (CFR) 27.51 prohibits disturbing and attempting to disturb wildlife on any national wildlife refuge; in addition, 50 CFR 27.72 prohibits "the operation or use of audio devices including radios, recording and playback devices, loudspeakers ... so as to cause unreasonable disturbance to others in the vicinity." Use of audio devices to lure birds violates at least one if not both of these regulations. We do not allow the use of audio playback devices on Bandon Marsh NWR for the purpose of getting birds to respond since it can disturb wildlife and other visitors and would be difficult if not impossible to avoid violating refuge regulations in doing so.

23. **Comment:** Support for the development of a loop trail connecting the Ni-les'tun parking lot with Fahys Creek.

    Response: The Service acknowledges the support for an access loop trail to upland habitats that will provide visitors with high-quality wildlife photography and observation experiences as proposed in Chapter 2, Goal 6 of the preferred alternative.

24. **Comment:** The Service should build an elevated boardwalk into the salt marsh on the Ni-les'tun Unit of Bandon Marsh NWR for the purpose of allowing the public better views of shorebirds and waterfowl.

    Response: The Service briefly considered the feasibility of constructing a facility in the dynamic Ni-les'tun tidal salt marsh and investigated the cost and maintenance required for such a structure as built on other refuges. It was determined that the initial cost and ongoing maintenance of a structure relative to the expected level of public use was difficult to justify. Therefore, the Service decided not to include an elevated boardwalk in the alternatives and chose to focus on other more affordable wildlife observation access trails on the Refuge (e.g., upland loop trail). As part of the restoration in the Ni-les'tun Unit, the Service constructed a 600-foot-long graveled nature trail gravel into the marsh to provide easy pedestrian access along two small tidal channels.

Environmental Education and Interpretation

25. **Comment:** The Service should provide information in the form of brochures or kiosks on the ethics of watching wildlife.

    Response: Interpretation is identified as one of the priority public uses of the Refuge System. As part of the CCP, the Service intends to develop interpretive trails, information kiosks, and informational brochures with an ultimate goal of enhancing visitors' appreciation, understanding, and enjoyment of the Refuge's natural and cultural resources. Interpretation will also be used to help enlist the cooperation of visitors by sharing refuge rules and regulations in a manner that encourages them to minimize disturbance and respectfully care for the Refuge and its wildlife.

26. **Comment:** Support for the expansion and development of interpretive trails, observational overlooks, and environmental education programs.

    Response: The Service has listed strategies to expand and develop the wildlife observation and photography, environmental education, and interpretation programs in Chapter 2, Goals 6 and 7 of the CCP. The Service believes environmental education plays a key role in encouraging current and future generations of the American public to understand environmentally responsible land and wildlife stewardship such as supporting the protection of habitat for wildlife through the NWRS. Currently the Refuge offers one formal environmental education program, the Shorebird Sister Schools Program, but there is demand for additional programming covering different themes and topics. By partnering with Shoreline Education for Awareness, Free Flight Wildlife Rehabilitation Center, and others to develop and implement refuge-based curriculum for all ages the Refuge will be able to reach more students and community groups with a goal of developing an aware and environmentally literate citizenry.

Hunting and Fishing

27. **Comment:** Support of expanding waterfowl hunting on the Bandon Marsh NWR to include lands in the Ni-les'tun Unit. Hunting should be allowed seven days per week on all refuge lands. Support for the preferred alternative to allow waterfowl hunting on the Ni-les'tun Unit three days per week.

Response: Minimizing disturbance to wintering waterfowl and providing quality waterfowl hunting opportunities on refuges are priorities for the USFWS. Currently the Refuge is open to waterfowl hunting on the Bandon Marsh Unit and closed on the Ni-les'tun Unit. To ensure that waterfowl are provided sanctuary habitat, the Refuge will establish a hunt program on the Ni-les'tun Unit that provides days when there is no human-caused disturbance by closing areas from any public use. This type of intermittent closure can improve the ability of a site to sustain waterfowl use in an area that is hunted all season long. For this reason, the Service has developed the preferred alternative, which limits hunting to three days per week at the Ni-les'tun Unit, with the full support of ODFW. As planned, the Service will continue to allow waterfowl hunting seven days per week at the Bandon Marsh Unit of the Refuge during the waterfowl hunting season.

28. **Comment:** The Service should use Oregon State Police (OSP) to conduct patrols for hunting and fishing on refuge lands instead of using a Federal Law Enforcement Officer.

    Response: In coordination with OSP officers and other law enforcement agencies, refuge Law Enforcement officers will conduct law enforcement patrols on a regular basis to ensure compliance with State and Federal waterfowl hunting regulations as well as refuge-specific regulations pertinent to the hunt. While OSP officers will primarily patrol State lands, concurrent jurisdiction will allow OSP officers and Coos County Sheriff's Department officers to have authority on refuge lands.

29. **Comment:** The Service should increase parking for hunters from the preferred alternative proposal of 3-4 parking spaces to 15-20 spaces.

    Response: The portion of the Ni-les'tun Unit that will be open for waterfowl hunting will be accessible from the overlook parking area and the eastern end of North Bank Lane. Because hunting is a priority public use on refuges, the USFWS will construct a gravel parking lot for visitors at the east end of the Refuge when funds are obtained. The parking lot capacity will be limited to accommodating 3-4 vehicles because the site conditions limit the parking lot size, and furthermore it is expected that the number of hunters accessing the area will be low (< 3 hunting groups at a time). Current low levels of waterfowl hunting use on the Bandon Marsh Unit, the size of the Ni-les'tun Unit hunting area, the availability of access to the unit by the overlook and by boat, and the tendency of waterfowl hunters to space themselves far apart to promote a better hunt quality, all indicate that there will not be a need for a larger east parking area. The USFWS will monitor the amount of hunting on the Ni-les'tun Unit and if demand exceeds available parking space in the future, we will reevaluate our options for providing additional parking and access.

30. **Comment:** The Service should allow boat parking anywhere along the riverbank of the Coquille River as opposed to the designated areas proposed in the CCP.

    Response: Waterfowl hunters will be allowed to bring boats inside the marsh for the purpose of waterfowl hunting; however, boat parking on the river bank is restricted to a designated area to reduce disturbance to wildlife and to protect other natural (e.g., soils, vegetation) and cultural resources. The boat parking area on the riverbank of the Coquille River was developed in cooperation with ODFW and the Oregon Department of State Lands.

31. **Comment:** The Refuge should be allowed to maintain its natural balance without recreational hunting and fishing.

    Response: The National Wildlife Refuge System Administration Act (16 U.S.C. 668dd - 668ee, et seq.), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) recognizes that wildlife-dependent recreational uses including hunting and fishing, when determined to be compatible with the mission of the NWRS and the purposes of the Refuge, are legitimate and appropriate uses of national wildlife refuges.

    During the preparation of this CCP, waterfowl hunting, which has taken place on the Bandon Marsh Unit of the Refuge since establishment, was given careful consideration along with the need to provide sanctuary for waterfowl and other wildlife. The Service also considered whether adding to the waterfowl harvest totals by establishing a new hunting program would significantly contribute to population changes of the waterfowl species using the Refuge. Additional waterfowl hunting opportunities on the Ni-les'tun Unit were ultimately chosen as the preferred alternative because the Service believes this intermittent hunting program can be implemented without causing unreasonable conflicts with other public use and management programs. The numbers of waterfowl expected to be taken from the Bandon Marsh and Ni-les'tun Units are expected to make up an extremely small proportion of local, State, or Pacific Flyway total harvest.

32. **Comment:** Change the wording from "artificial lures" to "artificial flies and lures" that are allowable fishing tackle for cutthroat trout fishing on the Ni-les'tun Unit under the strategy for providing opportunities for quality fishing.

    Response: The commenter is correct that the use of the wording "artificial lures" within the strategy to allow cutthroat trout fishing in the Ni-les'tun Unit is not consistent with the ODFW regulations. As defined in the regulations, a lure is "an artificial device, complete with hooks, intended to attract and entice fish; excluding molded soft plastic or rubber imitation baits and artificial flies." The Service will make the change in the strategy within the CCP to read "Allow artificial fly and lure fishing for cutthroat trout only, in accordance with refuge and ODFW regulations regarding allowable methods, on the tidal portions of Fahys, No Name, and Redd Creeks on the Ni-les'tun Unit."

33. **Comment:** Objective 8.3 (Provide opportunities for quality fishing and clamming) and the strategies identified to achieve this objective are not necessary since fishing and clamming on the Refuge should be regulated per ODFW policies.

    Response: Bandon Marsh NWR is committed to providing quality opportunities for wildlife-dependent recreation in cooperation and coordination with state natural resource agencies including ODFW. During all phases of the CCP development, ODFW has been an active extended team member with the Service and has reviewed and helped develop the strategies associated with fishing and clamming on the Refuge. Through the implementation of the strategies presented in the CCP, the Refuge will continue to support all six of the Refuge System's priority wildlife-dependent uses: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. To manage these uses on the Refuge there is a need for refuge-specific and ODFW fishing regulations to meet the Service's strategies, presented under Objective 8.3 of the CCP, of allowing bank fishing, fishing for cutthroat trout, and clamming on Bandon Marsh NWR. These regulations reduce or generally result in little disturbance to other visitors while continuing to provide a quality wildlife experience for all users. As an example, some anglers may inadvertently flush waterfowl being pursued by hunters. Therefore, to minimize wildlife disturbance and potential safety conflicts between hunters and cutthroat trout anglers, the fishing season opening on the Refuge will coincide with the ODFW opening, but the season will close on September 30 before the waterfowl hunting season begins. The ODFW trout season extends through January. Also to avoid conflict with waterfowl hunters, the Ni-les'tun Unit south of North Bank Lane, excepting the gravel trail, will be closed to wildlife observation and photography from October 1 through January 31.

To be more consistent with ODFW fishing regulations the CCP has been modified by removing "bank" from Objective 8.3 Strategy b that discusses the style of fishing on the Bandon Marsh Unit. The strategy has been changed and now reads "Allow fishing on the Bandon Marsh Unit in accordance with ODFW fishing regulations." In addition, within the Rationale of Objective 8.3 the "bank fishing" is replaced with "fishing."

34. Comment: The CCP should consider the bioaccumulation of off-refuge contamination into the Refuge's fish and wildlife that may in turn affect the health of people who fish and clam in the Refuge.

Response: As discussed in Chapter 3 of the CCP, in Section 3.8.2, Water Quality and Contaminants, the primary contaminant issue at Bandon Marsh NWR is the privately owned, abandoned facility that is located adjacent to the southern boundary of the Bandon Marsh Unit. The cleanup of this off-refuge site is led by the Oregon Department of Environmental Quality (ODEQ), which protects human health and the environment by identifying, investigating, and remediating sites contaminated with hazardous substances. The responsible party, the private landowner, is obligated to conduct additional assessment and potentially cleanup the site under the Oregon Cleanup Law. In addition, if a risk to human health and ecological receptors (i.e., bioaccumulation) is documented, ODEQ would work with assistance from Oregon Health Authority for the human health aspect, and the ODA and ODFW for shellfish contamination. If the Service is notified by these agencies of a shellfish safety closure or contaminant issue that threatens human health, the Refuge would take corrective action (e.g., closure of fishing/hunting). Clarification about clamming being subject to ODA and ODFW shellfish safety closures has been added to Chapter 2.

35. Comment: Clarification was requested on whether the existing Federal ban on the use of lead shot for waterfowl hunting applies to all hunting on the Refuge.

Response: The use of lead ammunition to hunt waterfowl has been banned in the United States since 1991. In addition, Oregon State gamebird regulations state that the possession and use of shot other than federally-approved nontoxic shot is always prohibited while hunting waterfowl. The Service is not proposing to allow any hunting other than waterfowl hunting on the Refuge, so no lead ammunition use will be permitted. Clarification about the use of lead shot has been added to the Rationale sections of Objectives 8.1 and 8.2 in Chapter 2.

36. Comment: No lead-containing ammunition or fishing tackle should be allowed on the Refuge to avoid contamination of fish and wildlife.

Response: Currently, the Service bans lead fishing tackle on certain refuges that have nesting common loons and trumpeter swans, which are species known to be harmed by ingesting lead from fishing tackle. This ban does not apply to Bandon Marsh NWR. The Service and ODFW encourage anglers to use non-lead tackle, and the Service will reinforce this position in all publications containing information on fishing on the Refuge. The use of lead ammunition for waterfowl hunting is prohibited on all national wildlife refuges, and since there is no upland game bird or other species hunting allowed on Bandon Marsh NWR, hunters may not possess any lead ammunition while on the Refuge. The Bandon Marsh NWR waterfowl hunting plan states that only federally approved nontoxic shot may be used or be in hunters' possession while hunting on the Refuge.

Visitor Facilities

37. **Comment:** Support for the City of Bandon's efforts to promote ecotourism by the development of a "community-based visitor center."

    Response: The Service acknowledges the public's support for the development of an ecotourism facility by the City of Bandon. The Refuge also supports the City in its efforts to promote the understanding, conservation, and protection of natural resources within coastal Oregon. The Service's support for an ecotourism center is detailed in the CCP under Section 2.2 Actions Considered but Not Developed, which reviews potential ecotourism sites within the City of Bandon. In the future, if an "ecotourism" or natural resource-based visitor center were constructed, the USFWS could assist these local government agencies in designing high-quality interpretive materials and displays. These interpretive materials will assist the Refuge in educating visitors to the Bandon area about the sensitivity of the wildlife and habitats of Bandon Marsh and Oregon Islands NWRs.

38. **Comment:** The Service should use native plants that provide natural food for birds and wildlife if landscaping at any buildings, kiosks, or visitor areas.

    Response: The Service supports the use of native plantings around its facilities that provide food, cover, and loafing habitat for birds and other wildlife. The strategy for the use of habitat-appropriate plants for landscaping around buildings, kiosks, and other public use facilities has been integrated into the CCP within Chapter 2, Goal 9, concerning the need to provide facilities and materials that welcome and orient visitors to natural wonders of fish and wildlife that use Bandon Marsh NWR.

Outreach

39. **Comment:** The Service should actively engage the birding community in volunteer opportunities that arise on the Refuge.

    Response: The Service recognizes the importance of working with the birding community and with volunteers. In fact, the Service already works with many birding groups, including the Kalmiopsis and Cape Arago Audubon Society Chapters, to carry out some of the tasks associated with refuge management (e.g., interpretation, invasive species control). The Service recognizes that groups such as these and their volunteers are key components of the successful management of refuge lands and are vital to the Refuge's biological and public use programs and projects.

Climate Change

40. **Comment:** Support for increasing the Refuge's role in climate change-related research and monitoring, particularly with regard to estuarine habitats and species.

    Response: The Service is committed to working with our partners to monitor and address the impacts of climate change on fish and wildlife, and their habitats. Particularly in coastal environments, we are challenged by the large geographic scale and technical complexity required to adequately measure and address climate change impacts, many of which are beyond the scope and scale of the Bandon Marsh NWR CCP. Because these challenges cannot be resolved by the Service alone, we will work with our partners to monitor and address climate change effects on wildlife and their habitats both on and off of refuge lands. The Service has developed a climate change strategic plan (USFWS 2010a), which will help us direct resources to address the impacts of climate change on natural systems. These combined efforts will provide the framework to gather baseline data on meaningful biological criteria at scales appropriate to monitor, assess, and plan for impacts of climate change.

41. **Comment:** Add alternative energy options for any new buildings or upgrading of existing buildings, such as solar panels, wind generation, or tidal energy generation, as part of a long-range plan to eliminate dependence on traditional grid-electricity. Carbon footprint reduction (e.g., via increasing fuel efficiency) should be done cost-effectively.

    Response: The Refuge will adhere to Department of Interior and Service policies and initiatives to reduce the carbon footprint of the Refuge. The Service's five-year Action Plan calls for the Service to make its operations carbon-neutral by 2020. The Refuge will work toward this goal by continuing to pursue energy efficiency, including exploring the feasibility and cost-effectiveness of alternative energy sources. Also, the current vehicle fleet will be gradually replaced with more fuel-efficient vehicles. Any new or replaced facilities will be designed to be appropriately sized and energy-efficient. Energy-efficient land management techniques will be used where feasible and in line with management goals. Methods of offsetting carbon balance, such as carbon sequestration, will be explored.

    At the habitat management level, we will continue to implement the strategies (as described in Sections 2.3 and 2.4 of this CCP) that enhance ecological resilience to climate-related stressors. We will work with our partners (e.g., via the North Pacific Landscape Conservation Cooperative) to encourage similar enhancement of ecological resilience on lands not overseen by the Service. Climate change may have drastic effects on the Refuge, but due to the complexity of the issue and unknown severity of change, the magnitude of effects during the term of this CCP on native fish, wildlife, plants, and their habitats found on the Refuge, as well as those ecological processes that support them, cannot be predicted with certainty.

42. **Comment:** Would climate change and/or sea level rise affect the Refuge? More information on larger climate change issues affecting the ocean should be addressed.

    Response: The potential effects of climate change on regional and refuge resources are described in Chapters 3 and 6 of the Draft CCP/EA. The Refuge has not been measurably affected by ongoing sea level rise due to upward vertical land movement and sediment accretion; however, the Refuge may be affected by increases in extreme precipitation events and storm surges, higher water temperatures, and ocean acidification. These climate change-related processes will likely further exacerbate the impact of any other environmental stressors since impacts will likely be additive or synergistic. Numerous inventory, monitoring, research, and assessment strategies described under Chapter 2, Goal 5 are intended to provide information regarding climate-change related impacts to refuge wildlife and habitat. Over time, these studies will allow the Refuge to implement adaptive management and climate change adaptation.

Refuge Establishment and Purposes

43. Comment: Were any parcels within the Refuge purchased using excise taxes derived under the Pitman-Robertson Act or other sportsman generated taxes? If so, then the purpose of the Refuge should be changed to provide unlimited access to sportsmen. The Bandon Marsh NWR establishing authorities referred to in the Draft CCP/EA should be listed.

Response: The acquisition of properties for the establishment of Bandon Marsh and subsequent expansion to include the Ni-les'tun Unit are detailed in Chapter 1 within Section 1.6.2, which reviews the laws, authorities, and funding sources used for bringing lands into the Refuge System. The original 289 acres of the Bandon Marsh Unit was acquired through a transfer of the Bandon U.S. Coast Guard Building, and additional lands, including the Ni-les'tun Unit, were acquired using funds generated from the Land and Water Conservation Fund (primarily from outer continental shelf Federal oil and gas revenue). The 34-acre Smith Tract was donated to the Service in 2003.

The Bandon Marsh NWR purposes and establishment processes are described in the CCP under Section 1.6, which lists one of the purposes for establishment as "to provide opportunity for wildlife-oriented recreation." Currently, the Service provides hunting and fishing opportunities on the Bandon Marsh Unit and, during implementation of the CCP, will provide the public with fishing and hunting opportunities on the Ni-les'tun Unit.

Physical Environment

44. Comment: In light of the 2011 Tōhoku earthquake and tsunami in Japan, the CCP should discuss how refuge planning takes into account the fact that much of the Refuge is in a designated Tsunami Hazard Zone.

Response: The Service acknowledges that the low-lying areas of the Refuge are within the Tsunami Hazard Zone, as designated by the Oregon Department of Geology and Mineral Industries. The Oregon coast is threatened by large tsunamis resulting from earthquakes that occur locally or elsewhere in the North Pacific Rim. Research has documented evidence of large earthquakes and subsequent tsunamis affecting the Coquille River estuary at least 12 times in the last 6,700 years (Witter et al. 2003), with tsunamis extending up to 6 miles (10 kilometers) up the river. All evidence points to the inevitability of similar future events.

In light of this threat, the Refuge Continuity of Operations Plan (USFWS 2012f) discusses a contingency plan in the event of an earthquake and/or tsunami, and refuge staff has discussed emergency evacuation plans. All habitable buildings on the Refuge are located above the Tsunami Hazard Zone, and the CCP does not consider construction of any new buildings inside the Hazard Zone. The level of disruption to the refuge operations and its environment resulting from a major earthquake is difficult to predict or plan for, since there is a large range of severity possible. A large event could involve a general subsidence of the landscape of several feet and major dislocation of surface materials by the tsunami flows, which would drastically alter the distribution of habitats within the estuary. However, after the event the same ecological processes active today would be re-established as they have been many times before, and the estuary would eventually regain its biological productivity.

Human Environment

45. **Comment:** The CCP should mention the U.S. Army Corps of Engineers historic (early 19th and 20th centuries) involvement in clearing malarial swampland to allow agricultural development in the Coquille Valley. The comment also contends that historically significant buildings were razed on refuge lands without due process.

    Response: According to the U.S. Army Corps of Engineers website (USACE 2013), the Corps had no presence in the Pacific Northwest until 1871, when the first office was opened in Portland with two staff. The remainder of the 19th century the Corps was focused on improving navigation on the Columbia and Willamette Rivers, while also building jetties at the mouths of coastal rivers including the Coquille. The Corps dike building activity on the Coquille occurred in the early to mid-twentieth century, but we can find no documentation of "swamp clearing" by that agency. Malaria is not indigenous to North America and was introduced to Oregon by immigrants early in the settlement period. It was most prevalent in the lower Columbia and Willamette valleys, but by one account infected Native Americans in "villages on Oregon's coastal estuaries" in the early 1800s (Robbins 2002). However, the Centers for Disease Control and Prevention has an online map of the historical extent of malaria that does not show the disease occurring on the southern Oregon coast (CDCP 2010), nor does the Coos County Health Department have any record of malaria in the county. Malaria was finally considered eradicated in the U.S. after an intensive effort immediately after World War II, when a nationwide campaign of DDT spraying and wetland draining was conducted.

    All of the buildings that were razed by the Service on the Ni-les'tun Unit were subject to historic evaluations through the Service's Cultural Resource Compliance Program, which included a detailed review of each building's date of construction, ownership history, physical condition, and cultural context. In all cases (former Philpott dairy barn complex and four houses), the buildings were found not to be historically significant, either because they were not over 50 years old [the barn complex, built in the 1950s and 1960s (Speulda and Bourdeau 2001)], or "because of the systematic alterations to original materials that have critically modified the distinguishing features associated with vernacular house styles" (Speulda 2000). The barn had not been used for at least 10 years prior to the Service's purchase of the tract. The Service recognizes that the dairy barn, in particular, had become a local landmark, and its razing may have been disconcerting to some residents, but it would have served no use to the operation of the Refuge that would have justified the expense of repair and maintenance it would have required. Most of the wood from the barn was salvaged and shipped to Wisconsin to be reused, and the metal was recycled. The smaller structures were salvaged and rebuilt on private property nearby, and the four old homes were used by the Bandon Rural Fire Department in their "Burn to Learn" training program.

46. **Comment:** The CCP/EA fails to adequately review and address the existing Bandon Marsh Refuge management, operations, and potential expansion within the context of its true sphere of influence.

    Response: The potential impact area analyzed by the economic analysis for the CCP/EA is not limited to the city of Bandon. Instead, the economic analysis defines the impact area as Coos County, which includes unincorporated areas of the Coquille Valley. The economic model accounts for leakages (i.e., money lost from a regional economy by payments to suppliers outside the region) and does not assume that all refuge operations and management expenditures will directly impact Coos County. The model is designed to take into account that not all industries are supported within the County and that some refuge expenditures occur outside the County. Thus, the potential local job creation of four jobs within Coos County is reasonable.

    Since land protection planning (i.e., refuge boundary expansion study) is outside of the scope of the CCP (see Section 1.9.3), the economic analysis within the Draft CCP/EA only focuses on the potential economic impacts of future management actions that would occur within existing refuge-managed lands.

47. **Comment:** The CCP/EA discusses the benefits of ecotourism but fails to mention the existing tourism trends and seasons.

    Response: The overall annual economic impact from recreational spending is not dependent on what time of year tourists are visiting the Refuge. On average, they are spending the same amount of money whether they are visiting in April or December. Different expenditure profiles (i.e., daily expenditures such as food, lodging, transportation, and other expenses) are already incorporated into the economic model, in which expenditures vary depending on the recreational visitor’s primary activity. For example, expenditure profiles are different for waterfowl hunters and wildlife watching visitors.

Planning Process

48. **Comment:** The CCP should consider cumulative impacts from threats to estuaries in the area, such as the proposed liquefied natural gas (LNG) and coal export facilities around Coos Bay.

    Response: 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. Within a NEPA analysis, “reasonably foreseeable” projects are those that are probable, or likely to occur, rather than those that are merely possible. As the fate of proposals such as the LNG and coal export facilities in Coos Bay and any non-refuge conservation efforts within the Coquille Valley are uncertain and not yet finalized, a cumulative effects analysis evaluating possible impacts from these proposed or conceptual projects would be speculative. However, the losses of important habitats along the Oregon coast such as tidal salt and brackish marsh, tidal swamp, and late-successional Sitka spruce-western hemlock forest are acknowledged within the CCP. Regionally, challenges such as human development, the alteration of disturbance regimes, the introduction of non-native species, and climate change pose increasingly challenging conservation issues. The Service recognizes these threats to region-wide biological integrity and is committed to cultivating working relationships with pertinent local, county, State, and Federal agencies to stay abreast of current and potential developments and utilizing outreach, education, and information as needed to raise awareness of refuge resources and their dependence on a healthy local environment. Over time, the Refuge, although relatively small and isolated from other natural lands, may become increasingly valuable for the persistence of native estuarine-dependent wildlife. Active improvement of refuge habitats will increase or maintain the value of refuge lands and waters for a wide variety of native fish and wildlife, and biological diversity.

49. **Comment:** Many comments were submitted regarding the Bandon Marsh NWR Land Protection Planning process and other landscape-scale conservation efforts within the Coquille Valley.

    Response: The USFWS started the planning process to develop a CCP for Bandon Marsh NWR in November 2010. On December 2, 2010, we held a public scoping meeting in Bandon to meet with the public and identify issues for evaluation. After the scoping period ended, we reviewed the potential issues, management concerns, and opportunities that we, our partners, and the public identified during scoping.

    The Service acknowledges that several scientific assessments recognize the importance of protection, enhancement, and/or restoration of fish, wildlife, and habitats within the Coquille Valley (e.g., OWJV 1994, OCSRI 1997, CWA 2003, ODFW 2006, Vander Schaaf et al. 2006, Coquille Indian Tribe 2007, ODFW 2007). On July 28, 2011, we formally requested approval from the Director of the USFWS to initiate a detailed study examining potential refuge boundary expansion. Permission was granted on September 6, 2011.

    Preliminary draft alternatives were developed to address issues identified during scoping and to meet the goals of the Refuge. In November 2011, we presented for the first time these preliminary draft alternatives to the public and held a public open house meeting on November 9, 2011. Included within preliminary draft Alternative C was the refuge boundary expansion study. Following the public meeting, we discovered that many landowners within the study area did not receive the Planning Update newsletter and the notice of the public meeting. On November 17, 2011, a letter was sent to every landowner within the study area informing them of the process and how they could participate. The letter also included Planning Update 2, a map depicting the study area, a summary of Frequently Asked Questions titled "Land Protection Planning for Bandon Marsh National Wildlife Refuge," and an offer to meet with each landowner individually to answer questions. Comments regarding the preliminary draft proposal to expand the refuge boundary were received from landowners, State agencies, County governments, interested groups, and interested individuals.

    In early February 2012, we made the decision to separate the CCP from the refuge boundary expansion study (Land Protection Plan, or LPP). This change allowed the CCP to continue on pace while allowing more time for thorough analysis and study of the potential boundary expansion range of alternatives. In other words, we removed the LPP from the scope of the CCP and placed it on a completely separate track with a different timeline so that we could finish the CCP. Additionally, landscape-scale planning and/or conservation efforts occurring within the Coquille Valley through other agencies or non-profit organizations are considered outside of the scope of this CCP. In May 2012, a website explaining the potential boundary expansion was launched (http://www.fws.gov/oregoncoast/bandonmarsh/LPP_1.htm), and in July 2012 Planning Update 1 for the boundary expansion study was released.

In September 2012, the Draft CCP for Bandon Marsh Refuge was released for public comment. Since the LPP was removed from the scope of the CCP, none of the draft alternatives for the CCP propose boundary expansion. The Draft CCP only focuses on future management actions that will occur within refuge-managed lands. However, all substantive comments received during the Draft CCP comment period regarding potential refuge boundary expansion will be addressed and incorporated into the Draft LPP/EA.

The Bandon Marsh NWR Draft Land Protection Plan/Environmental Assessment will be presented to the public as soon as the required analyses are completed. This draft plan will describe the “no action” and “action alternatives,” describe “Conceptual Management Plans” for any proposed action, provide a summary of the expected environmental and socioeconomic effects of each alternative, and announce a public review and comment period. We will also hold a public meeting in conjunction with the release of this draft plan. After the close of the comment period, we will work towards a Final Land Protection Plan/Environmental Assessment by finalizing a “preferred alternative.” The Final Land Protection Plan will then be forwarded to the Director of the USFWS for review and a final decision. Finally, if a refuge boundary expansion is proposed and approved, the USFWS would notify the public of the decision and be able to begin the process of identifying funding needs and opportunities and start discussions with interested landowners. We continue to be available to address issues or concerns from landowners within and adjacent to the LPP study area, and all interested parties will be notified when we restart this study in earnest.

50. Comment: Why are compatibility determinations being updated through the CCP development process?

Response: According to Service policy, CDs are to be completed for all uses proposed under a CCP that have been determined to be appropriate. Existing wildlife-dependent recreational uses must also be reevaluated and new CDs prepared during development of a CCP (602 FW 3). According to the Service’s compatibility policy, 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 (603 FW 2). 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 within the CCP. CDs updated with the CCP supersede the CDs produced in 1994 for the Bandon Marsh Unit and interim CDs produced as part of the Ni-les’tun Unit’s Conceptual Management Plan (USFWS 1999b).

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Appendix L. Waterfowl Hunt Plan

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Bandon Marsh
National Wildlife Refuge

Ni-les'tun Unit
Waterfowl Hunt Plan

Prepared by:
U.S. Fish and Wildlife Service
Oregon Coast National Wildlife Refuge Complex
2127 SE Marine Science Drive
Newport, Oregon 97365

U.S. Fish and Wildlife Service
Pacific Northwest Planning Team
911 NE 11th Avenue
Portland, Oregon 97232

January 2013

Recommended by: Roy W. Lowe   Date: 1/22/13
Project Leader

Reviewed by: Robert L. Peyton   Date: 1-23-2013
Refuge Supervisor

Approved by: Gerald J. West   Date: 1-23-13
Regional Chief, National Wildlife Refuge System

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Bandon Marsh National Wildlife Refuge Ni-les'tun Unit Waterfowl Hunt Plan

1. Introduction

In December 2012, the Bandon Marsh National Wildlife Refuge (NWR or Refuge) Comprehensive Conservation Plan and Environmental Assessment (CCP/EA or CCP) (USFWS 2012a) was approved by the U.S. Fish and Wildlife Service (USFWS or Service) Regional Director. The CCP will guide the management of Bandon Marsh NWR for 15 years. It was finalized after several years of extensive planning and public participation, and it resolved several key issues on the Refuge, including waterfowl hunting. The Bandon Marsh NWR CCP/EA describes and analyzes three alternatives and summarizes the planning effort, public comments, and USFWS responses. It is incorporated by reference as part of this Waterfowl Hunt Plan and is available at the following website: http://www.fws.gov/oregoncoast/ccp_nes_slz_bdm.htm. Supporting documents include the Finding of No Significant Impact (FONSI) (December 2012) and the Waterfowl Hunting Compatibility Determination (CCP Appendix B; also appended to this Waterfowl Hunt Plan and incorporated by reference). In accordance with the CCP and its associated FONSI, Bandon Marsh NWR will expand the waterfowl hunt program by opening 299 acres of refuge lands on the Ni-les'tun Unit (Figure 1) for waterfowl hunting three days per week.

1.1. About the Refuge

Bandon Marsh NWR is located in Coos County within the Coquille River estuary on the south coast of Oregon, approximately 90 miles from the California border. Bandon Marsh NWR is managed by the USFWS. The 889-acre Refuge consists of the Bandon Marsh Unit and the Ni-les'tun Unit (Figure 1). The 307-acre Bandon Marsh Unit, established in 1983, is located near the mouth of the Coquille River with approximately 25% of the Unit within the city limits of Bandon. The 582-acre Ni-les'tun Unit was established in 2000 and is located on the east side of U.S. Highway 101 on the north bank of the Coquille River. The primary purpose for establishing the Bandon Marsh Unit was to protect and conserve the physical and biological integrity of the last substantial tract of salt marsh in the Coquille River estuary (USFWS 1981). The Ni-les'tun Unit was established to protect and restore intertidal and salt marsh, freshwater marsh, and riparian areas to provide a diversity of habitats for migratory birds including waterfowl, shorebirds, wading birds, and songbirds, and to restore intertidal marsh habitat for anadromous fish such as Chinook and chum salmon, steelhead, cutthroat trout, and the threatened coho salmon (USFWS 1999). A great diversity of wading birds and shorebirds use the Coquille River estuary, especially the Bandon Marsh Unit, as stop-over habitat. The Coquille River and estuary support abundant, productive, and diverse populations of anadromous fish including Chinook salmon, cutthroat trout, steelhead, Pacific lamprey, and a threatened population of coho salmon. The estuary also provides important rearing habitat for numerous species of marine fish including northern anchovy, surf smelt, herring, perch, starry flounder, and English sole and economically important Dungeness crab. Waterfowl are also abundant within the estuary.

Bandon Marsh NWR was established in 1983 with the following purposes:

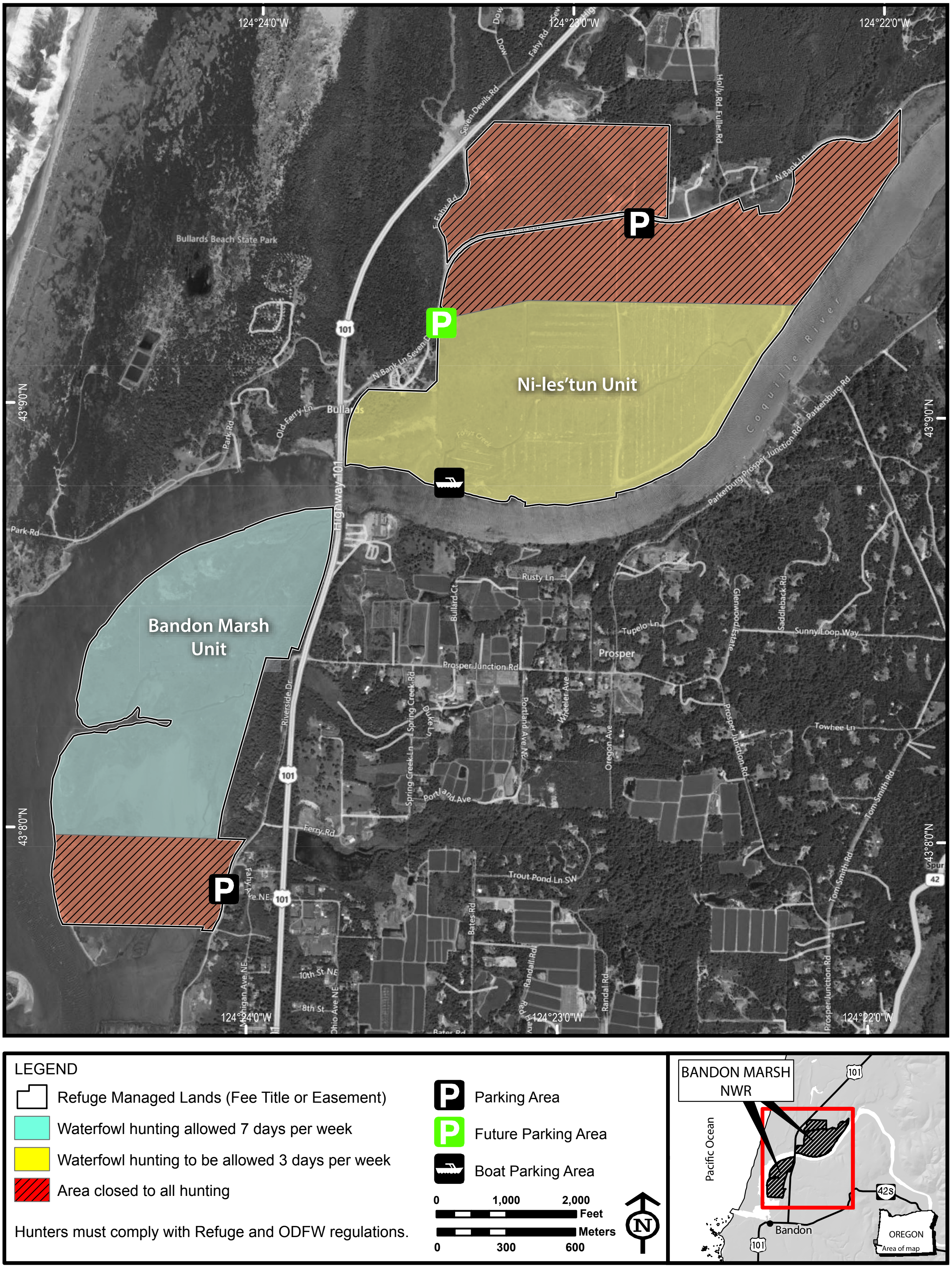
> "for the preservation and enhancement of the highly significant wildlife habitat … for the protection of migratory waterfowl, numerous species of shorebirds and fish … and to provide

> opportunity for wildlife-oriented recreation and nature study on the marsh" [95 Stat. 1709, dated December 29, 1981 and Public Law (PL) 97-137, December 29, 1981, and H.R. 2241 March 2, 1981].
>
> "for the development, advancement, management, conservation, and protection of fish and wildlife resources" [16 U.S. Code (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)].
>
> "particular value in carrying out the national migratory bird management program" [16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife)].

The following principles guided the development of the recently completed CCP/EA for Bandon Marsh NWR (USFWS 2012a). The Ni-les'tun Unit Waterfowl Hunt Plan will guide the implementation of the waterfowl hunt program as detailed in the CCP. These principles are consistent with refuge purposes, the National Wildlife Refuge System (NWRS or Refuge System) mission and goals, the NWRS Improvement Act (PL 105-57), USFWS policies, and international treaties.

- Enhance, maintain, and protect refuge habitats (including upland forests; forested wetlands; and estuarine and stream-riparian habitats) and other lands for the benefit of migratory birds and other wildlife.
- Gather sufficient scientific information to guide responsible adaptive management decisions.
- Provide visitors compatible wildlife-dependent public use opportunities that foster an appreciation and understanding of the Refuge's fish, wildlife, plants, and their habitats, and have limited impacts to wildlife.
- Initiate and nurture relationships and develop cooperative opportunities to promote the importance of the Refuge's wildlife habitat, and support refuge stewardship.
- Protect and manage the Refuge's cultural resources, and identify new ways to gain an understanding of the Refuge's history and cultural resources.

Figure 1 ***Bandon Marsh National Wildlife Refuge Waterfowl Hunt Area***



Map Date: 11/30/2012 File: 13-018-1.mxd Data Source: Refuge Boundaries from USFWS/R1; Roads from ESRI; Imagery from Bing Maps

1.2. Waterfowl Hunting Opportunities on the Refuge and Surrounding Areas

Bandon Marsh NWR is located within and adjacent to the small coastal city of Bandon, which has a population of approximately 3,066). The Bandon Marsh Unit of Bandon Marsh NWR currently offers all six of the wildlife-dependent public uses of the NWRS, which are fishing, hunting, wildlife observation and photography, environmental education, and interpretation. Historically, refuge visitation has been relatively low though it has increased in recent years with the installation of visitor use facilities (e.g., wildlife viewing decks and parking lots) at Riverside Drive and at the Ni-les'tun Unit. The Refuge is a popular destination for observing or photographing birds and other wildlife, and some visitors come to hunt waterfowl or search for clams in the mudflats. Their visits are often seasonal. Birders and photographers time their trips to coincide with the seasonal migration of shorebirds in late April–early May and again in late August–early September, and waterfowl hunters time their trips with the arrival of the fall migratory waterfowl within the early portion of the Oregon Department of Fish and Wildlife (ODFW) regulated waterfowl hunting season. Local residents tend to visit the Refuge year-round with most wildlife-viewing visitations occurring during the height of shorebird migration in the spring and fall.

The northernmost 256 acres of the Bandon Marsh Unit, outside of the city limits, has been open to waterfowl hunting during State of Oregon waterfowl hunting seasons since the Refuge was established in 1983; this hunt follows ODFW regulations (ODFW 2012). The remaining southern portion falls within city limits, where all hunting is prohibited by city ordinance and state law as well as refuge regulations. The Bandon Marsh Unit hunt program allows the take of waterfowl species including geese, ducks, and coot. The designated waterfowl hunting area is used by a small number of hunters. Access for waterfowl hunters is either via boat from the Coquille River or on foot from the Riverside Drive parking lot and passing through the southern area that is closed to hunting. There are no permanent blinds or designated hunting areas allowed. Only portable blinds or blinds constructed of on-site dead vegetation or driftwood may be used by hunters, and they must either be removed or disassembled at the end of each day. The Ni-les'tun Unit has been closed to waterfowl hunting since its establishment in 2000 due to salt marsh habitat restoration efforts. Restoration of the Unit was completed in 2011. Planning for wildlife-dependent public uses (e.g., hunting, fishing, wildlife observation, and photography) on the Unit occurred as part of the development of the Refuge's CCP (USFWS 2012a).

The South Slough National Estuarine Research Reserve (Reserve) offers a waterfowl hunt program that encompasses approximately two-thirds of its 5,000 acres. Both the State and Federal government manage the Reserve, a natural research and public use area located in the Coos River estuary. The Reserve is a short drive from Bandon Marsh NWR. The Reserve is composed of a network of estuarine habitats that are protected, managed, and restored for the purposes of long-term research, education, and coastal stewardship. In addition to the hunt program, the Reserve manages a series of hiking trails, a non-motorized boat launch, and a visitor center that offers year-round environmental education and interpretation programs.

The Bureau of Land Management (BLM) manages the New River Area of Critical Environmental Concern (ACEC), located approximately 10 miles south of Bandon, and the majority of this ACEC is open to waterfowl hunting. The New River runs parallel to the Pacific Ocean for nine miles and is separated from the ocean by a thin foredune. Many native birds, animals, and plants depend on the New River's estuarine, forest, meadow, wetland, and shrub habitats for survival. The ACEC is dedicated almost exclusively to watchable wildlife, providing nature enthusiasts and the general public with short, rustic, self-guided loop hiking trails to view wildlife. Due to the ACEC's isolated and remote location, participation in waterfowl hunting at this site is relatively low (Kip Wright, BLM, pers. comm.).

Waterfowl hunting occurs on many privately owned lands or hunt clubs within Coos County, but only to those who are granted permission and/or purchase hunting rights or leases. There are also a few additional public opportunities for waterfowl hunting within Coos County. Waterfowl hunting is permitted in the watercourses of local rivers and estuaries, within navigable waters below the mean high water mark. Waterfowl hunting within navigable waters is generally closed within all city limits with the exception of a portion of Coos Bay that includes dredge spoil islands, several of which were opened to waterfowl hunting through both a city ordinance and an Oregon Revised Statute. The remainder of the dredge spoil islands in Coos Bay are mostly owned by the Port of Coos Bay which restricts hunting and shooting on their lands.

2. Conformance with Statutory Authorities

National wildlife refuges are guided by the mission and goals of the NWRS, the purposes of an individual refuge, USFWS policy, and laws and international treaties. Relevant guidance includes the NWRS Administration Act of 1966, as amended by the NWRS Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations (CFR) and the Fish and Wildlife Service Manual.

The mission of the NWRS 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" (NWRS Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

The NWRS Improvement Act of 1997 provides guidelines and directives for the administration and management of all areas in the NWRS. The Act also recognized that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation, photography, environmental education, and interpretation, when determined to be compatible with the mission of the Refuge System and purposes of a refuge, are legitimate and appropriate public uses of the NWRS. Compatible wildlife-dependent recreational uses are the priority public uses of the NWRS, and they receive priority consideration in planning and management.

Conformance of refuge uses with refuge purposes is determined through a formal compatibility determination process. Compatibility means that the use will not materially interfere with or detract from the fulfillment of the purposes of a refuge or the mission of the NWRS (603 FW 2). The waterfowl hunt program, as described below in Section 5, was determined to be compatible with refuge purposes, with stipulations (see CCP Appendix B).

Annual costs to administer the waterfowl hunt on the Refuge, if fully staffed, were estimated in 2012 at approximately $13,500. In addition, the Refuge will seek funding to construct a small parking lot to provide better access for walk-in hunting at an estimated cost of $112,000 (USFWS 2012a).Waterfowl hunting will be permitted in accordance with State and Federal regulations and seasons. Refuge-specific regulations will also govern waterfowl hunting activities (see Section 7.1).

3. Statement of Objectives

Waterfowl hunting objectives and strategies in the Bandon Marsh NWR CCP were designed to provide a quality hunting experience that meets refuge guidelines and policies. Opening the Ni-les'tun Unit to waterfowl hunting will provide a quality, safe walk-in or boat-in opportunity for waterfowl hunters to hunt geese, ducks, and coots while minimizing impacts to other wildlife and other recreational users. A quality waterfowl hunting experience on the Refuge is defined as having (1) a high priority on safety; (2) clear and concise regulations that are readily available; (3) minimal conflict with wildlife and habitat objectives; (4) minimal conflict with other priority public use activities; and (5) minimal conflict with neighboring lands.

4. Assessment

4.1. Flyway, Regional, and Local Analysis

4.1.1. Flyway Analysis

Waterfowl follow distinct, traditional migration corridors, also known as "biological flyways," in their annual travels between breeding and wintering areas. Since 1948, waterfowl have been managed through four administrative "Flyways" that are based on those migration paths: the Atlantic, Mississippi, Central, and Pacific Flyways. The review of the policies, processes, and procedures for waterfowl hunting are covered in a number of documents (Flyways.us 2012).

The National Environmental Protection Act (NEPA) considerations by the USFWS 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 for this document in the Federal Register (FR) 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 FONSI. Further, in a notice published in the Federal Register on September 8, 2005 (70 FR 53776), the USFWS announced its intent to develop a new Supplemental Environmental Impact Statement (SEIS) for the migratory bird hunt program. Public scoping meetings were held in the spring of 2006, as detailed in the Federal Register on March 9, 2006 (71 FR 12216). The Service released the draft SEIS on July 9, 2010 (75 FR 39577).

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. The outcome is intended to result in a level of harvest that is appropriate based upon biological assessments prepared annually by the USFWS. These biological assessments detail the overall 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 (e.g., Flyway Study Committees, Flyway Councils, USFWS Regulations Committee) 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 an annual waterfowl population status report (for example, USFWS 2012b). In addition, the number of waterfowl hunters and resulting harvest are closely monitored through both the Harvest Information Program and the "Wing Bee," which utilizes duck wings sent in from a sample of hunters to compute the species composition of the duck harvest (see http://central.flyways.us/surveys/surveys-conducted/wing-bee for more information). Since 1995, such information has been used to support the Adaptive Harvest Management (AHM) process (USFWS 2012c) for setting duck hunting regulations. Under AHM, a number of decision-making protocols taking into account population models and environmental conditions iteratively determine the choice (package) of predetermined regulations (appropriate levels of harvest) that constitute the framework offered to the States that year. In Oregon, the ODFW Commission then selects season dates, bag limits, shooting hours, and other options from the Pacific Flyway package. The Commission's 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 Hunting Frameworks published annually in the Service's regulations on migratory bird hunting. Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the applicable 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 may be more restrictive than the State allows.

Oregon is within the Pacific Flyway, which also includes those states and portions of states west of the Continental Divide, including Alaska. The most recent (2011-2012) duck harvest for the Pacific Flyway was 3.2 million birds, which represents approximately 20% of the estimated 15.8 million (±6%) ducks harvested in the United States during the 2011-2012 waterfowl hunting season (Raftovich et al. 2012). The estimated goose harvest for the Pacific Flyway during the 2011-2012 season was 429,900, which represents approximately 15% of the estimated annual U.S. harvest of an estimated 2.9 million (±5%) geese.

4.1.2. Regional and Local Analysis

Every year, the Service conducts surveys that are used to estimate waterfowl hunting activity, success, and harvest by species. Results are used by the USFWS and State wildlife agencies, in part, to establish season lengths and bag limits designed to maintain healthy, sustainable waterfowl populations. During the 2011-2012 waterfowl hunting season, hunters in Oregon harvested an estimated 480,300 (±24%) ducks and 65,400 (±20%) geese (Raftovich et al. 2012). On the Bandon Marsh Unit of Bandon Marsh NWR during 2010-2011, hunters harvested ducks but the harvest numbers are considered to be below reportable levels (B. Reishus, ODFW, pers. comm.). At any given time, there are generally no more than one to three hunting parties in the Bandon Marsh Unit because the relatively small size of the hunting acreage (256 acres) is further constrained by the stage of the tide and the availability of quality hunting habitat with open water (e.g., the mouth of the tidal sloughs). Waterfowl hunters tend to self-limit their numbers due to the above constraints. Most hunting occurs in October and November when waterfowl are most plentiful on lower estuaries. Generally by December, inland habitat becomes flooded, and birds disperse from Bandon Marsh NWR, thus resulting in a reduction in the frequency of hunting on the Refuge.

The most heavily harvested duck species in Oregon are mallard, American wigeon, northern pintail, green-winged teal, and northern shoveler (Raftovich et al. 2012). The most abundant duck species identified at Bandon Marsh/Coquille River estuary during the 2010-2011 mid-winter waterfowl survey include bufflehead, green-winged teal, and mallard (USFWS unpublished data). In 2012, continental populations of mallard, green-winged teal, northern shoveler, and scaup were all above their long-term averages (Raftovich et al. 2012). American wigeon were 20% below their long-term average, and northern pintail were similar to the species' long-term average. Hunters are permitted to harvest American coots, but they are not popular game with local hunters. Coots on Bandon Marsh are uncommon but appear to be increasing in number (USFWS unpublished data). Overall waterfowl harvest levels on the Bandon Marsh Unit of the Refuge represent a very small portion of the waterfowl production for the State and the Pacific Flyway and of the total harvest based on production surveys and mid-winter surveys. Given the low harvest rates of all these species relative to the State harvest, Ni-les'tun Unit harvest numbers are expected to make up a very small proportion of local, State, or Pacific Flyway harvest, and the refuge hunt program will not significantly contribute to population changes of these species.

4.2. Are wildlife populations present in numbers sufficient to sustain optimum population levels for priority refuge objectives other than hunting?

Bandon Marsh NWR's estuarine habitat (salt marsh and intertidal mudflats) and freshwater habitat (e.g., freshwater emergent wetland, non-tidal coastal streams) provide important migratory winter habitat for ducks and white-cheeked geese. During fall migration, tens of thousands of birds pass through the refuge area, and hundreds to thousands may be observed using the site as stop-over habitat during the winter. Some earlier surveys documented 1,400 to 2,200 birds (USFWS unpublished data). Mallards and wood ducks, which can be found wintering in the lower Coquille estuary, have been documented as breeders on refuge lands. In addition, the upper marsh provides breeding habitat for a small number of western Canada geese.

The peak waterfowl use at the Refuge is during fall and early winter, prior to the inland pastures and fields becoming flooded by winter rains. As the winter rainy season begins, waterfowl disperse to flooded lowlands and river valleys, including the Coquille. Geese at Bandon Marsh NWR mainly use the upper marsh during spring and the areas of low, lush grasses during the winter, whereas ducks primarily utilize the estuarine and freshwater areas during their migratory periods. However, large concentrations of ducks can also be found on the upper marsh habitat when flooded by tides or in combination with high river levels. Dabbling ducks use freshwater shallows and the edge of salt marshes.

Along the Oregon coast, including Bandon Marsh NWR and the Coquille River estuary, mid-winter waterfowl surveys are conducted during the first two weeks in January as part of a continent-wide protocol. Observers count diving ducks, dabbling ducks, geese, swans, and American coots from a fixed-wing aircraft, and an overall abundance is estimated (USFWS unpublished data). Data have been compiled for all waterfowl observed at Bandon Marsh NWR and the lower Coquille River estuary during the mid-winter waterfowl surveys from 1986 to 2011. The overall mean count was 531 individuals. The lowest count was 49 individual birds recorded in 1990, and the largest was

2,116 in 2008. These data are collected from a fixed-wing aircraft at an altitude of 200-300 feet and traveling 80-120 miles per hour (mph), which limits ability to survey all areas and all habitats and count every individual present. The mid-winter waterfowl survey serves as an index for comparative purposes and is not necessarily representative of the number of ducks that may be present within the entire geographic area. Waterfowl abundance is also usually lower during the January mid-winter survey compared to fall months, when birds are concentrated on the lower estuary prior to dispersing throughout the area due to field and seasonal wetland flooding (R. Lowe, USFWS, pers. comm.). However, general abundance and population trends can be inferred from the results of the mid-winter waterfowl survey, and Bandon Marsh NWR and the Coquille River estuary are regionally important use areas for waterfowl.

It is not anticipated that waterfowl hunting will negatively affect priority refuge objectives or waterfowl populations on the Refuge. Based on conversations with the ODFW biologist who includes the Coquille River estuary in his area of responsibility, hunter use of and harvest from Bandon Marsh are relatively low (S. Love, ODFW, pers. comm.). Waterfowl utilize both private and refuge lands, and waterfowl numbers vary greatly depending on habitat conditions, tidal cycles, weather, and breeding production. Using mid-winter waterfowl survey data as an index, the number of wintering ducks in Bandon Marsh is highly variable. Refuge personnel conduct bird surveys at Bandon Marsh NWR throughout the winter to document distribution and abundance of all bird species. Refuge counts for ducks have generally ranged from 500 to 2,100 over the past several winters, with the exception of the 2011 count, which was below 500 (USFWS unpublished data). Ducks are plentiful in fall through the early winter months, utilizing refuge tidal and non-tidal wetlands. The recent tidal salt marsh restoration completed on the Ni-les'tun Unit in 2011 added over 400 acres of quality wetland habitat to the Refuge, which may entice additional waterfowl.

In addition, the Ni-les'tun Unit waterfowl hunt has been designed with measures and restrictions to ensure it does not negatively affect other refuge priority objectives. For example:

- The hunt area is limited in size and location, to ensure that sufficient sanctuary for waterfowl is available.
- Waterfowl hunting will be allowed only three days per week to limit wildlife disturbance. The Unit will be closed to all public entry the other four days of the week during waterfowl hunting season.
- Hunter outreach and education will be part of the waterfowl hunt program, to reduce wildlife disturbance and the potential for conflict among visitors.

4.3. Is there competition for habitat between target species and other wildlife?

A wide variety of other migratory birds use the estuary and refuge tidal marsh. Key species or groups using these habitats during waterfowl hunt periods include wading birds, shorebirds, and raptors. Shorebird use of the salt marsh and mudflat during ODFW-regulated waterfowl hunting season is low, as it is outside the late April–early May and late August–early September peak periods of shorebird migration. Wildlife species such as great blue heron, bald eagle, great egret, and northern harrier forage in refuge wetlands and waterbodies. The portions of the Ni-les'tun Unit that will remain closed to hunting will provide sanctuary to waterfowl and other wildlife. Limiting hunting on this unit to three days per week will also help reduce habitat competition and human disturbance to wintering migratory birds. See the Bandon Marsh NWR CCP/EA (USFWS 2012a) and the Waterfowl Hunting Compatibility Determination (CCP Appendix B) for additional description of effects on wildlife and habitat. Competition between species targeted by the waterfowl hunt program and other wildlife or their habitats is not considered a limiting factor.

4.4. Are there unacceptable levels of predation by target species on other wildlife species?

Not applicable.

5. Description of Waterfowl Hunt Program

5.1. Areas of the Refuge That Support Populations of the Target Species

Bandon Marsh NWR, including the Ni-les'tun Unit, provides important wintering and migration (stop-over) habitat for ducks, coots, and geese. Ducks are plentiful in fall through the early winter months, utilizing refuge tidal and non-tidal wetlands. Surveys have indicated that waterfowl make significant use of the open bay, mudflats, and tidal marsh with heaviest use occurring from September through December and again during spring migration. Waterfowl abundance is usually lower during the January mid-winter survey compared to fall months, when birds are concentrated on the lower estuary prior to dispersing throughout the area due to field and seasonal wetland flooding. (R. Lowe, USFWS, pers. comm.). In 2011, over 400 acres of tidal salt marsh was restored on the Ni-les'tun Unit and already waterfowl use of the area is increasing. It is anticipated that increasing numbers of waterfowl will utilize this area in the near future. Waterfowl numbers vary depending on habitat conditions and yearly variables such as weather and breeding production.

5.2. Areas to Be Opened to Public Hunting

The waterfowl hunt program on the Ni-les'tun Unit of Bandon Marsh NWR will open 299 acres of salt marsh within the 582-acre Ni-les'tun Unit. Waterfowl hunting is currently open seven days per week during the hunt season on 256 acres of the Bandon Marsh Unit on refuge salt marsh lands that fall outside of Bandon city limits, and this program is being continued. The recent tidal salt marsh restoration at the Ni-les'tun Unit added over 400 acres of quality tidally influenced wetland habitat to the Refuge, and the new refuge waterfowl hunt area will encompass 299 acres of this restored tidal marsh.

5.3. Species to Be Taken, Hunting Periods, Hunting Access

Waterfowl hunters will be allowed to hunt geese, ducks, and coots on 299 acres of the 582-acre Ni-les'tun Unit three days per week. The established days for waterfowl hunting on the Ni-les'tun Unit will be Wednesday, Saturday, and Sunday during the hunt season.

On the Coquille River there are three boat launches nearby that waterfowl hunters occasionally use to launch their watercraft. One launch is at Bullards Beach State Park, another one is located further downstream at the Port of Bandon, and one is located upstream at Rocky Point County Park. To access the Ni-les'tun Unit waterfowl hunting area, hunters can either use one of these boat launches, or they can walk in by using the Ni-les'tun Unit parking lot located on North Bank Lane across from the refuge office (Figure 1). As soon as funding allows, a small graveled parking area will be developed to accommodate three or four vehicles, which will provide improved walk-in access for the Unit. The planned parking area will be located on refuge-owned lands adjacent to North Bank

Lane near the northeast corner of the Coquille River RV Park. Hunters may park boats within the marsh while they hunt but boats parked on the bank of the Coquille River within the Unit will be required to park within a designated location.

Hunter access to refuge lands will only be allowed from one hour before sunrise to one hour after sunset. Refuge waterfowl hunting hours will be in accordance with State regulations listed in the Game Bird Shooting Hour Table (ODFW 2012). Construction of permanent blinds will not be allowed; however, hunters will be allowed to use portable blinds or blinds constructed of on-site dead vegetation or driftwood under the condition that they either be removed or disassembled at the end of each day. Bag limits and hunting seasons on the Ni-les'tun Unit will conform to ODFW regulations.

Although dogs are prohibited on the Refuge away from parking lots, they are a vital part of the waterfowl hunting tradition and can reduce the loss of waterfowl to the hunter's bag and hence prevent waste and reduce the overall impact to the resource. Because of their role, both as part of the waterfowl hunting tradition and their contribution to increasing the likelihood of retrieval of birds that have been shot, dogs used in the act of waterfowl hunting are allowed on the Ni-les'tun Unit as well as the Bandon Marsh Unit of Bandon Marsh NWR per Service Policy in 50 CFR 32.26.21. Hunters are encouraged to use dogs as an aid to retrieving waterfowl during the hunting season; however, dogs must remain under control of the handler at all times. Dogs must be in a vehicle or on a leash until being used for hunting.

5.4. Justification for the Permit, If One Is Required

No refuge-issued permit is required. However, hunters must comply with all State and Federal regulations regarding waterfowl hunting, including provisions outlined in 50 CFR 32.2, which states:

- Each person shall secure and possess the required State license and waterfowl validation.
- Each person 16 years of age and older shall secure and possess a Federal Migratory Bird Hunting Stamp while hunting migratory waterfowl.
- Each person shall comply with the terms and conditions authorizing access or use of wildlife refuges.

5.5. Procedures for Consultation and Coordination with the State

ODFW was involved in the needs assessment and design of the Ni-les'tun Unit waterfowl hunt during the preparation of the Bandon Marsh NWR CCP/EA. ODFW supported the preferred alternative described in the CCP/EA and approved by the Regional Director. The USFWS will manage the waterfowl hunt program on refuge lands. Refuge outreach and enforcement programs will also benefit waterfowl hunt programs on State lands Refuge law enforcement officers will coordinate regularly with OSP officers to conduct law enforcement, outreach, and education, and to enforce bag limits, species limits, and the requirement for federally approved nontoxic shot.

5.6. Methods of Control and Enforcement

The following methods will be used to control and enforce hunting regulations.

- Refuge and waterfowl hunting area boundaries will be clearly posted.

- The Refuge will develop an informational sheet on the rules and regulations of waterfowl hunting at Bandon Marsh NWR, including the Ni-les'tun Unit.
- Access to the Refuge will be prohibited from one hour after sunset to one hour before sunrise.
- The USFWS will conduct law enforcement patrols on a regular basis to ensure compliance with State and Federal waterfowl hunting regulations as well as refuge-specific regulations pertinent to the hunt, including compatibility stipulations (see Compatibility Determination, CCP Appendix B).
- USFWS law enforcement staff will coordinate with OSP officers and other law enforcement agencies. OSP officers will patrol State lands when available to help ensure compliance with laws and hunting regulations. Concurrent jurisdiction will allow OSP officers as well as Coos County Sheriff Department officers authority on refuge lands as well.
- Information and hunting area maps will be made available on the refuge website, at the refuge headquarters/office in Newport/Bandon, at ODFW offices, and at refuge parking areas.
- USFWS will work with ODFW to include a description of the Bandon Marsh Refuge hunting program and pertinent regulations in the annual State of Oregon Game Bird Regulations publications.

5.7. Funding and Staffing Requirements

Administering the waterfowl hunt will require refuge staff time to coordinate with ODFW and the local community, develop an informational "tear sheet" with regulations for the waterfowl hunt, produce news releases, respond to hunter inquiries, conduct hunter and visitor outreach, minimize conflicts among users, coordinate with OSP, conduct law enforcement, maintain boundary posting and hunter information sites, monitor impacts to wildlife and habitat and visitor use, and ensure public safety (see CCP Appendix B). Additional funds will be required to build and maintain a small gravel parking lot for vehicle use and foot access, and to develop and post a boat parking area along the Coquille River bank.

This new hunt program was described in the Bandon Marsh NWR CCP, specifically in the Compatibility Determination and the Implementation Appendix (CCP Appendices B and C). Full implementation will become possible only with increased funding and staffing to assist in enforcement, outreach, and monitoring. Implementation during at least the first few years of the program will be done with existing staffing, so it will redirect some effort from other high-priority habitat and public use programs. Because of the proximity of State navigable waters and other public hunting lands and the prevalence of waterfowl hunting on nearby private lands, close coordination will be needed between Bandon Marsh NWR staff (e.g., Refuge Manager, Biologist, Law Enforcement staff) and ODFW and OSP personnel. This coordination will be necessary to effectively conduct outreach and enforcement and to implement regulations.

Surveying and posting Ni-les'tun Unit waterfowl hunting boundaries will be accomplished prior to the start of the 2013-2014 waterfowl hunting season. A designated boat parking area along the Coquille River has been chosen through coordination with Oregon Department of State Lands and will be clearly marked prior to the waterfowl hunting season. Law enforcement and outreach efforts to educate waterfowl hunters about the boundaries and regulations involving waterfowl hunting on the Ni-les'tun Unit will commence following publication of the final CCP and Waterfowl Hunt Plan.

6. Measures Taken to Avoid Conflicts with Other Management Objectives

The Ni-les'tun waterfowl hunt program was designed to provide a quality waterfowl hunting opportunity, while minimizing or eliminating conflicts with refuge purposes, goals, and management objectives. These objectives include a focus on estuarine and other habitat restoration and reduction in human disturbance to fish and wildlife. Refuge objectives also include providing the public with safe, compatible, and accessible wildlife viewing opportunities that reduce conflicts between refuge users (see the Bandon Marsh NWR CCP [USFWS 2012a] and the Waterfowl Hunting Compatibility Determination [CCP Appendix B]). The Ni-les'tun Unit will be closed to unrestricted walking during waterfowl hunting season (October 1 through January 31) to reduce conflicts between refuge users and promote visitor safety. The Unit will only be open to waterfowl hunting three days per week and closed four days per week to provide wildlife sanctuary. Viewing platforms and some selected refuge trails will remain open for public use on days when hunting is allowed on Ni-les'tun.

6.1. Biological Conflicts

Human disturbance to wintering birds and other wildlife using the tidal marshes of the Ni-les'tun Unit will occur as a result of waterfowl hunting activity. Migratory and wintering waterfowl require access to areas with adequate food reserves and areas where they can loaf and roost undisturbed. They generally minimize time in flight and maximize foraging time because flight requires considerably more energy than any other activity, except egg laying. In addition to direct mortality of individual hunted birds, human disturbance associated with waterfowl hunting includes loud noises such as those produced by shotguns and boat motors. This disturbance, especially when repeated over a period of time, can cause waterfowl to change feeding habits, feed only at night, lose weight, or abandon feeding areas. Prolonged and extensive disturbances may cause large numbers of waterfowl to temporarily or permanently leave disturbed areas (Madsen 1985).

Spatial regulation of hunting activity in the form of providing sanctuaries, or non-hunted areas, is the most common strategy to reduce disturbance caused by hunting. Bregnballe and Madsen (2004) found that to increase species diversity in hunted areas, a sanctuary area with quality feeding and resting habitat should be located adjacent to the hunt area. The number of migratory birds that a site can support can be increased if birds can escape a short distance to sanctuary. Thus, sanctuary areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of the Ni-les'tun Unit. In tidal areas, high-tide roosts present an obvious first choice for sanctuary areas, although nighttime roosts may differ from those used by day. The higher elevation portion of the Ni-les'tun Unit, which is outside of the hunt area within the eastern portion of the Unit, and the marsh adjacent to North Bank Lane, which is furthest from the Coquille River, will remain closed to waterfowl hunting, providing an area of sanctuary throughout the entire waterfowl hunting season.

Other management strategies to reduce biological conflicts include temporal restrictions such as hunting only certain days per week, or only allowing hunting part of the day. By itself, intermittent hunting is generally not found to be the most effective way to minimize hunting disturbance effects (Fox and Madsen 1997). When birds move from a disturbed site, the frequency of disruption affects the probability of their return, and introduces a lag in recovery time to levels of abundance experienced in the absence of hunting. However, an intermittent hunt program can minimize disturbance, especially if the interval of non-hunting time is measured in weeks rather than days (Fox and Madsen 1997). Even if the non-hunted period is shorter, it can improve the ability of a site to sustain waterfowl use in an area that is hunted all season long (Bregnballe and Madsen 2004). Because minimizing disturbance to wintering waterfowl and providing waterfowl hunting opportunities on refuges are both priorities for the USFWS, it is common for refuges to manage hunt programs with intermittent hunting in the form of non-hunt days. On the Ni-les'tun Unit the period of non-hunting disturbance will be measured in days rather than instituting a diurnal time restriction closure (e.g., hunting only from sunrise to noon). Waterfowl hunting will be allowed three days per week (Saturday, Sunday, and Wednesday) and will be permitted according to the Game Bird Shooting Hour Table in the annual ODFW Game Bird Regulations, to accommodate daily tidal variations and subsequent changes in waterfowl use of the Unit. No public entry, for any purpose, will be permitted during the other four days of the week during the waterfowl hunting season. Because the Ni-les'tun Unit is easily distinguishable and spatially separated from public hunting opportunities on the Bandon Marsh Unit that are allowed seven days a week during hunting season, the intermittent waterfowl hunt program should not cause confusion for waterfowl hunters.

Boating activity associated with waterfowl hunting during the fall and winter can alter distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). Because of the potential safety hazard posed by boating in an area with strong tidal influence, waterfowl hunters may use either motorized or non-motorized boats to engage in waterfowl hunting on the Ni-les'tun Unit. Disturbance from motorized boats can occur even when waterfowl densities are low, depending upon boats' noise, speed, and capability to cover extensive areas in a short amount of time. However, boat use by waterfowl hunters is expected to be minimal since boat access into the Ni-les'tun Unit is limited and challenging due to the availability of correct weather conditions (e.g., winds <15 mph) and high-tide waters to fill tidal channels or cover the mudflats. The Ni-les'tun Unit's access by boat is further limited by the scarcity of tidal channels unrestricted by large woody debris. To minimize impacts from boat use, boats parking on the Coquille River Bank during the waterfowl hunting season will be restricted to a designated location.

The amount of waterfowl harvest is not expected to have a measureable effect on refuge population numbers. Very few hunters currently pursue waterfowl in the Bandon Marsh Unit (B. Reishus, ODFW, pers. comm.), and no hunters were surveyed in 2010-2011. At any given time there are generally no more than one to three hunting parties in the Bandon Marsh Unit because of limited huntable area (256 acres), tidal cycles, and few spots with high-quality hunting conditions (e.g., the mouth of the sloughs). The Ni-les'tun Unit is expected to present similar conditions due to the presence of tidal channels and the extreme variation in flooding caused by daily tidal fluctuations. As on the Bandon Marsh Unit, most waterfowl hunting is expected to occur in October and November. In late November when rain increases and causes prolonged flooding and the development of seasonal wetland habitat further inland, waterfowl in the lower Coquille estuary disperse to newly flooded areas. Thus there is limited hunting occurring on Bandon Marsh after mid-December due to the lower abundance of birds.

The three-day-per-week waterfowl hunt program on the Ni-les'tun Unit will also include the following restrictions to reduce biological impacts: (1) hunting of geese, ducks and coots only; (2) a limited waterfowl hunting area, which will be posted and enforced; (3) a requirement to use only federally approved nontoxic shot; (4) boat landing on the Coquille River bank is restricted to a designated boat parking location; (5) sufficient feeding and resting habitat for waterfowl in areas closed to waterfowl hunting (i.e., sanctuary); and (6) periodic biological and social monitoring and evaluation of the waterfowl hunt program, including feedback from users to determine if objectives are being met.

6.1.1. Impacts to Non-target Species

The refuge hunt program indirectly impacts species other than those targeted by hunters. The presence of hunters and dogs, sounds of gunfire, and the sight of hunters traveling to and from hunt areas can disturb other wildlife species, such as great blue heron, bald eagle, great egret, and northern harrier, which forage in refuge wetlands and waterbodies. This disturbance, especially when repeated over a period of time, may result in some wildlife species altering feeding habits or moving to other areas during the active waterfowl hunting season. Waterfowl hunting will occur outside of the breeding season for these avian species. Accidental shootings of non-game birds are believed to be negligible. Hunters' foot trails and temporary blinds in the tidal marsh could slightly alter wetland vegetation; however, these impacts and those to refuge fish populations and other wildlife are expected to be negligible (see the Waterfowl Hunting Compatibility Determination [CCP Appendix B] for additional discussion of impacts to non-target species).

6.2. Public Use Conflicts

Bandon Marsh NWR supports all six of the Refuge System's priority wildlife-dependent uses: hunting, fishing, wildlife observation and photography, environmental education, and interpretation. Waterfowl hunting has occurred on the Bandon Marsh Unit since the Refuge's establishment in 1983. No conflicts among users of the Refuge have been documented in relation to waterfowl hunting. This is likely at least partially related to the weather along the Oregon coast during the fall and winter months, which is often cold and rainy and thus not particularly popular with wildlife viewers or photographers.

The Ni-les'tun Unit was not opened for any public access prior to full tidal restoration and completion of the CCP. Because the marsh is still undergoing post-restoration habitat recovery, it is still too early to determine where the predominant waterfowl use will occur on the Unit. During the initial year (2011-2012) of habitat recovery, dabbling and diving ducks have concentrated in the lower elevation salt marsh and in the newly constructed tidal channels throughout the Unit, and geese have been observed scattered in the high marsh vegetation as well as within the open waters of the Unit (USFWS unpublished data).

The peak use times for bird watching (i.e., during shorebird and passerine migration) are expected to be spring and early fall; however, the peak use time by waterfowl on the Unit is early fall to early winter. It is possible that people engaged in other public uses including wildlife observation, photography, and fishing could flush waterfowl, thus impacting waterfowl hunters in the area during the early fall period. To avoid this impact and reduce any conflicts between user groups, the Ni-les'tun Unit will be closed to access for all other wildlife-dependent public uses, including wildlife observation and photography, from October 1 through January 31 annually. As proposed in the Bandon Marsh CCP/EA (USFWS 2012a), cutthroat trout fishing will be closed during the month of October to eliminate user conflicts. This refuge-specific closure to reduce user conflict is a departure from State cutthroat trout fishing dates. The viewing deck and graveled marsh trail, located outside of the waterfowl hunt area, will remain open to wildlife observation, photography, and interpretation daily throughout the year. Because the uses are separated to a large part in time and location and by the primary wildlife species being observed or pursued (spring and early fall for bird watching; fall and early winter for waterfowl hunting), conflicts between the uses are expected to be minor.

To ensure safety and minimize conflict between hunters and people engaged in wildlife observation and photography, the USFWS will provide information about the waterfowl hunt program's boundaries and seasons to the general public and those utilizing other refuge programs. Information will be provided at the interpretive kiosk, on the refuge website, in the refuge office, and in the ODFW game bird regulations handbook. In addition, law enforcement patrols will be conducted on a regular basis to contact the public and ensure compliance with State, Federal, and refuge regulations. The refuge law enforcement officer will also monitor and collect data on the hunt program's participation and activities to ensure it does not interfere with other wildlife-dependent uses. If necessary, using the best available science and data, the program will be modified accordingly to ensure the program meets the goals and objectives of the Refuge.

6.3. Administrative Conflicts

There are no administrative conflicts at this time.

7. Conduct of the Hunt

7.1 Refuge-specific Hunting Regulations

- Hunting of geese, ducks, and coots is allowed on designated areas of the Refuge three days per week. The established days for waterfowl hunting on the Ni-les'tun Unit will be Wednesday, Saturday, and Sunday.
- Only federally approved nontoxic shot may be used or be in hunters' possession while hunting on the Refuge.
- Only portable blinds or blinds constructed of on-site dead vegetation or driftwood may be used. All blinds, decoys, shotshell hulls, and other personal equipment and refuse must be removed from the Refuge at the end of each day.
- Hunters accessing refuge lands via boat must secure or anchor boats and use established boat launch areas. Hunters may park boats within the marsh while they hunt, but boats landing on the bank of the Coquille River within the Ni-les'tun Unit will be required to park within a designated location.
- Access to the Refuge will be prohibited from one hour after sunset to one hour before sunrise.
- The use or possession of alcoholic beverages while hunting is prohibited.
- Hunters are encouraged to use dogs as an aid to retrieving waterfowl during the hunting season; however, dogs must remain under control of the handler at all times. Dogs must be in a vehicle or on a leash until they are in the marsh as a part of the hunt.
- Hunters may enter closed areas of the Refuge only to retrieve downed birds.

7.2. Anticipated Public Reaction to the Hunt

Waterfowl hunting was discussed at two public meetings held in conjunction with the CCP process. Comments were solicited on waterfowl hunting through a variety of methods, including the public meetings, presentations, planning updates, and the release of the draft CCP/EA. Among the comments received regarding Bandon Marsh NWR, many were related to waterfowl hunting on refuge lands, and specifically opening the Ni-les'tun Unit to waterfowl hunting. Some commenters supported opening the Ni-les'tun Unit to waterfowl hunting seven days per week, while others supported limiting hunting to three days per week. Others offered specific concerns regarding the appropriateness of allowing hunting on a refuge. Public input was considered and efforts were made to design the hunt program to meet the NWRS and refuge-specific goals and objectives, provide a safe and high-quality visitor experience, minimize wildlife disturbance, provide improved wildlife sanctuary, reduce or avoid conflicts with other refuge users, and minimize confusion for hunters. A summary of public comments and the USFWS's responses can be found in Appendix K (Summary of Public Comment and the Service's Responses) in the CCP (USFWS 2012a).

7.2.1. Adjacent Landowners and Economy

The planned opening of 299 acres of refuge tidal marsh in the Ni-les'tun Unit to waterfowl hunting will create a new opportunity for public waterfowl hunting that will support a traditional hunting activity in the Coquille River estuary. The economic benefits from expanding waterfowl hunting opportunities on Bandon Marsh NWR are associated with the contributions that hunters will make to the local and regional economies as a result of expenditures for both activity-related equipment and supply purchases and travel-related goods and services. Trip-related expenditures include food, lodging, transportation, and other incidental expenses. Equipment expenditures consist of guns, ammunition, decoys, hunting dogs, and special hunting clothing. Waterfowl hunters that hunt both ducks and geese spend an average of $854 annually (Carver 2008) on the activity. The Refuge had an estimated 4,772 recreation visits in 2010 (USFWS 2012a). Approximately $11,000 was spent by visitors, both resident and nonresident, engaged in waterfowl hunting on the Bandon Marsh Unit of the Refuge. This total will likely increase somewhat with the addition of waterfowl hunting opportunities on the Ni-les'tun Unit.

Noting current trends in waterfowl hunting on other nearby Federal and State lands, a significant increase or decrease in hunting levels is not anticipated by opening the Unit to waterfowl hunting. The actual amount of hunting on refuge lands is not expected to greatly increase, because waterfowl hunting has occurred from 1983 to the present on the Bandon Marsh Unit. In addition, while under private ownership and prior to the Refuge's establishment, limited private waterfowl hunting by select individuals occurred on these lands (E. Bussmann, pers. comm.). It is anticipated that opening the Ni-les'tun Unit of Bandon Marsh NWR to waterfowl hunting will have some local economic benefit from allowing public hunting in an area where little exists presently. It will not have a significant impact on the local community or its economy.

7.3. Hunter Application and Registration Procedures (if applicable)

Not applicable. This will be a free-roam hunt waterfowl hunt area, which will require no applications or registrations to hunt.

7.4. Media Selection for Announcing and Publicizing the Hunt

The Refuge has a standard list of local and regional media contacts for news releases. A news release announcing the waterfowl hunting opportunities will be sent out prior to the first waterfowl hunting season and annually thereafter. Notices will also be posted on the refuge website, at the refuge office in Bandon, and other appropriate locations. This new hunting opportunity will also be defined in the ODFW game bird hunting regulations handbook (ODFW 2012).

7.5. Hunter Requirements

Hunters are required to be familiar with all State, Federal, and refuge-specific regulations. Refuge-specific regulations will be available on the refuge website and refuge waterfowl hunting tear sheet, at the designated access points for waterfowl hunters, and in the ODFW game bird hunting regulations (ODFW 2012).

1. **Age (if restrictions are imposed by the State)**

   Age requirements will be in accordance with ODFW requirements.

2. **Allowable equipment (dogs, vehicles, blinds, sporting arms, ammunition)**

   Requirements will be in accordance with ODFW and refuge regulations.

3. **License and permits**

   a. All goose, duck, and merganser hunters must have a valid Oregon hunting license, State Harvest Information Program validation, and a signed Federal Waterfowl (Duck) Stamp. Residents and nonresidents must possess a Resident Waterfowl Validation or Nonresident Game Bird Validation, respectively.

   b. If hunting coots: hunters are required to be in possession of the above permits (a) except that a Federal Duck Stamp is not required.

   c. If hunting sea ducks (harlequin duck, scoter, long-tailed duck, and eider): hunters are required to be in possession of the above permits (a) and a Sea Duck Permit.

   d. If hunting black brant: hunters must be in possession of the above (a) and a Black Brant Permit.

4. **Reporting harvest**

   Hunters must fulfill all ODFW reporting requirements.

5. **Hunter training and safety (if required by State)**

   Hunters must fulfill all ODFW requirements for training and hunter safety classes.

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U.S. Department of the Interior
U.S. Fish & Wildlife Service
Bandon Marsh
National Wildlife Refuge
83673 North Bank Lane
Bandon, OR 97411

Phone: 541/347 1470
Fax: 541/347 9376

http://www.fws.gov

National Wildlife Refuge System Information
1 800/344 WILD

April 2013

The mission of the U.S. Fish & Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

Cover Photo
Bandon Marsh from the west

Inset Photos
Coho Salmon
Mink
Wood duck

All photos Roy W. Lowe/USFWS